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ANNUAL REPORTS

OF THE

WAR DEPARTMENT

FOR THE

FISCAL YEAR ENDED JUNE 30, 1905.

VOLUME V.

REPORT OF THE CHIEF OF ENGINEERS.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1905.

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ARRANGEMENT OF THE ANNUAL REPORTS OF THE WAR DEPARTMENT FOR THE YEAR ENDED JUNE 30, 1905.

Volume I.....Secretary of War:
- Chief of Staff.
- The Military Secretary.
- Inspector-General.
- Judge-Advocate-General.

Volume II.....**Armament, Transportation and Supply:**
- Quartermaster-General.
- Commissary-General.
- Surgeon-General.
- Paymaster-General.
- Chief of Engineers, Military Affairs.[a]
- Chief of Ordnance.[b]
- Chief Signal Officer.
- Chief of Artillery.
- Board of Ordnance and Fortification.

Volume III.....**Division and Department Commanders:**
- Atlantic Division—
  1. Department of the East.
  2. Department of the Gulf.
- Northern Division—
  1. Department of the Lakes.
  2. Department of the Missouri.
  3. Department of Dakota.
- Southwestern Division—
  1. Department of Texas.
  2. Department of the Colorado.
- Pacific Division—
  1. Department of California.
  2. Department of the Columbia.
- Philippines Division—
  1. Department of Luzon.
  2. Department of the Visayas.
  3. Department of Mindanao.

Volume IV.....**Militia Affairs, Military Schools and Colleges, Military Parks, and Soldiers' Homes.**
- The Military Secretary, Militia Affairs.
- Military Academy—
  1. Board of Visitors.
  2. Superintendent.
- Infantry and Cavalry School and Staff College.
- School of Application for Cavalry and Field Artillery.
- Artillery School.
- Engineer School.
- School of Submarine Defense.
- Army Medical School.
- Commissioners of National Military Parks—
  1. Chickamauga and Chattanooga.
  2. Gettysburg.
  3. Shiloh.
  4. Vicksburg.
- Soldiers' Home, District of Columbia—
  1. Board of Commissioners.
  2. Inspection of.
- Inspection of National Home for Disabled Volunteer Soldiers.

Volumes V–VIII....Chief of Engineers.

Volume IX.....Chief of Ordnance.

Volumes X–XIV....The Chief of the Bureau of Insular Affairs, the Philippine Commission, and Acts of the Philippine Commission.

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[a] Printed in Report of Chief of Engineers, Vol. V.
[b] Printed in Report of Chief of Ordnance, Vol. IX.

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ANNUAL REPORT

OF THE

CHIEF OF ENGINEERS,

UNITED STATES ARMY.

1905.

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REPORT

OF

THE CHIEF OF ENGINEERS,

UNITED STATES ARMY.

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, September 29, 1905.

SIR: I have the honor to present for your information the following report upon the duties and operations of the Engineer Department for the fiscal year ending June 30, 1905.

OFFICERS OF THE CORPS OF ENGINEERS.

The number of officers holding commissions in the Corps of Engineers, United States Army, at the end of the fiscal year, including 13 who graduated from the Military Academy on June 13, 1905, but were not officially assigned to the Corps of Engineers until July 13, 1905, was 168.

Since the last annual report the Corps of Engineers has lost 4 of its officers—Maj. Theodore A. Bingham, who was commissioned a brigadier-general, United States Army, July 11, 1904; Col. Alexander M. Miller, who died September 14, 1904; Col. David P. Heap, who was retired from active service February 16, 1905, upon his own application, after more than forty years' service, under the provisions of the act of Congress approved June 30, 1882; and Col. William A. Jones, who was retired from active service June 26, 1905, by operation of law, under the provisions of the act of Congress approved June 30, 1882.

There were added to the Corps of Engineers, by promotion of graduates of the Military Academy, 13 second lieutenants on July 13, 1905, to rank from June 13, 1905.

The duties devolving upon the Corps of Engineers have been increasing year by year. They now include the command of three battalions of troops; the construction of fortifications; superintending works of river and harbor improvements; the construction and repair of light-houses; the construction of public buildings; the water supply, the municipal engineering, care of public buildings and grounds, and a share in the city government of the capital of the United States; the improvement of the Yellowstone National Park; the survey of the Northern and Northwestern lakes; the mining and débris commission

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in the State of California, all of which involve the expenditure of many millions annually, and, in addition to various other duties, supervision of military engineering and reconnaissance work in the several military divisions and instruction at the Military Academy and schools of application.

On the 30th of June, 1905, the officers were distributed as follows:

Commanding the Corps of Engineers and Engineer Department, and on Board of Ordnance and Fortification	1
Office of the Chief of Engineers	3
Office of the Chief of Engineers and Light-House Board	1
Division engineer and The Board of Engineers	1
Division engineer	1
Division engineer, The Board of Engineers, Chief Engineer Officer, Atlantic Division, and Light-House Board	1
Mississippi River Commission and Isthmian Canal Commission	1
River and harbor works	15
The Board of Engineers and river and harbor works	1
Division engineer, fortifications, river and harbor works, and California Débris Commission	1
Fortifications, river and harbor works, and light-house districts	6
Division engineer, California Débris Commission, and light-house district	1
Division engineer, fortifications, and river and harbor works	2
Light-House Establishment	2
River and harbor works and light-house districts	5
Fortifications and river and harbor works	18
General Staff, Philippines Division	1
Division engineer and river and harbor works	1
Leave of absence	2
Washington Aqueduct, fortifications, and river and harbor works	3
En route to Philippine Islands	11
Mississippi River Commission, river and harbor works, and light-house district	1
Philippines Division	16
General Staff	2
Engineer Commissioner, District of Columbia	1
Post of Washington Barracks, D. C., Engineer School, and Second Battalion of Engineers	14
Chief engineer officers, military divisions	2
River and harbor works and Yellowstone National Park	1
Military attachés with Russian and Japanese armies	2
United States Military Academy	8
Post of Fort Leavenworth, Kans., and First Battalion of Engineers	13
Assistants to Engineer Commissioner, District of Columbia	2
California Débris Commission	1
Public buildings and grounds, District of Columbia	1
Buildings for War College, Washington Barracks, and Government Printing Office	2
Mississippi River Commission	1
Fortifications	1
Infantry and Cavalry School and Staff College	5
River and harbor works and Vicksburg National Military Park	1
General Staff and Chief Engineer Officer, military division	1
Board of road commissioners of Alaska	1
Fortifications, river and harbor works, and California Débris Commission	1
Graduating leave of absence	13
Total	168

THE BOARD OF ENGINEERS.

The regulations for the government of the Corps of Engineers provide for a Board of Engineers, consisting of not less than three officers, designated by the Chief of Engineers with the sanction of the Secretary of War. This Board acts in an advisory capacity to the

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Chief of Engineers upon important questions of engineering. One of its principal duties is to plan or revise the projects for permanent fortifications of the United States.

During the fiscal year the Board has reported upon numerous subjects connected with fortification work, and various tests have been witnessed and inspections made by its members.

A statement of the composition of this Board during the past fiscal year will be found in its report.

(See Appendix No. 1.)

FORTIFICATIONS.

The scheme of national defense upon which work has been in progress since 1888 is based primarily upon a report submitted January 16, 1886, by the Endicott Board. This report indicated the localities where defenses were most urgently needed, determined the character and general extent of the defenses, with their estimated cost, and recommended for first consideration the names of 27 principal ports, arranged in the order of their importance.

The first act of Congress based on that report was approved September 22, 1888. It created the Board of Ordnance and Fortification and made appropriations for beginning the manufacture of modern seacoast ordnance, but made no provision for the construction of batteries. The first appropriation for the construction of gun and mortar batteries was contained in the act of August 18, 1890, since which time appropriations of varying amounts have been made each year, except 1905, for carrying forward the scheme of coast defense. Under the general scheme of the Endicott Board the detailed projects were originally prepared by The Board of Engineers, and by its constant revision and study have been kept in touch with the changes of naval attack and naval armament. Before any money has been spent under a project, or revision thereof, the formal approval of the Secretary of War has been secured by the Chief of Engineers.

Up to the present time projects for permanent seacoast defenses have been adopted for 31 localities in the United States, as follows:

1. Frenchman Bay, Maine.
2. Penobscot River, Maine.
3. Kennebec River, Maine.
4. Portland, Me.
5. Portsmouth, N. H.
6. Boston, Mass.
7. New Bedford, Mass.
8. Narragansett Bay, Rhode Island.
9. Eastern entrance to Long Island Sound.
10. New York, N. Y.
11. Delaware River.
12. Baltimore, Md.
13. Washington, D. C.
14. Hampton Roads, Virginia.
15. Entrance to Chesapeake Bay at Cape Henry.
16. Cape Fear River, North Carolina.
17. Charleston, S. C.
18. Port Royal, S. C.
19. Savannah, Ga.
20. St. Johns River, Florida.
21. Key West, Fla.
22. Tampa Bay, Florida.
23. Pensacola, Fla.
24. Mobile, Ala.
25. New Orleans, La.
26. Galveston, Tex.
27. San Diego, Cal.
28. San Francisco, Cal.
29. Columbia River, Oregon and Washington.
30. Puget Sound, Washington.
31. Lake Champlain.

In addition to the above localities, the defense of the Great Lakes and the St. Lawrence River is under consideration.

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Appropriations for construction of gun and mortar batteries in accordance with these approved projects have been made as follows:

Act of—		Act of—	
August 18, 1890	$1,221,000.00	May 7, 1898	$3,000,000.00
February 24, 1891	750,000.00	July 7, 1898	2,562,000.00
July 23, 1892	500,000.00	March 3, 1899	1,000,000.00
February 18, 1893	50,000.00	May 25, 1900	2,000,000.00
August 1, 1894	500,000.00	March 1, 1901	1,615,000.00
March 2, 1895	500,000.00	June 6, 1902	2,000,000.00
June 6, 1896	2,400,000.00	March 3, 1903	2,236,425.00
March 3, 1897	3,841,333.00	April 21, 1904	700,000.00
Allotments from the appropriation for "National Defense" act of March 9, 1898	3,817,676.02	Total	28,693,434.02

The following table shows the present status of permanent work completed or in progress with funds already provided, and also the work remaining to be done under defensive projects as now adopted:

Calibers.	Total number carried by Endicott Board scheme as revised and approved by Secretary of War to June 30, 1905.	Provided for by appropriations already made.	To be provided for by appropriations yet to be made.
12-inch mortars	524	376	148
12-inch rifles	125	105	20
10-inch rifles	169	133	36
8-inch rifles	71	70	1
6-inch rapid-fire guns	353	171	182
5-inch rapid-fire guns	106	53	53
4.7-inch and 4-inch rapid-fire guns	38	38	0
3-inch rapid-fire guns	342	254	88

Columns 2 and 3 show that funds already provided by Congress will be sufficient to emplace 72 per cent of the 12-inch mortars, 84 per cent of the heavy rifles, and 62 per cent of the rapid-fire guns (6-inch and smaller calibers).

With such a large part of the projected armament in position, it is possible to state accurately what will be the cost of completing the present scheme of defense along the lines so far followed. The records show that for $16,000,000 the armament carried in the last column of the table can be provided with the latest type of emplacements, equipped with all necessary electric lights, and provided with electrically operated ammunition service, capable of supplying powder and projectiles as fast as the latest types of ordnance guns can be fired. It will be noted that the fourth column contains 36 10-inch, 1 8-inch, and 53 5-inch guns. While these calibers still appear in the unexecuted parts of the projects, it should be understood that in actual construction these intermediate calibers would be replaced by the equivalent number of 12-inch, 6-inch, and 3-inch guns. Their presence in the table only indicates that up to June 30, 1905, some projects had not been completely revised. The amount already appropriated, $28,693,434.02, added to the above estimate of $16,000,000 for completion, indicates that $44,693,434.02 would be the total cost of all engineer work involved in the execution of the original Endicott

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Board scheme, revised and brought up to date by subsequent modifications approved by the Secretary of War, but not including the recently developed systems of range finding and of searchlights for night service of the guns, neither of which was contemplated at the time the Endicott Board estimates were prepared. This $44,693,434.02, it will also be noted, covers 31 harbors, while $55,483,000 was the original estimate of the Endicott Board for the engineer work connected with the defense of only 27 harbors. In 1900 the Chief of Engineers in his annual report called attention to the fact that up to that date a saving of $5,000,000 had been made by the Engineer Department in carrying on its part of the work, and his own estimate, then submitted, was that the cost of the whole project (31 harbors) as far as engineer work was concerned, would not exceed $50,000,000.

In his annual reports for the fiscal years 1902 and 1903 the Chief of Engineers suggested the creation of a tribunal similar to the Endicott Board, stating that, due to changes in both ships and guns, present conditions were widely different from those existing when the Endicott Board report was written, and recommending that such a board should consider not only the defenses of the United States proper, but also prepare and submit for Congressional action a well-studied and comprehensive scheme of coast defense for our insular possessions. During the year such a board, with the Secretary of War as its president, has been constituted by Executive order, dated January 31, 1905, and is now pursuing its investigations.

The following table shows that the Engineer and Ordnance departments have worked in harmony, the numbers of gun carriages and emplacements being the same, except where extra carriages are needed for purposes other than seacoast defense:

Type of gun or carriage.	Total carriages provided.	Total emplacements provided.
12-inch mortar carriages, model 1896	[a] 306	296
12-inch mortar carriages, model 1891	[b] 85	80
12-inch disappearing carriages, L. F., model 1901	11	11
12-inch disappearing carriages, L. F., model 1897	35	35
12-inch disappearing carriages, L. F., model 1896	27	27
12-inch gun-lift carriages, altered to nondisappearing	3	3
12-inch gun-lift carriages, model 1891	2	2
12-inch nondisappearing carriages, model 1892	[c] 28	27
10-inch disappearing carriages, A. R. F., model 1896	3	3
10-inch disappearing carriages, L. F., model 1901	12	12
10-inch disappearing carriages, L. F., model 1896	74	74
10-inch disappearing carriages, L. F., model 1894	[d] 35	35
10-inch nondisappearing carriages, model 1893	[e] 11	9
8-inch disappearing carriages, L. F., model 1896	38	40
8-inch disappearing carriages, L. F., model 1894	26	26
8-inch nondisappearing carriages, model 1892	[f] 9	[g] 9
15-inch smoothbore carriages altered for 8-inch rifles	21	[h] 21
6-inch disappearing carriages, model 1898	29	29

[a] The number of carriages of this type provided for exceeds by 10 the number which the Chief of Engineers has notified the Chief of Ordnance are required for the emplacements he has provided.
[b] One in use at West Point; 4 in storage.
[c] One in use at Sandy Hook Proving Ground.
[d] One carriage is the original experimental one for this caliber of gun, and has been put out of service at the instance of the Artillery Corps.
[e] One at Sandy Hook Proving Ground. The number of carriages of this type provided for exceeds by 2 the number which the Chief of Engineers has notified the Chief of Ordnance are required for the emplacements he has provided.
[f] One at West Point and one at Sandy Hook Proving Ground.
[g] Five temporary; armament removed from 3.
[h] Temporary; armament removed from 20.

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Type of gun or carriage.	Total carriages provided.	Total emplacements provided.
6-inch rapid-fire (Vickers Son & Maxim), pedestal mounts	8	8
6-inch disappearing carriages, model 1903	90	90
6-inch rapid-fire, pedestal mounts, model 1900	44	44
5-inch balanced-pillar mounts, model 1896	32	32
5-inch pedestal mounts, model 1903	21	21
4.7-inch rapid-fire (Armstrong pattern), pedestal mounts	34	34
4.7-inch rapid-fire (Schneider pattern), pedestal mount	1	[a] 1
4-inch rapid-fire (Driggs-Schroeder), pedestal mounts	4	4
3-inch balanced-pillar mounts	118	118
3-inch casemate mounts	2	2
3-inch pedestal mounts	134	134
2.24-inch rapid-fire field carriages and rampart mounts	70	(b)

[a] Temporary. [b] Movable mounts.

At the last session of Congress no appropriation was made for the construction of gun and mortar batteries. The construction of emplacements, which had been begun under prior appropriations, has continued under the original allotments, and as the estimates were accurate the balances on hand will be sufficient to complete them all.

At the close of the fiscal year the status of emplacements for which funds have been provided by Congress is as follows:

	12-inch mortars.	12-inch.	10-inch.	8-inch.	Rapid-fire.
Guns mounted	367	101	[a] 119	[b] 94	[c] 231
Ready for armament	9	4	12	2	[d] 326
Under construction	0	0	2	0	30
Total	376	105	133	96	587

[a] Including original experimental 10-inch carriage.
[b] Including 26 which have been mounted temporarily; 23 of these have since been dismounted.
[c] One temporarily.
[d] Including 70 6-pounders not requiring permanent emplacements.

At the close of the previous fiscal year there were reported mounted:

12-inch mortars.	12-inch.	10-inch.	8-inch.	Rapid-fire.
350	93	119	93	185

A comparison of the last two tables shows an increase during the year in guns actually available for service of 17 mortars, 8 12-inch guns, 1 8-inch gun, and 46 rapid-fire guns.

For continuing the construction of gun and mortar batteries in accordance with projects approved by the Secretary of War an estimate of $4,000,000 is submitted.

Modernizing older emplacements.—The construction of high-power batteries has been in progress since 1890. All of the emplacements permit reasonably effective service of their guns, but when the earlier batteries were built the rapidity of fire of modern high-power guns and the mechanical appliances required in connection therewith could not be anticipated. Improved methods of construction and better general designs of the emplacements were from time to time developed to enable the new works to withstand the blast and jar produced

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by smokeless powder and to provide facilities for the new fire-control system, and these new provisions were incorporated in all subsequent emplacements. The latest batteries therefore leave little to be desired. Very many of the emplacements require only moderate additions to bring them up to full efficiency; but a few of the very earliest would require extensive changes and additions, if they are worth the additional cost. It is believed to be wise, as a rule, to restrict changes to such as are evidently and decidedly necessary for proper service—that is, to let well enough alone. Where a battery is capable of doing effective service it should be utilized in its existing condition to as great an extent as practicable; where changed conditions have made a battery obsolete it should be abandoned. It hardly ever pays to remodel an emplacement to receive a more powerful gun than that for which it was originally built, for such changes in batteries cost as much as, if not more than, the construction of entirely new works for such new guns. For these reasons the proposed remodeling is limited in character and amount, and the principal improvements will conist in widening the loading platforms, in increasing the number of dry storerooms for projectiles, in supplying better facilities for ammunition service, in providing adequate water supply at each emplacement, and in providing additional means of lighting gun platforms, carriages, and gun sights for night practice. For these improvements an estimate of $942,500 was submitted last year. The amount appropriated was $450,000, and the application of this sum to the purposes for which appropriated is now in progress. For the continuation of this work the appropriation of $492,500, the balance of the original estimate, is recommended to Congress.

Fire control at fortifications.—The fortification appropriation act approved March 3, 1905, provided for this purpose the sum of $1,000,000, to be distributed in the discretion of the Secretary of War among the Engineer and Ordnance departments and the Signal Corps, the object being to insure an early and systematic prosecution of the work of installing this new development in seacoast artillery practice. In the distribution the sum of $590,000 was assigned to the Engineer Department for the installation of permanent fire-control systems at as many of six selected harbors as the funds would permit. As soon as detailed Artillery and Signal Corps plans are approved by the Secretary of War work by the Engineer Department will begin.

Tentative fire-control schemes for existing batteries have been adopted by the Chief of Artillery for almost all of the harbors now defended and corresponding detailed plans covering the engineer part of the work have been prepared. A few of these schemes have received the approval of the Secretary of War. The estimates for the work yet required of the Engineer Department to put into execution these schemes of the Artillery and Signal Corps, as they now stand, aggregate $4,263,364.47. While the general principles of the fire-control system have been satisfactorily determined and adopted, the actual details on which costs largely depend are still in a condition of experimental development by the Artillery, and it is anticipated that the cost of actual construction will probably largely exceed the above sum when such development is complete. Any portion of the above sum which is appropriated by Congress and allotted to the Engineer Department by the Secretary of War will be applied to the

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systematic installation of complete fire-control systems in such harbors as are selected as most important. As this single item in the appropriation act covers the work of three bureaus and is apportioned between them by the Secretary of War, no specific estimate for the engineer portion is submitted.

Sites for fortifications.—During the past year negotiations have been continued for the acquisition of one site at the eastern entrance to Long Island Sound and of a tract at Mobile, Ala. A tract on the Kennebec River, Maine; one near Charleston, S. C.; one on the Columbia River, one at Narragansett Bay, and one at Puget Sound were acquired during the year.

No funds were provided in the last fortification appropriation act for this purpose. A number of sites still remain to be acquired to carry out the approved projects of seacoast defenses, and an estimate of $500,000 is submitted for the acquisition of such sites as may be desirable in the near future. The total required for all sites can not be stated till the Board of which the Secretary of War is president has submitted its reports.

Searchlights and electrical connections.—With the appropriation of $200,000 contained in the fortification appropriation act approved March 3, 1905, a number of 36-inch portable searchlight outfits are under construction for distribution to as many forts as the funds will permit. Successive joint maneuvers of the Army and Navy have emphasized the need at all defended harbors of an adequate supply of powerful searchlights. The Chief of Engineers and the Chief of Artillery are entirely in accord in the view that systematic installation of such apparatus for night defense should continue.

For this purpose an estimate of $500,000 is submitted. Till further experience is had the total cost of such a complete equipment can not be estimated, but the aggregate will be large. The subject will doubtless receive full consideration by the board created by Executive order dated January 31, 1905.

Preservation and repair of fortifications.—The operations under this appropriation have consisted during the fiscal year in the preservation of engineer material in new batteries, the application of remedial measures for reducing the dampness in some magazines in the earlier works and the repair and improvement of the ammunition service. The mechanical and electrical appliances in modern batteries demand unremitting attention to prevent deterioration and damage under the destructive influence of the moist sea air. The new works already constructed represent an expenditure of approximiately $28,000,000 for engineering work alone. With the $300,000 provided by the act of March 3, 1905, for works of preservation and repair, it will be possible to remedy many incipient leaks and other defects, as well as to keep the iron work and apparatus for ammunition service well painted and free from rust. It is strongly recommended that an appropriation of the same sum be again made this year, as the needs are great and the number of completed batteries, etc., requiring attention and care is increasing, due to the completion of works now under construction from balances in hand, and their transfer to the troops for use and care.

Supplies for seacoast defenses.—Owing to the large number of electric installations supplying power and light in seacoast batteries, funds have been appropriated annually for the past six years for

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"tools and electrical and engine supplies for use of the troops for maintaining and operating light and power plants in gun and mortar batteries." This appropriation is designed to enable the Engineer Department to comply with the regulations of the War Department for the supply and service of the batteries. Requisitions are made directly upon the Chief of Engineers, and authorized articles are purchased and issued by district engineer officers with as little delay as possible. This system has proved eminently satisfactory to the garrisons.

The amount appropriated for this purpose during the present fiscal year was $40,000, and it is believed that this will be sufficient. The same sum will be required for these purposes during the next fiscal year, and an estimate of that amount is submitted.

Sea walls and embankments.—The sum of $19,400 was appropriated for this purpose by the fortification appropriation act approved March 3, 1905. This amount is being applied to work at the defenses of the eastern entrance to Long Island Sound.

Based upon detailed estimates prepared by district engineer officers, an estimate of $215,900 is submitted for the construction of sea walls and embankments at a number of localities on the Atlantic, Gulf, and Pacific coasts, where they are needed to protect the defenses.

Sea walls, defenses of Galveston, Tex.—The defensive works at Galveston were unavoidably in most exposed positions, and the level of the lands surrounding the batteries was greatly lowered by the storm of September 8, 1900. Work of reconstruction and repair of the Galveston defenses is now approaching completion, under the appropriation contained in the fortification act approved March 1, 1901. With the funds so provided and in accordance with the plans before Congress when that appropriation was made each individual battery has been made secure against any similar storms which are likely to occur in the future, but no provision has been made to protect the sites on which quarters, barracks, and other post buildings must be located at Fort Travis and Fort San Jacinto. At Fort Crockett a sea wall partly covering the site of the proposed post has been built with appropriations of $410,000 and $181,046.25, provided in the sundry civil act of Congress approved April 28, 1904. To properly protect the range-finder stations, electric communications, submarine-mine buildings, and other engineer accessories, as well as the barracks and other quartermaster buildings at these three forts, very heavy sea walls and extensive sand filling will be essential. For this work there is submitted an estimate of $1,433,953.75, based on detailed estimates prepared by the district engineer officer and confirmed by boards of officers of other branches of the service associated with him.

Submarine mines.—While the operation of torpedo defenses is the duty of the Artillery Corps, the building of structures required in connection therewith is under the charge of the Engineer Department. The location and number of torpedo structures required on the Atlantic and Gulf coasts have been considered during the year by boards appointed by the War Department and consisting of a specially detailed traveling artillery member associated with local engineer and artillery officers; for the same purpose similar boards have recently been constituted on the Pacific coast.

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The fortification act of March 3, 1905, provided $400,000 for the construction of torpedo structures. In accordance with schemes devised by these boards, and approved by the Chief of Artillery, this amount has been applied to the construction of such casemates, storehouses, etc., as were selected by the Chief of Artillery as being most urgently needed. For each harbor on the Atlantic and Gulf coasts detailed estimates of the sums needed to complete the engineer work comprised in these torpedo-defense schemes have been prepared. The aggregate amounts to $540,700, and an estimate of that sum is submitted for the coming year.

Preservation and repair of torpedo structures.—A large number of these new torpedo-defense structures are now approaching completion or have been completed. In accordance with the views of the artillery authorities, they are in great measure built of timber and corrugated iron, which permits the electrical instruments to be kept in dry, well-lighted rooms, but which makes the structures themselves liable to more rapid deterioration and decay than the more costly structures of concrete and masonry adopted by the Engineer Department when it had charge of torpedo operations. An estimate of $50,000 is therefore submitted for the preservation and repair of these buildings, to be applied to miscellaneous repairs to the more recent timber structures as the necessity therefor may arise, and to the prevention of dampness, etc., in the older concrete and brick structures which are still kept in service. The appropriations made to date for building torpedo structures aggregate $1,778,000, and it is believed that the above estimate for maintenance is reasonable when considered in connection with the original cost of the buildings and the character of those recently erected.

Defenses of insular possessions.—The fortification appropriation acts of 1904 and 1905 each provided the sum of $700,000 for the construction of batteries for the defense of our insular possessions. With the approval of the Secretary of War the funds appropriated by the act of 1904 are being applied to the construction of batteries for the defenses of Manila Bay and Subic Bay, Philippine Islands; the funds provided in the later act are being applied to a continuation of the work at Manila Bay and Subic Bay, and to the installation of batteries for the defense of the important naval station at Guantanamo Bay, Cuba.

Preliminary projects for the emergency defense of the most important harbors in the insular possessions have been prepared and have been approved by the Secretary of War. While the defense of these localities is now under consideration by the board constituted by Executive order dated January 31, 1905, and of which the Secretary of War is the president, it is believed that in view of the utter insufficiency of the existing defenses, any funds which Congress may provide at the coming session can be advantageously applied to work under existing approved projects; an estimate of $3,020,000 is submitted, $2,000,000 to be applied to the defenses of Manila, P. I.; $500,000 to Subic Bay, Philippine Islands, and $520,000 to Honolulu and Pearl Harbor, Hawaii.

In his annual report for the fiscal year ending June 30, 1903, the Chief of Engineers submitted an estimate of $526,100 for the acquisition of land for fortification purposes in the Hawaiian Islands. This

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estimate was based on an examination on the ground by a board of artillery and engineer officers, and is believed to be a fair estimate of the total amount that will be required for this purpose. The sum of $200,000 contained in the appropriation act of April 21, 1904, has so far been appropriated for this purpose. This amount has all been expended or definitely pledged and the sites so far acquired have been obtained at reasonable rates. It is considered of importance and in the interest of economy that the remaining sites required should be obtained as soon as possible, and the appropriation of the remainder of the original estimate, $326,100, is recommended.

The following money statements show the condition of all general appropriations under which operations were in progress at the close of the fiscal year:

"GUN AND MORTAR BATTERIES."

For battery construction.

July 1, 1904, balance unallotted	$373,661.20
June 30, 1905, net allotments during fiscal year	277,791.20
July 1, 1905, balance unallotted	95,870.00
July 1, 1905, amount pledged	56,797.85
July 1, 1905, balance available for miscellaneous work	39,072.15

For modernizing older emplacements.

March 3, 1905, amount appropriated	$450,000.00
June 30, 1905, allotted during fiscal year	292,729.75
July 1, 1905, balance unallotted	157,270.25
July 1, 1905, amount pledged	157,270.25

For installation of range and position finders.

July 1, 1904, balance unallotted	$179,071.38
June 30, 1905, net allotments during fiscal year	174,505.37
July 1, 1905, balance available for miscellaneous purposes	4,566.01

"FIRE CONTROL AT FORTIFICATIONS."

April 1, 1905, amount allotted to the Chief of Engineers from the appropriation of March 3, 1905	$590,000.00
June 30, 1905, net allotments during fiscal year	124,397.00
July 1, 1905, balance unallotted	465,603.00
July 1, 1905, amount pledged	425,654.00
July 1, 1905, balance available for miscellaneous purposes	39,949.00

"SITES FOR FORTIFICATIONS AND SEACOAST DEFENSES."

July 1, 1904, balance unallotted	$207,397.29
June 30, 1905, repayments during fiscal year	7,166.56
July 1, 1905, balance unallotted	214,563.85
July 1, 1905, amount pledged	200,000.00
July 1, 1905, balance available	14,563.85

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"SEARCHLIGHTS FOR HARBOR DEFENSES."

July 1, 1904, balance unallotted	$50,350.00
March 3, 1905, amount appropriated	200,000.00
	250,350.00
June 30, 1905, net allotments during fiscal year	249,350.00
July 1, 1905, balance unallotted	1,000.00
July 1, 1905, amount pledged	1,000.00

"PRESERVATION AND REPAIR OF FORTIFICATIONS."

July 1, 1904, balance unallotted	$249,894.70
March 3, 1905, amount appropriated	300,000.00
	549,894.70
June 30, 1905, net allotments during fiscal year	341,590.02
July 1, 1905, balance unallotted	208,304.68
July 1, 1905, amount pledged	208,304.68

"PLANS FOR FORTIFICATIONS."

July 1, 1904, balance unallotted	$5,000.00
March 3, 1905, amount appropriated	5,000.00
	10,000.00
June 30, 1905, net allotments during fiscal year	10,000.00

"SUPPLIES FOR SEACOAST DEFENSES."

July 1, 1904, balance unallotted	$12,306.91
March 3, 1905, amount appropriated	40,000.00
	52,306.91
June 30, 1905, net allotments during fiscal year	39,714.40
July 1, 1905, balance unallotted	12,592.51
July 1, 1905, pledged for later allotments	6,100.00
July 1, 1905, balance available	6,492.51

"SEA WALLS AND EMBANKMENTS."

July 1, 1904, balance unallotted	$34,500.00
March 3, 1905, amount appropriated	19,400.00
	53,900.00
June 30, 1905, net allotments during fiscal year	53,900.00

"CASEMATES, GALLERIES, ETC., FOR SUBMARINE MINES."

July 1, 1905, balance unallotted	$87,000.00
March 3, 1905, amount appropriated	400,000.00
	487,000.00
June 30, 1905, net allotments during fiscal year	487,000.00

"FORTIFICATIONS IN INSULAR POSSESSIONS."

For construction of seacoast batteries.

July 1, 1904, balance unallotted	$700,000.00
March 3, 1905, amount appropriated	700,000.00
	1,400,000.00
June 30, 1905, net allotments during fiscal year	1,400,000.00

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For sites, Hawaiian Islands.

July 1, 1904, balance unallotted	$200,000.00
June 30, 1905, net allotments during fiscal year	177,238.00
July 1, 1905, balance unallotted	22,762.00
July 1, 1905, amount pledged	22,762.00

ESTIMATES OF APPROPRIATIONS REQUIRED FOR 1906–7.

Fortifications.

For gun and mortar batteries:		
For construction of gun and mortar batteries	$4,000,000.00	
For modernizing older emplacements	492,500.00	
		$4,492,500.00
For fire control at fortifications		(a)
For sites for fortifications and seacoast defenses		500,000.00
For searchlights for harbor defenses		500,000.00
For protection, preservation, and repair of fortifications		300,000.00
For preparation of plans for fortifications		5,000.00
For supplies for seacoast defenses		40,000.00
For sea walls and embankments		215,900.00
For sea walls, defenses of Galveston, Tex		1,433,953.75
For casemates, galleries, etc., for submarine mines		540,700.00
For preservation and repair of torpedo structures		50,000.00
For defenses of insular possessions:		
For seacoast batteries, Manila, P. I	$2,000,000.00	
For seacoast batteries, Subic Bay, Philippine Islands	500,000.00	
For seacoast batteries, Honolulu and Pearl Harbor, Hawaii	520,000.00	
For procurement of land for sites for defenses of the Hawaiian Islands	326,100.00	
		3,346,100.00
Total		11,424,153.75

ENGINEER DEPOT, WASHINGTON BARRACKS, D. C.

In the charge of Maj. Edward Burr, Corps of Engineers, during the entire year.

The Engineer Depot, located at Washington Barracks, D. C., is the repository for the military bridge equipage of the Army; for miscellaneous military engineering tools, supplies, and materials of all kinds, and for astronomical, surveying, drafting, and reconnaissance instruments and supplies used by the Army and by officers of the Corps of Engineers on public works, both military and civil. It purchases and issues military engineering tools and supplies and serves particularly as an exchange for engineer instruments of all kinds, receiving them from the Army or public works, caring for them while in store, causing to be made the necessary repairs, reissuing them when required, and, so far as limited appropriations will permit, making purchases of such items as can not be supplied from store.

One of the principal items of the routine work of the depot has been the purchase and issue to the companies, troops, batteries, and posts of the Army of the reconnaissance instruments prescribed in General Orders, No. 24, War Department, February 14, 1905.

The storage facilities for the depot have not improved during the year. The depot property has been stored in various old brick and

(a) No specific estimate submitted for the engineer portion of this work.

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frame buildings, and, for want of sufficient space in these, a portion of it has been placed under temporary shelters. With the completion of the new storehouse now building in connection with the reconstruction of the post of Washington Barracks ample facilities should become available within the next six months.

The details of the operations of the depot, including the purchase, issue, and care of all stores will be found in the report of the officer in charge.

STATEMENT OF FUNDS.

I. For Engineer Depots, fiscal year ended June 30, 1904:		
July 1, 1904, balance unexpended		$565.26
June 30, 1905, amount expended during fiscal year	$556.98	
June 30, 1905, amount turned into the Treasury	8.28	
		565.26
II. For Engineer Depots, 1905:		
Amount allotted for fiscal year ended June 30, 1905, for Incidentals and Instruments		13,521.09
June 30, 1905, amount expended during fiscal year	$11,699.15	
June 30, 1905, amount pledged	1,821.94	
		13,521.09
III. For Engineer Equipment of Troops, fiscal year ended June 30, 1904:		
July 1, 1904, balance unexpended		2,265.44
June 30, 1905, amount expended during fiscal year	$2,264.53	
June 30, 1905, amount turned into the Treasury	.91	
		2,265.44
IV. For Engineer Equipment of Troops, 1905:		
Total of allotments during fiscal year ended June 30, 1905		17,826.10
June 30, 1905, amount expended during fiscal year	$10,702.20	
July 1, 1905, outstanding liabilities	7,123.90	
		17,826.10
V. For Equipment of Officers' Schools, Military Posts, 1905, for "Purchase of Instruments:"		
Amount allotted for fiscal year ended June 30, 1905	$5,000.00	
Amount allotted on account of refundments	50.49	
		5,050.49
June 30, 1905, amount expended during fiscal year	490.69	
July 1, 1905, amount pledged	4,559.80	
		5,050.49
VI. For Gun and Mortar Batteries, for "Purchase of Instruments and Articles for Engineer Equipment:"		
July 1, 1904, balance unexpended	$405.77	
July 1, 1904, amount allotted[a]	4,600.00	
		5,005.77
June 30, 1905, amount expended during fiscal year	4,919.48	
June 30, 1905, amount turned into Treasury	86.29	
		5,005.77

[a] Allotment reimbursed from appropriation for "New Arms and Equipment for Organized Militia."

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VII. For Examinations, Surveys, and Contingencies of Rivers and Harbors, for "Purchase and Repair of Instruments:"		
July 1, 1904, balance unexpended		$273.02
June 30, 1905, amount expended during fiscal year	$83.25	
June 30, 1905, amount pledged	46.05	
July 1, 1905, balance available	143.72	
		273.02
VIII. Emergency Fund, War Department, act of March 3, 1899, for "Equipment of Electrical Laboratory at Engineer School, Washington Barracks:"		
July 1, 1904, balance unexpended		35.35
June 30, 1905, amount expended during fiscal year		35.35
IX. For Improving Harbor at Honolulu, Hawaii, for "Purchase of Instruments:"		
May 20, 1905, amount allotted		292.75
June 30, 1905, amount expended to end of fiscal year		292.75

NEW APPROPRIATIONS.

For Engineer Depots for fiscal year ending June 30, 1906, the following sums were allotted by the Chief of Engineers, United States Army, for disbursement at Washington Barracks, D. C., viz:		
1. For "Incidentals"	$6,500.00	
2. For "Instruments"	5,000.00	
		11,500.00
3. For Engineer Equipment of Troops, 1906		5,000.00
For Engineer School, Washington, D. C., 1906, for "Equipment and Maintenance of the Engineer School at Washington Barracks, D. C.," amount appropriated		25,000.00
Total		41,500.00

(See Appendix No. 2.)

ENGINEER DEPOT, FORT LEAVENWORTH, KANSAS.

This depot is maintained for the purpose of issuing supplies to the battalion of engineers there stationed and for the storage, repair, and manufacture of ponton materials. It was under the charge of Lieut. Col. S. S. Leach, Corps of Engineers, until November 13, 1904, and of Capt. Herbert Deakyne, Corps of Engineers, from November 13, 1904, to March 14, 1905, since which date it has been in the charge of Maj. Thomas H. Rees, Corps of Engineers.

The operations of the depot during the year have consisted in the purchase of depot supplies, including artillery harness for the bridge train, and building pontons, chess, and balk with materials purchased in the preceding fiscal year. In addition, tool wagons for the four companies of the First Battalion of Engineers were constructed, and experiments were continued with a view to developing a more satisfactory tool outfit for pack transportation.

(See Appendix No. 3.)

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ESTIMATES OF APPROPRIATIONS REQUIRED FOR THE ENGINEER DEPOTS FOR 1906–7.

For incidental expenses of the depots, including fuel, lights, chemicals, stationery, hardware, machinery, pay of civilian clerks, mechanics, and laborers, extra-duty pay to soldiers necessarily employed for periods not less than ten days as artificers on work in addition to and not strictly in the line of their military duties, such as carpenters, blacksmiths, draftsmen, printers, lithographers, photographers, engine drivers, telegraph operators, teamsters, wheelwrights, masons, machinists, painters, overseers, laborers, repairs of and for materials to repair public buildings, machinery, and unforeseen expenses	$11,500
For purchase and repair of instruments, to be issued to officers of the Corps of Engineers and to officers detailed and on duty as acting engineer officers for use on public works and surveys	5,000
Total	16,500

ENGINEER EQUIPMENT OF TROOPS.

By the act of Congress approved April 23, 1904, the sum of $25,000 was appropriated for the engineer equipment of troops in the field and for the procurement of ponton trains, intrenching tools, instruments, drawing materials, etc. This appropriation was limited to the fiscal year 1905.

With these funds engineering supplies were furnished, mainly through the United States Engineer Depots, for the various military divisions and departments in the United States and the Philippines; the engineer battalions were supplied with materials called for in approved outfits for engineer companies; a number of experiments were made with intrenching tools and reconnaissance instruments; pontons were built with materials previously purchased, and parts of the Engineer Field Manual were prepared for the printer and Parts I and III of the Manual were published.

The sum of $24,989.50 was expended from this appropriation and a balance of $10.50 reverted to the Treasury.

The army appropriation act of March 2, 1905, provided $15,000 for the engineer equipment of troops during the fiscal year ending June 30, 1905. For the same purpose during the next fiscal year an estimate of $50,000 is submitted.

In support of this estimate it is desired to call particular attention to the condition of the ponton bridge equipment, much of which dates back to the civil war. The quantity on hand is not large and is only sufficient for the routine ponton drills of the present number of authorized engineer troops. Experience during the past two years, particularly at the Manassas maneuvers, shows that the greater part of this equipage is, through old age, absolutely unfit for field service and can not be relied upon for a march of 100 miles. Recently the wagons pertaining to the bridge equipage in the Philippines were condemned and it has been impossible to replace them, as there are no wagons on hand that are deemed to be worth shipping to the Philippines. If the Army is to have any field bridge equipage fit for service it is essential that the present equipment be thoroughly overhauled and parts of it entirely rebuilt. This work should be undertaken without delay, and the modifications should be in accord with the best practice as determined by the experience of modern armies since the civil war.

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If the full amount of the estimate is appropriated it is proposed to use $25,000 of the amount on ponton equipment.

Another large item of expenditure under this appropriation consists of the purchase and issue to the companies, troops, batteries, and posts of the Army of the reconnaissance instruments prescribed by General Orders, No. 24, War Department, current series. With existing funds issues have been made in accordance with these allowance tables to about one-third of the service. To entirely outfit all organizations and posts as contemplated by this order will require $15,000.

The additional amount estimated for is required for the equipment of the engineer companies in accordance with the recommendations of the Board of Engineer officers now considering that subject.

For details of expenditures under this appropriation, see Appendixes 2 and 3.

CIVILIAN ASSISTANTS TO ENGINEER OFFICERS.

By act of Congress approved April 23, 1904, the sum of $25,000 was appropriated for civilian assistants to engineer officers serving on the staffs of division, corps, and department commanders, to enable them to secure the services of surveyors, draftsmen, photographers, master laborers, and clerks during the fiscal year 1905. These funds have been applied to the purpose for which appropriated; the sum of $21,838.32 was expended during the fiscal year, and a balance of $3,161.68 reverted to the Treasury.

The army appropriation act of March 2, 1905, provided $25,000 for the same purpose during the fiscal year ending June 30, 1906, and an estimate of the same amount is submitted for the fiscal year 1907.

RIVER AND HARBOR IMPROVEMENTS.

Appropriations.—The funds with which the works for the improvement of rivers and harbors were prosecuted during the past fiscal year were derived from the appropriations made by the river and harbor act and the sundry civil act approved April 28, 1904; the river and harbor act and the sundry civil act approved March 3, 1905, and from such balances of former appropriations as were available.

The following works are provided for by permanent appropriations: Removing sunken vessels; operating and care of dredge boats on upper Mississippi River; removing obstructions in Mississippi River; gauging waters of lower Mississippi River and its tributaries; examinations and surveys at South Pass, Mississippi River; maintenance of South Pass channel, Mississippi River; operating snag boats on Ohio River; operating and care of canals, etc.; support and maintenance of the Permanent International Commission of the Congresses of Navigation.

Status of works.—Statements derived from the reports of the officers in charge of the various works, and given herewith, set forth the condition of each improvement and the extent of the work performed during the past fiscal year.

Expenditures.—The total amount actually expended under the

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direction of the Chief of Engineers in connection with the improvement of rivers and harbors during the fiscal year ending June 30, 1905, is as follows:

Rivers and harbors (general, including examinations, surveys, and contingencies)	$20,789,423.30
Removing sunken vessels	69,960.77
Operating snag and dredge boats on upper Mississippi River	25,000.00
Removing obstructions in Mississippi River	78,909.55
Gauging waters of lower Mississippi River and its tributaries	9,942.14
Maintenance of South Pass channel, Mississippi River	105,214.12
Examinations and surveys at South Pass, Mississippi River	10,231.79
Operating snag boats on Ohio River	34,688.23
Operating and care of canals, etc	1,145,644.82
Prevention of deposits in New York Harbor	97,658.15
California Débris Commission	15,548.99
Permanent International Commission of the Congresses of Navigation	1,401.73
Total	22,383,623.68

This amount does not include the following:

Expenditures under Mississippi River Commission	$2,265,073.69
Enlargement of Governors Island, New York Harbor	97,575.74

Estimates.—The following estimates are submitted by the Chief of Engineers for the fiscal year ending June 30, 1907:

Under continuing contracts	$17,456,801.63
Under California Débris Commission	15,000.00
Prevention of deposits in New York Harbor	85,260.00

The Mississippi River Commission submits an estimate amounting to $3,625,000, which has been reduced in this office to $2,000,000.

Engineer divisions.—The engineering works in the charge of this office are arranged in divisions, and officers of the Corps of Engineers were assigned as division engineers to overlook these works, as follows:

East of the Rocky Mountains: Northeast Division, Col. Chas. R. Suter; Eastern Division, Col. Amos Stickney; Chesapeake Division, Col. W. A. Jones, to June 26, 1905; Southeast Division, Lieut. Col. James B. Quinn; Gulf Division, Col. H. M. Adams, to August 12, 1904, and Lieut. Col. Clinton B. Sears since that date; Central Division, Col. G. J. Lydecker; Northwest Division, Col. O. H. Ernst, to April 5, 1905, and Lieut. Col. W. H. Bixby since that date. West of the Rocky Mountains: Pacific Division, Col. D. P. Heap (now brigadier-general, United States Army, retired), to October 16, 1904, and Col. T. H. Handbury since that date; Northern Pacific Division, Col. W. H. Heuer.

Survey of United States land within the flats of Anacostia River, District of Columbia.—The District of Columbia appropriation act of July 1, 1902, appropriated $5,000 to be expended under the direction of the Secretary of War for making a survey and outline map of land owned by the United States within what is known as the flats of the Anacostia River from its mouth to the boundary line of the District of Columbia, and authorized and directed the Attorney-General to report upon the nature of title to lands embraced within said flats. The survey has been made and the report thereon by Lieut. Col. Chas. J. Allen, Corps of Engineers (now brigadier-general, United States

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Army; retired), dated February 17, 1903, with maps, has been transmitted to the Attorney-General with a view to examination and report pursuant to the law. This report has been rendered and the papers will be submitted to Congress at its next session.

Preliminary examinations and surveys.—The river and harbor act of March 3, 1905, provides for preliminary examinations and surveys of certain localities, and the duty of making the same has been assigned to Boards of Engineers, and officers of the Corps of Engineers in charge of the various engineering districts. Reports thereon will be duly submitted when received.

ATLANTIC COAST AND GULF OF MEXICO.

IMPROVEMENT OF RIVERS AND HARBORS IN MAINE AND NEW HAMPSHIRE.

This district was in the charge of Maj. S. W. Roessler, Corps of Engineers, to August 2, 1904, and of Lieut. Col. W. M. Black, Corps of Engineers, since that date, the officer in charge having under his immediate orders First Lieut. C. W. Otwell, Corps of Engineers. Division engineer, Col. Chas. R. Suter, Corps of Engineers.

1. Lubec Channel, Maine.—This channel lies between the eastern extremity of the State of Maine and Campobello Island, Canada.

Originally the depth was about 5 feet at mean low tide and 2 feet at low water of spring tides.

A project was adopted in 1879 which, as subsequently modified, provided for a channel 275 feet wide, increasing to 300 feet in the bends, and 12 feet deep at mean low tide. This project was completed in 1890, practically as proposed, at a cost of $168,954.68.

The present project was adopted August 18, 1894, and its object was to widen the then existing channel to a least width of 500 feet, at an estimated cost of $150,000. The amount expended on the work of the existing project up to the close of the fiscal year ending June 30, 1905, was $134,481.12. At the latter date the channel had been dredged to the full projected width and depth contemplated by the project of 1894. The work will probably be reasonably permanent, but examinations will be made from time to time, when opportunity offers, to determine this question.

The maximum draft that can be carried is about 11.5 feet at mean low water; the mean variation in tide level is 18.2 feet. The channel, which is about 3 miles long, connects the roads above with the Atlantic Ocean, and is the convenient and direct approach to Lubec, Eastport, and St. Croix River from the westward. It is an international passage, and the benefits from the improvement are almost entirely general. As the tidal currents are very strong and dense fogs prevail a large part of the time, the widening of the passage decreases the chances of stranding and collision.

The commerce is reported as follows:

	Tons.		Tons.
1897	53,400	1901	165,000
1898	87,000	1902	148,400
1899	126,700	1903	127,000
1900	76,800	1904	76,200

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There is no record for 1904 of the vessels passing through the channel, only the local traffic being given. The greatest single item was fish, which amounted to 44,000 tons.

July 1, 1904, balance unexpended	$33,305.76
June 30, 1905, amount expended during fiscal year, for works of improvement	17,741.56
July 1, 1905, balance unexpended	15,564.20

(See Appendix A 1.)

2. Narraguagus River, Maine.—The navigable portion of the river is 7 miles in length. The town of Millbridge is located about 2 miles above its mouth and the lumber town of Cherryfield at the head of navigation. The mean range of tide is 11.3 feet.

Before improvement the river was obstructed from its mouth to Millbridge by a bar having a depth of 6 feet at mean low tide and less than 4 feet at extreme low tide. Between Millbridge and Cherryfield the river was obstructed by bowlders and ledge.

The original project upon which the first appropriation was made is set forth in the district officer's report of December 8, 1870, and provided only for the betterment of navigation above Millbridge by the removal of obstructions, such as mill waste, sunken bowlders, and the construction of an iron spindle on Half Tide rock. This work was completed in 1874. The amount expended was $22,000, and the resulting improvement is said to have been of great benefit to navigation.

The improvement of the river below Millbridge was provided for by project submitted in 1880. Its object was to dredge a channel 200 feet wide and 11 feet deep as far up as Long Wharf, and 9 feet thence to the anchorage known as Deep Hole. The estimated cost was $50,000, and appropriations aggregating this amount were made between 1886 and 1899.

The amount expended on the latter project to the end of the fiscal year 1905 was $49,643.81; but the project was not completed as originally projected, a change having been made necessary by the abandonment of Long Wharf by the steamboat company and the erection of a new wharf farther down the river. This change of location of the steamboat wharf rendered unnecessary any further dredging above that point, and accordingly the last appropriation was expended in dredging in front of the wharf and between that point and the deep water of the bay. In obtaining a depth of 11 feet to the steamboat wharf where it is now located the main object of the improvement has been accomplished. The work is only temporary. The material excavated was a mixture of sawdust and mud and will be replaced in the course of a few years by a new deposit of the same material. It is reported that the portion of the river in front of the wharf has already shoaled to a depth of 7 feet at mean low tide.

Nothing has been done during the fiscal year.

The commerce for the last eight years is given as follows:

	Tons.		Tons.
1897	41,500	1901	41,934
1898	26,147	1902	32,885
1899	23,545	1903	40,525
1900	35,825	1904	41,925

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More than 50 per cent of the tonnage is lumber.

July 1, 1904, balance unexpended	$356.19
July 1, 1905, balance unexpended	356.19

(See Appendix A 2.)

3. Breakwater from Mount Desert to Porcupine Island, Bar Harbor, Me.—The object of the breakwater is to protect the wharves of Bar Harbor and the anchorage in front of the town from the heavy seas of southerly gales.

The present project is the original one, approved June 14, 1889, modified as to length of breakwater by the revised project of 1893. It provides for a breakwater of riprap stone, extending from Porcupine Island a distance of 2,500 feet in a westerly direction, to a point about 600 feet from the low-water line of Mount Desert Island, the estimated cost being $420,200.

The expenditures to June 30, 1905, were $189,789.18, by which date the breakwater had been raised to a height of mean high tide for a distance of 1,790 feet from Porcupine Island. The width on top is 20 feet and the side slopes are such as the rock naturally assumes. As funds become available the existing work will be maintained and extended until the proposed length is obtained, after which the cross section will be strengthened to the extent required for permanency.

The beneficial effects resulting from the portion of the breakwater already built in protecting the wharves at Bar Harbor and the anchorage basin are appreciably felt; but in order to secure the desired protection at high water of spring tides it will probably be found necessary to raise the breakwater to a height of about 6 feet above mean high tide. The mean range in tides is 11.5 feet.

The benefits to navigation are general in providing a harbor of refuge, and local in making it possible for boats to land at the wharves at all times with safety. The only convenient method of transportation to and from Bar Harbor is by boat.

The last appropriation for this work was in 1899, and no work has been done since 1900. At the last inspection it was noted that the crest of the portion in place had been lowered throughout about 6 feet by storm action.

The commerce has been reported as follows:

	Tons.
1898	22,175
1899	24,393
1901	42,150

July 1, 1904, balance unexpended	$210.82
July 1, 1905, balance unexpended	210.82
Amount (estimated) required for completion of existing project	230,200.00

(See Appendix A 3.)

4. Harbor at Sullivan Falls, Maine.—Sullivan River has a length of about 6 miles and is the outlet of a large bay. About midway of its length a point of land projects to such extent as to reduce the width to about one-fourth that immediately above and below, and at this place the slope and velocity are such that the locality is termed "Sullivan Falls." The bottom is ledge, the higher portions forming dan-

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gerous obstructions to navigation. Hatchers rock, about midway of the narrow channel at the falls, had originally only about 6 inches of water over it at mean low tide. The mean range in tides is 11.5 feet.

Under a project set forth in report of the district engineer, dated December 10, 1870, and under appropriations based thereon, the sum of $35,000 was expended in removing three old piers, in excavating the obstructing ledges at the falls to a depth of 7 feet at mean low tide, and in replacing spindles on two rocks near the mouth of the river. This work was completed in 1875 and was of material benefit to navigation.

The present project is that referred to in the river and harbor act of June 3, 1896, as the "approved project," and published in the Annual Report of the Chief of Engineers for 1891, page 619. It provides for removing Hatchers rock and two other points of ledge to a depth of 10 feet at mean low tide, at an estimated cost of $35,000.

The expenditures under the existing project to June 30, 1905, were $14,795.64, and the operations consisted in removing the entire area of Hatchers rock and about five-sixths of ledge "C" to a depth of 10 feet at mean low tide.

To complete the present project the remaining part of ledge "C," containing about 67 cubic yards in situ, and ledge "B," containing 255.3 cubic yards in situ, will have to be removed.

The improvement not only increases the navigable depth, but also, by removing the cause of eddies and cross currents, has added to the length of time at each high and low tide during which vessels may pass through the rapids with safety.

Vessels can not use the channel at low stages except when the tide is slack. This occurs after the tide has flowed about 2 feet, at which time vessels drawing 11 feet can pass through safely.

The improvement may be regarded as permanent.

The commerce for the last six years has been as follows:

	Tons.		Tons.
1899	42,125	1902	37,050
1900	35,926	1903	45,700
1901	49,125	1904	31,400

The commerce consists almost entirely of granite.

July 1, 1904, balance unexpended	$204.36
July 1, 1905, balance unexpended	204.36
Amount (estimated) required for completion of existing project	20,000.00

(See Appendix A 4.)

5. Union River, Maine.—The navigable portion of the river extends from the head of Union Bay to the foot of the falls at Ellsworth, a distance of about 3¾ miles.

Before improvement the channel was obstructed by a large deposit of slabs, edgings, and sawdust near Ellsworth, which practically suspended navigation except at high tide, by projecting ledges in the narrows about three-fourths of a mile below the wharves at Ellsworth, by bowlders at several points along the channel, and by a broad, flat bar of sawdust and mud at the mouth.

The first project for the improvement of the river is contained in the report of the district officer dated June 30, 1867, and provided for

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erecting beacons, removing sunken ledges and bowlders, and dredging mill waste near Ellsworth, so as to secure a depth of 3 feet at mean low tide, this being the available depth on the bar at the mouth of the river. This improvement was completed in 1873 with an expenditure of $30,000.

A survey was made in 1889 under the provisions of the act of 1888, and a new project was submitted with a view to obtaining a depth of 6 feet at mean low tide from the wharves at Ellsworth to deep water in the bay. This depth was to be obtained by dredging mill waste near Ellsworth, by removal of ledge in the Narrows, and by dredging across the bar at the mouth of the river. To maintain the improved depth of the latter point the same project provided for the construction of a training wall to concentrate the ebb flow in the channel. The present authorized project is that described above with the training wall omitted, and is published on page 461, Part 1, Annual Report of the Chief of Engineers for 1890.

The act of June 3, 1896, appropriated $15,000 for beginning the improvement. This sum was expended in excavating to a depth of about 6 feet over a section of river about 3,000 feet long in the vicinity of the Narrows, and in carrying a single cut of the dredge to the same depth as far up as the wharves, to afford immediate relief to navigation. This single cut was partly filled with new deposit by the next freshet.

By the act of March 3, 1899, the sum of $15,000 was appropriated and a contract was authorized for completing the improvement, at an additional cost of $115,000.

Changes having occurred since the making of the survey upon which the project was based, a new survey was made in May, 1899, and a project for securing the completion of the improvement, with such changes in quantities as were shown to be necessary by the survey, was approved by the Secretary of War June 28, 1899.

This project was completed in 1902. The dredging at the mouth of the river and the removal of the ledge in the Narrows were accomplished, and the channel at Ellsworth, where the material was sawmill waste, was dredged, but the depth at the latter place is not expected to maintain because of the movement during freshets of material from the great deposits of mill waste at that locality.

The expenditures to June 30, 1905, in connection with the last project were $142,101.36.

The mean range in tide is 11.5 feet.

The tonnage for the past seven years is given below. It is reported that nearly all commodities now come by rail instead of by water. Shipments from Ellsworth by rail are increasing with corresponding decrease in shipments by water.

	Tons.		Tons.
1898	50,462	1902	32,169
1899	49,800	1903	20,038
1900	42,580	1904	14,961
1901	37,749		

July 1, 1904, balance unexpended	$2,898.64
July 1, 1905, balance unexpended	2,898.64

(See Appendix A 5.)

6. Bagaduce River, Maine.—This is a small stream that empties into Penobscot Bay at Castine, Me. The upper part of the river

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divides into two branches, one called Northern Bay and the other South Bay. Northern Bay, near South Penobscot, is a shoal sheet of water of about 700 acres area, the bottom of which for the greater part is bare at low tide. Before improvement there was a narrow channel from Bridges Point to Bowden's wharf, which had a depth of less than 2 feet and was obstructed by ledges and bowlders near Winslows Island. The South Bay is obstructed by ledges at Johnsons Narrows. Mean rise and fall of tide, 9.8 feet.

The approved project is understood to be that published at page 398 of the Annual Report of the Chief of Engineers for 1888. Its object is to secure a channel 100 feet wide and 6 feet deep at mean low tide from Bridges Point, Northern Bay, to Bowden's wharf, at an estimated cost of $45,000. The same project provides for removing a small quantity of rock in the channel at Johnsons Narrows, at an estimated cost of $1,875. All work done has been in accordance with this project.

The expenditures to June 30, 1905, were $24,865.21. At that date there had been obtained by dredging and by the removal of rocks and bowlders, mainly at Winslows Island, which was the shoalest place, a channel 40 feet wide and about 2 feet deep at mean low tide.

Navigation has not been appreciably benefited by the improvement, which is of doubtful public value.

There were no operations during the fiscal year 1905. A contract has just been made under which it is expected during the present working season to secure about 4 feet depth through the 40-foot cut already made.

The commerce for the last eight years is given below, but it is to be remarked that this includes the business of Castine, a place of some importance at the mouth of the river:

	Tons.		Tons.
1897	86,600	1901	95,900
1898	79,965	1902	99,250
1899	89,500	1903	99,775
1900	86,000	1904	102,950

July 1, 1904, balance unexpended	$3,254.59
June 30, 1905, amount expended during fiscal year, for works of improvement	119.80
July 1, 1905, balance unexpended	3,134.79
July 1, 1905, outstanding liabilities	2.86
July 1, 1905, balance available	3,131.93
July 1, 1905, amount covered by uncompleted contracts	2,713.80
Amount (estimated) required for completion of existing project	18,875.00

(See Appendix A 6.)

7. Penobscot River, Maine.—Except the dredging of a sawdust bar opposite High Head, near Bucksport, Me., the improvements have been confined to a stretch of about 3½ miles of the river at and below Bangor. Before improvement this part of the river was obstructed by ledge, bowlders, and mill waste to such extent as to afford a safe available depth of only about 6 feet at extreme low tide. The mean range in tides is 13.1 feet.

The original project is given in the district officer's report of August, 1870, and was approved August 22, 1870. Its object was to obtain, by dredging and by removing obstructing ledges and bowlders

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over 3½ miles of river at and below Bangor, an unobstructed channel having a width of 150 feet and a depth of 12 feet at the lowest tides. There was expended prior to the adoption of the present project $198,300.

The present project is an extension and modification of that of 1870. It is based on a survey ordered by the act of September 19, 1890, and its object is to secure a channel depth of 11 feet at extreme low tide for a width of 360 feet in Bangor Harbor; to widen, straighten, and deepen the channel near Crosbys Narrows and Stern's mill to a depth of 12 feet at extreme low tide; and to secure a depth of 22 feet at mean low tide between Bucksport and Winterport, at an estimated cost of $440,000.

In 1899 the project was extended to include certain work at Bangor Harbor, estimated to cost $28,000.

The expenditures under the existing modified and enlarged project to June 30, 1905, amounted to $169,434.27, and the object of the general project has virtually been accomplished.

The available depths are as follows: Bangor Harbor, 14 feet at mean low tide, or 11 feet at extreme low tide; at Stern's mill and Crosbys Narrows, 15 feet at mean low tide, or 12 feet at extreme low tide. The shoal at Frankfort flats was dredged to 22 feet at mean low water, and, so far as known, has given no trouble since. The shoal at High Head above Bucksport was dredged to the same depth, but afterwards shoaled up to a certain extent and subsequently deepened again by the natural scour of the river. Examination made since the dredging was done shows that the depths on the bar vary and that no material benefit has been obtained by dredging.

In view of the shifting character of this bar, the utter failure to obtain a permanent improvement by dredging, and the fact that it is not in any way a dangerous obstruction to navigation, no further work is recommended upon it at this time.

In the act of March 3, 1899, Congress adopted a project for further local improvement in Bangor Harbor, the object being to remove the ledge in front of the Boston and Bangor Steamboat Company's wharf to a depth of 11 feet at extreme low tide, and to deepen the basin of the Kenduskeag stream at its junction with the Penobscot River. As approved by the Secretary of War, May, 1899, the detailed plan of improvement of the Kenduskeag River, under the general project adopted by the act of March 3, 1899, contemplated dredging through both draws of the railroad bridge, and within the basin between the lower bridge and the post-office bridge, so as to obtain a uniform depth of about 2 feet below mean low water to within 30 feet of the wharf.

Both improvements were completed by the removal of 2,225 cubic yards of ledge in front of the Boston and Bangor Steamboat Company's wharf and 15 cubic yards of bowlders and 27,428 cubic yards of gravel and sand from the basin of the Kenduskeag stream. The improvement at the Boston and Bangor steamboat wharf is permanent; that in the mouth of the Kenduskeag not so. The depth it was expected to obtain in the later was 2 feet below mean low water, but the available depth secured is, in fact, less than this on account of bowlders brought in by freshets and scattered over the basin.

During the fiscal year no work has been done.

As above stated, the mean range in tide at Bangor Harbor is 13.1 feet, and the depth of water resulting from past improvements is 14

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feet, giving a depth of 27½ feet in the improved channel at high water of an average tide. The available high-water depth is some less than this at neap tide and correspondingly greater at spring tide. Deep-draft vessels always come in and depart at the height of the tide. Incoming vessels of deep draft are immediately docked on arrival, as there is not enough water in the channel to float them at low tide. There has been no special demand made for a further deepening of the channel of the river, but there has been a growing demand for an increase in its capacity by widening, the present area of deep water being insufficient to accommodate the traffic. Several instances have been reported of vessels being injured by striking ledges after being forced out of the channel. The act of 1905 provided for a preliminary examination, which has been made and a survey ordered.

The commerce of the river for the last eight years is given as follows:

	Tons.		Tons.
1897	790,698	1901	708,012
1898	639,671	1902	689,369
1899	658,632	1903	861,579
1900	917,835	1904	812,273

The bulk of the business for 1904 consisted of coal and lumber.

July 1, 1904, balance unexpended	$8,610.39
June 30, 1905, amount expended during fiscal year, for works of improvement	44.66
July 1, 1905, balance unexpended	8,565.73

(See Appendix A 7.)

8. Bucksport Harbor, Maine.—The mean range in tide is 10.6 feet. Before improvement the bed of the river on the east side in front of the wharves of Bucksport was obstructed by a deposit of sawdust and mud, having a minimum depth of about 4 feet at mean low tide.

Under appropriations aggregating $16,500, this obstructing shoal, locally known as the Middle Ground, was dredged between 1875 and 1878, under the general project for improving Penobscot River, to a depth of 12 feet at mean low tide over that portion of its area lying immediately in front of the wharves, and to a depth of 8 feet over the remainder.

The existing project is based upon a report of a survey printed in the Annual Report of the Chief of Engineers for 1900, page 1103, and was adopted by the act of June 13, 1902. It provides for removing the Middle Ground, which has again shoaled, to a depth of 16 feet at mean low tide, at an estimated cost of $20,000.

The expenditures under existing project to close of fiscal year ending June 30, 1905, have been $18,420.99. The improvement was completed in 1903.

As there are large sawdust and mud bars above this point, which are set in motion in times of freshet, it is expected that the area dredged at Bucksport will slowly fill in again in the course of years. The improvement should therefore not be regarded as entirely permanent.

July 1, 1904, balance unexpended	$1,685.36
June 30, 1905, amount expended during fiscal year, for works of improvement	106.35
July 1, 1905, balance unexpended	1,579.01

(See Appendix A 8.)

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9. Camden Harbor, Maine.—The mean range in tide is 9.7 feet. Before improvement navigation was impeded by shoal water, there being a depth of about 6 feet in the outer harbor at the steamboat landing and less than 1 foot in the inner harbor, where most of the wharves are located.

The first project is contained in the district officer's report of December 17, 1872, and provided for dredging two channels, one 1,500 feet long, 100 feet wide, and 7 feet deep at mean low water on the easterly side of the harbor, the other 1,400 feet long, 100 feet wide, and 7 feet deep at mean low water. This improvement was completed in 1875, under appropriations aggregating $30,000 made by acts of 1873, 1874, and 1875.

The harbor was again surveyed and a new project submitted in 1887, under the provisions of the river and harbor act of 1886. This project provided for dredging at the entrance to the harbor to a depth of 12 feet at mean low tide; to dredging a channel on each side of the harbor and approaches to the same to a depth of 10 feet; to dredging small channels along the wharves at the extreme upper end of the harbor to 5 feet, and after completion of the above, to dredging the Middle Ground of the harbor to the same depths as the adjacent channels. The project was completed in 1897, with an expenditure of $44,940.79.

There is one small stream emptying into the harbor at the extreme upper end, but it is not a silt-bearing stream, and it is believed that the improved depths have remained practically permanent.

Under the provisions of the river and harbor act of March 3, 1899, a new survey was made in the vicinity of the Boston and Bangor Steamboat Company's wharf in the outer harbor and a project submitted for increasing the depths in this vicinity to 14 feet at mean and 11 feet at extreme low water so as to accommodate the boats of this line, which have had difficulty in reaching their wharves at extreme low run of tides. The cost was estimated at $7,400. This project is published at page 1111 of the Annual Report of the Chief of Engineers for 1900.

Expenditures under the latter project up to June 30, 1905, were $7,285.53, and resulted in completion of the improvement, giving a uniform depth of 14 feet at mean low tide over an area in front of the Eastern Steamship wharf, where the depth had previously ranged from 9.5 to 13 feet.

July 1, 1904, balance unexpended	$173.68
July 1, 1905, balance unexpended	173.68

(See Appendix A 9.)

10. Rockland Harbor, Maine.—The wharves are located on the shores of three coves, formed by two projecting points of land on the western side of the harbor, known as Crocketts Point and Atlantic Point. The general direction of the wharf frontage is north and south and the length of frontage is about 800 feet. Before improvement depths in front of the wharves increased very slowly. All the wharves except those at the end of Crocketts Point and Atlantic Point extended only a short distance beyond the low-water contour, a high mean range in tide, which at this point is 9.6 feet, being relied upon to give access to moderate and light draft vessels at high tides. The entrance to the harbor from the east has a width of about 9,000 feet.

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Before improvement the anchorage in front of the wharves, vessels lying at the wharves, and the wharves themselves were endangered by heavy seas during easterly gales.

The first improvement undertaken was to render it a safe harbor of refuge for coastwise shipping, and incidentally also to protect the wharves as far as possible from heavy seas. To accomplish this a project was adopted in 1881 in which two breakwaters were contemplated, one extending south from Jamesons Point, the other a detached breakwater nearer to and opposite the principal wharves in the town; both to be raised in the first instance to the level of mean tide, but with the expectation that a further raising would be necessary as experience might dictate.

In 1886 this project was amended so as to raise the height of the breakwater at Jamesons Point to the level of mean high tide. In 1890 it was again amended so as to eliminate the detached breakwater and to provide for extending farther south than was first contemplated the breakwater at Jamesons Point.

By the act of June 3, 1896, Congress adopted a project for dredging the inner harbor in the vicinity of the wharves to depths ranging from 4 feet to 13 feet at mean low tide and for removing two dangerous ledges, one occupying a central position in the harbor, which was to be cut down to the depth of 22 feet at mean low tide; the other, less centrally located, was to be removed to a depth of 14 feet. The estimated cost was $403,000. By the same act this project was combined with that for the breakwater as one project, and authority was given for completing the whole under the continuous-contract system, at an estimated expenditure of $1,036,000.

The dredging was finished in May, 1901; the removal of ledge in the fall of 1901. The breakwater was also completed to the height and slopes contemplated before the close of the same season. The sea slope of the breakwater did not maintain its status under the heavy gales of the winter of 1900–1901, and 32,656 tons additional of heavy riprap was placed on it before the close of the fiscal year 1902.

The winter of 1903–4 was phenomenal for its extreme cold and consequent heavy ice. An examination of the breakwater early in 1904 showed more or less disturbance of the sea slope as a result of the ice movement and the heavy seas. During the fiscal year 1905, 19,716 tons of stone was placed along the outer slope. This work is regarded as rather for improvement than for maintenance, as it was to be expected that some work would be necessary from time to time until the slopes had assumed a state of rest.

The total expenditures to the close of the fiscal year 1905 were $915,466.78. The benefits resulting are that the breakwater affords a safe and extensive anchorage and harbor of refuge. The removal of ledges has increased the available anchorage area, and the dredging affords access to the wharves by vessels of greater draft.

The commerce for the last eight years is given as follows:

	Tons.		Tons.
1897	594,992	1901	522,175
1898	579,300	1902	470,825
1899	755,649	1903	498,660
1900	553,000	1904	512,170

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July 1, 1904, balance unexpended	$34,551.27
June 30, 1905, amount expended during fiscal year, for works of improvement	24,518.05
July 1, 1905, balance unexpended	10,033.22
July 1, 1905, outstanding liabilities	201.95
July 1, 1905, balance available	9,831.27

(See Appendix A 10.)

11. Carvers Harbor, Vinalhaven, Me.—The object of the improvement is to secure a better anchorage than the harbor afforded in its natural state. Before improvement the anchorage area was limited as to area and depth, there being less than 8 feet at mean low tide over the most of it.

The project of improvement, as approved by the Secretary of War May 11, 1897, provides for dredging the inner harbor to a depth of 16 feet at mean low tide over an area about 23 acres in extent and at an estimated cost of $64,000.

The expenditures under the existing project up to the close of the fiscal year ending June 30, 1905, amounted to $42,841.60.

The project is completed, giving 16 feet at mean low tide over an area about 1,300 feet by 750 feet, or practically all that part of the inner harbor used for commerce.

The improvement will be fairly permanent and will be a benefit to navigation in affording a harbor of refuge and increased facilities for reaching the wharf.

The mean range in tides is 9.3 feet.

The commerce for the last eight years is given as follows:

	Tons.		Tons.
1897	63,074	1901	78,300
1898	60,000	1902	77,200
1899	63,390	1903	82,906
1900	64,500	1904	64,650

Probably 70 per cent of the tonnage is granite.

July 1, 1904, balance unexpended	$2,158.40
July 1, 1905, balance unexpended	2,158.40

(See Appendix A 11.)

12. Georges River, Maine.—This river is a tidal estuary with a mean rise and fall of the tide of 10 feet. The head of navigation is Thomaston, Me.

The navigable depth is full 3½ fathoms to a point about 1 mile from Thomaston, but from this point to the head of navigation the channel before improvement was narrow, with a short bend at one point and with a least depth of about 11 feet at mean low tide.

By act of June 3, 1896, Congress adopted a project for dredging to 16 feet at mean low tide, and to widths as follows: As far up as the bend, 160 feet; in the bend, 220 feet; beyond the bend, 125 feet, narrowing to 90 feet at the upper end.

The estimated cost was $26,000.

The expenditures to June 30, 1905, were $25,787.91, and the work covered by the project has been accomplished.

Gradual shoaling by material brought down by freshets may be expected, but the process will be slow and a depth sufficient to accommodate the traffic will probably be maintained for a number of years.

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The depth of the dredged channel is such that vessels could be towed out at any stage of the tide, but as the business at that locality does not seem to warrant the maintenance of a tug they have to wait until near high water and a favorable wind in order to go in or out under sail with safety.

The commerce is given as follows:

	Tons.		Tons.
1897	64,250	1901	60,000
1898	59,000	1902	45,000
1899	60,000	1903	21,050
1900	29,225		

July 1, 1904, balance unexpended	$357.09
June 30, 1905, amount expended during fiscal year, for works of improvement	145.00
July 1, 1905, balance unexpended	212.09

(See Appendix A 12.)

13. New Harbor, Maine.—This is a small harbor on the easterly side of Pemaquid Neck and about 14 miles southeast of Newcastle, the nearest railroad station. The entrance is good, but inside the harbor the greatest depth is only about 10 feet at mean low tide, and that for a limited area. The upper part of the harbor is bare at low tide. These conditions prevented the steamer, on which local interests depend for freighting, from landing at low tide and made it impossible for fishing vessels and boats to reach the upper wharves to land their catch except at high water. Lack of anchorage room also produced a crowded condition in the lower harbor.

The existing project, which was adopted by the act of March 3, 1905, is based on a survey made in 1903, the report of which was printed in the Annual Report of the Chief of Engineers for 1904 (p. 816). It covers the only work ever proposed for this locality and provides for dredging to a depth of 12 feet at mean low tide over an area of about 4½ acres in the lower part of the harbor and to 6 feet at mean low tide over an area of about 4¼ acres in the upper part. The estimated cost is $10,500.

The amount expended to the close of the fiscal year 1905 was $129.75. No work has yet been done, but a contract has been made for doing all the dredging covered by the project. It is expected that operations will be commenced about the last of July and completed during the present season.

The tonnage for the year 1904 is reported as 8,349 tons, and the number of passengers 1,500. It has been estimated that about $300 per year will be saved through the steamer making regular landings alone.

Amount appropriated by river and harbor act approved March 3, 1905	$10,500.00
June 30, 1905, amount expended during fiscal year, for works of improvement	129.75
July 1, 1905, balance unexpended	10,370.25
July 1, 1905, outstanding liabilities	12.60
July 1, 1905, balance available	10,357.65
July 1, 1905, amount covered by uncompleted contracts	9,229.50

(See Appendix A 13.)

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14. Damariscotta River, Maine.—Damariscotta River is a tidal estuary about 15 miles in length up to the head of navigation, where the villages of Newcastle and Damariscotta are situated. The approach to the wharves is obstructed by a shoal having a least depth of 5 feet at mean low tide.

The existing project, which represents the first work proposed for this locality, was adopted by the act of March 3, 1905, and is based upon a survey made in 1903, the report of which is published in the Annual Report of the Chief of Engineers for 1904 (p. 800). It provides for dredging the above-mentioned shoal to a depth of 9 feet at mean low tide, at an estimated cost of $5,000.

The amount expended to the close of the fiscal year 1905 was $25.53. No work has yet been done, but a contract has been made for doing all the dredging covered by the project. It is expected that operations will be commenced about the 1st of August and completed during the present season.

Amount appropriated by river and harbor act approved March 3, 1905	$5,000.00
June 30, 1905, amount expended during fiscal year, for works of improvement	25.53
July 1, 1905, balance unexpended	4,974.47
July 1, 1905, outstanding liabilities	5.60
July 1, 1905, balance available	4,968.87
July 1, 1905, amount covered by uncompleted contracts	4,177.36

(See Appendix A 14.)

15. Kennebec River, Maine.—Before improvement the main channel of the river between the foot of Swan Island and Gardiner was obstructed by shoals near Beef rock, with only 10 feet of water at mean low tide, by dangerous sunken ledges in Lovejoy Narrows, by a shoal below South Gardiner with only 8 feet on it at mean low tide, and by a ledge at Nehumkeg Island. The steamboat channel to the west of Swan Island (at Hatchs rock) was obstructed by a shoal over which there was only 7½ feet of water, and the channel between Gardiner and Augusta, a distance of 6½ miles was obstructed by shoals which gave a navigable depth of only 3½ feet in low summer tides.

Appropriations for minor improvements were made at various times between 1827 and 1852.

In 1866 a project was begun for improving the upper part of the river with a view to obtaining a channel 7 feet deep and 100 feet wide at low water. This project, with modifications, was completed in 1877 and resulted in obtaining a channel 10 feet deep at mean low tide and not less than 100 feet wide in its lowest summer stages as far up as Gardiner, and a depth of 6½ feet at low tide and width of 100 feet from Gardiner to Augusta.

The channel west of Swan Island, being obstructed by shoal water (8½ feet at mean low tide) and a too narrow channel at the head of the island, by shoal water at Hatchs rock, below Richmond, and by a very narrow channel 30 feet wide at the foot of the island, was improved by dredging in 1881–1883, so as to give a channel 175 feet wide and 11 feet deep at the foot of the island and a channel of about 80 feet width and 10 feet depth at Hatchs rock and the head of the island.

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The river and harbor act of 1886 provided for a new survey of the river from Bath to Augusta. This survey was made in 1887, and a project embracing dredging, rock excavation, and contraction works was submitted for the further improvement of the river. In 1892 this project was revised to secure depths as follows: Thirteen feet at mean low tide as far up as Sands Island; 12 feet thence to Hinckleys shoal, above Gardiner, and 10 feet thence to Augusta, at an estimated cost of $388,500. This project was approved August 19, 1892, and was completed in 1898.

The total expenditures upon the river to June 30, 1905, upon the projects above enumerated, were $483,674.33.

The improved channel obtained under the above projects has suffered some loss of available depth by the deposits brought down by freshets. This shoaling has been most marked in the stretch of 6½ miles of river between Gardiner and Augusta, the further improvement of which is provided for by the river and harbor act approved June 13, 1902, which appropriated $40,000 and authorized a continuous contract for the completion of the project. The last project is published at page 1121 of the Annual Report of the Chief of Engineers for 1900, and proposes a widening of the channel from Gardiner to Augusta to 125 feet, and a cleaning out of the old dredged channel and its further deepening to 16 feet at mean high water, or 11 feet at mean low water.

Nothing has yet been done under the project of 1902, and there have been no expenditures. The work has been advertised, but the bids were rejected because in excess of the authorized cost. It will be readvertised.

The mean rise and fall of tides at Bath is 6.9 feet; at Gardiner, 5.1 feet; at Augusta, 4.3 feet.

Augusta is the head of general navigation, though above the dam at that place the stream admits of navigation in a limited way. Probably not more than 7 feet at mean low tide could be carried up to Augusta.

The commerce for eight years is given as follows:

	Tons.		Tons.
1897	665,991	1901	542,626
1898	1,211,808	1902	431,118
1899	714,199	1903	499,849
1900	716,930	1904	468,980

GENERAL IMPROVEMENT.

July 1, 1904, balance unexpended	$17,413.12
June 30, 1905, amount expended during fiscal year, for works of improvement	737.45
July 1, 1905, balance unexpended	16,675.67
July 1, 1905, outstanding liabilities	75.00
July 1, 1905, balance available	16,600.67

BETWEEN GARDINER AND AUGUSTA.

July 1, 1904, balance unexpended	$40,000.00
July 1, 1905, balance unexpended	40,000.00
Amount (estimated) required for completion of existing project	41,000.00

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Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	$41,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix A 15.)

16. Portland Harbor, Maine.—The entrance to the main part of the harbor of Portland, or the anchorage, has always been good, but before improvement the approach to the inner harbor was obstructed by a shoal known as the Middle Ground, over which the depth was only from 8 to 10 feet at mean low tide, while between it and Stamford ledge the greatest available depth was only 16 feet. The best part of the wharf front was exposed to swell from the main entrance, which sometimes made it dangerous for vessels to lie at the docks, and along this front the depth was in some places as shallow as 4 feet.

The first work of improvement undertaken by the Government was the construction of the breakwater. This was begun as early as 1836. It was completed in 1874.

The work of deepening the harbor was begun under the act of Congress of 1868, the plan of improvement being to excavate a channel 300 feet wide and 20 feet deep at mean low tide through the southern slope of the Middle Ground and to remove the bar off the Grand Trunk Railroad wharves to the same depth.

The project was modified in 1870 so as to provide for a channel 400 feet wide, and again in 1871 so as to provide for a channel 500 feet wide. In 1872 further modifications were made by including in the project the dredging of Back Cove and the dredging of the inner harbor up to the harbor commissioner's lines to a depth of 16 feet at mean low tide. The project, modified as above described, excepting some dredging in the inner harbor, was completed by 1876. Between 1881 and 1885 the Middle Ground was removed to a depth of 21 feet at mean low tide.

A further deepening of a portion of the harbor to 29 feet at mean low tide was next begun under the project of 1886. To this was subsequently added, in 1890, a small amount of dredging in the upper part of the harbor.

In 1894 the project was extended to cover the widening of the upper part of the 29-foot area and the dredging of a channel 25 feet deep to connect the deep water in the lower part of the harbor with deep water in the upper part. This work was completed in 1894.

By the act of June 3, 1896, Congress adopted a project for dredging to 30 feet at mean low tide over the greater part of the harbor, at an estimated cost of $770,000, and included in the project the further improvement of Back Cove at a combined estimate of $946,250. The same act appropriated $20,000 for beginning work and authorized the making of a contract for its completion.

The latter project was completed in 1902 at a cost which was about $253,000 less than the estimate. By the sundry civil act of March 3, 1905, Congress authorized an amendment to the project by which the 30-foot channel is to be continued up Fore River as far as the Boston and Maine Railroad bridge, and a channel of entrance to Back Cove dredged to the same depth. The width in each case is to be about 300 feet. The work is to be done without increasing the estimated cost.

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The total expenditures to the close of the fiscal year ending June 30, 1905, have been $1,270,815.89.

There are no silt streams emptying into Portland Harbor, and the improved depths obtained under the project will be practically permanent. The maximum draft that can be carried to the wharves in Portland Harbor at mean low tide is 30 feet and to the wharves in Back Cove about 11 feet. The mean range in tide is 8.8 feet.

Two principal advantages have followed this large improvement. A large and well-sheltered deep-water anchorage has been created under the shelter of the breakwater, and the trans-Atlantic vessels can arrive and depart from their docks at the lowest stages of tide.

The portion of the harbor in which most of the dredging has been done is the lower part of so-called Fore River. This river is crossed by four bridges. Going up the harbor these are: (1) Portland Bridge; (2) bridge of the Boston and Maine Railroad, eastern division; (3) Vaughan Bridge, belonging to city; (4) bridge of Boston and Maine Railroad, western division. Portland Bridge has a draw 65 feet wide, and admits vessels of the largest class coming to Portland. The next bridge has recently been reconstructed with a draw opening of 60 feet, and the city of Portland is now negotiating for the reconstruction of the third bridge with an opening of not less than 60 feet. The improvement in the bridges and the new channels will afford great relief to the coal trade and other deep-draft commerce which has been much hampered and retarded by lack of room and sufficient water.

The commerce for the last eight years is given as follows:

	Tons.		Tons.
1897	1,326,844	1901	2,461,515
1898	1,334,752	1902	2,224,091
1899	1,620,284	1903	2,312,457
1900	2,261,008	1904	2,233,475

July 1, 1904, balance unexpended	$13,779.58
Amount appropriated by river and harbor act approved March 3, 1905	100,000.00
	113,779.58
June 30, 1905, amount expended during fiscal year, for works of improvement	868.42
July 1, 1905, balance unexpended	112,911.16
July 1, 1905, outstanding liabilities	115.02
July 1, 1905, balance available	112,796.14
Amount (estimated) required for completion of existing project	139,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	139,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix A 16.)

17. Saco River, Maine.—[This work was in the charge of Col. W. S. Stanton, Corps of Engineers, to March 31, 1905.] In its original condition Saco River had a very winding course with abrupt bends and narrows, which, with its sunken rocks and ledges, presented many difficulties of navigation. The depth on the bar was only 2 feet at mean low water.

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The original projects appear to have been—

(1) From 1824–1827 for the erection of piers, placing beacons and buoys, and removing obstructions near the entrance to the harbor. Under this project 12 piers of timber and stone were built, 10 in the river to mark sunken rocks and to facilitate navigation by sailing vessels, and 2 outside the mouth designed, but without success, to create a channel through the bar. The construction and maintenance of these works cost, 1824–1827, $12,000.

(2) Adopted by the act of June 23, 1866, to construct a breakwater 2,915 feet long connecting the two outside piers, and to repair the river piers and improve the channel. Under this project, completed in 1874, the channel in the river and through the bar was improved, and a breakwater built on the north side of the channel 4,200 feet long and 10 feet high above mean low water, at an expense of $162,271.75.

The existing project is the consolidation by the act of September 19, 1890, of the project adopted in 1884 for repairing the breakwater, extending it 2,200 feet to Sharps ledge, building a stone jetty on the south side of the channel, and dredging between the jetties at an estimated cost of $356,500; and the project adopted in 1886 for improving the river to Saco, 5 miles above its mouth, to the depth of 6 feet at mean low water, estimated to cost $50,000, amounting to $406,500. But some uncertainty seems to exist whether Congress has adopted that part of the project extending the breakwater 2,200 feet to Sharps ledge. By the report of the district officer in 1900, from an examination made at that time it appears that extension of the breakwater is necessary to prevent the influx of sand into the channel, which is from the north side.

On June 30, 1905, there had been expended on this consolidated project $172,258.37, with which all the works of improvement have been completed except the extension of the breakwater 2,200 feet to Sharps ledge, estimated to cost $200,000, and upon which no work has been done. An examination made in 1900 showed that 3½ feet at mean low water was the maximum draft that could then be carried over the bar, the shoalest part of the locality under improvement. No examination has since been made from which the depth can be given to June 30, 1904.

The mean range of tides is 8.8 feet.

The head of navigation is at Saco and Biddeford on opposite sides of the river, to which towns, about 5 miles above the bar, the river is navigable in fact.

The commerce benefited by the improvement consists of coal and building materials, principally coal, and amounted in 1901 to 42,625 tons, in 1902 to 38,072 tons, in 1903 to 33,879 tons, and in 1904 to 39,730 tons.

A description of the harbor and of the earliest improvements is published in the Report of the Chief of Engineers for 1866, page 188. The present project for improvement at the river's mouth is published in the report for 1884, page 484, and for improving the river above the bar in the report for 1886, page 552.

July 1, 1904, balance unexpended	$5,241.63
July 1, 1905, balance unexpended	5,241.63
Amount (estimated) required for completion of existing project	200,000.00

(See Appendix A 17.)

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18. Kennebunk River, Maine.—By an act of Congress in 1798 provision was made for keeping in repair a pier built at the mouth of the river, and under subsequent projects, from 1829 to 1871, an easterly and westerly pier of stone at the mouth of the river, and a wharf of timber cribs filled with stone about 700 feet above the shore end of the easterly pier appear to have been extended and maintained.

In 1876 the project was modified to obtain by dredging a channel of navigable width, not less than 4 feet deep at mean low water, from the mouth of the river up about 1⅛ miles to Kennebunkport, at an estimated cost of $5,000.

With the amount ($83,584.01) expended on the original and modified projects to 1893, when they were reported completed (Annual Report, Chief of Engineers for 1893, p. 713), a westerly pier 600 feet, an easterly pier 290 feet, and a wharf 300 feet in length appear to have been extended and maintained, and a channel of navigable width, 4 feet deep at mean low water, obtained by dredging and rock excavation.

In December, 1902, an estimate was submitted, amounting to $3,500, for the repair of the two piers and the wharf. This sum was appropriated for maintenance by the act of March 3, 1905.

The maximum draft that could be carried at mean low water on June 30, 1905, over the shoalest part of the locality under improvement is 4 feet. The mean range of tide is 9 feet.

The head of navigation is at Kennebunkport, to which point, 1⅛ miles from its mouth, the river is navigable in fact.

The commerce benefited consists principally of coal, of which 2,000 tons was delivered on the river in 1904. An occasional vessel brings in lumber for the shipyards, of which there are two at this point

A description of the improvement at the mouth of the river may be found in the Annual Report of the Chief of Engineers for 1870, page 506, and of the channel above the mouth, in the report for 1875, Part 2, page 434.

Amount appropriated by river and harbor act approved March 3, 1905	$3,500.00
July 1, 1905, balance unexpended	3,500.00

(See Appendix A 18.)

19. York Harbor, Maine.—York Harbor is the mouth of York River, a small stream emptying into the Atlantic Ocean, about 10 miles east of Portsmouth, N. H. Originally the channel was crooked and difficult to navigate. A project was approved in 1886 for widening and straightening the channel by removing part of the spit off the southwest point of Stage Neck, removing part of a sand shoal off Bragdons Island, and removing the upper shoal just north of Bragdons Island, at an estimated cost of $25,000, subsequently increased (in 1888) to $44,000, on account of some of the material proving harder than was expected. This project was regarded as completed in 1894. The cost was $44,000.

The existing project was adopted by the act of March 3, 1905. It is based on a survey made in 1903, the report on which is published in the Annual Report of the Chief of Engineers for 1904 (page 823), and provides for widening the channel off Bragdons Island about 170 feet by dredging to the depth of 10 feet at mean low tide, and for removing to the same depth the point of a projecting shoal just

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above. The estimated cost is $13,400. No work has yet been done, but bids have been invited and it is expected to make a contract for doing all the work covered by the project during the present working season. There have been no expenditures under the new project.

The commerce for 1904 is reported as 21,900 tons, mostly brick.

Amount appropriated by river and harbor act approved March 3, 1905	$13,400.00
July 1, 1905, balance unexpended	13,400.00
July 1, 1905, outstanding liabilities	50.00
July 1, 1905, balance available	13,350.00

(See Appendix A 19.)

20. Harbor at Isles of Shoals, Maine.—[This work was in the charge of Col. W. S. Stanton, Corps of Engineers, to March 31, 1905.] The most protected anchorage at Isles of Shoals, known as Gosport Harbor, lies between Star Island on the south and southwest, Cedar Island on the southeast, and Smuttynose Island on the north and northeast. At mean low water its anchorage of about 32 acres had a depth of 18 to 48 feet and none of its entrances less than 24 feet.

The original project of March 3, 1821, appears to have been to rebuild the small breakwater on the north side of Haleys Cove, projecting westerly from Smuttynose Island to Cedar Island, directly protecting Gosport Harbor from easterly storms.

The amount expended on the original project prior to operations under the existing project was $13,251.61.

The existing project, adopted by the act of June 13, 1902, is to construct a breakwater on the base of the breakwater that was built under the project of 1821 between Smuttynose and Cedar islands, the upper part of which throughout its length had been demolished down to the level of 1½ feet above mean low water, at an estimated cost of $30,000.

The amount expended on the work of the existing project to June 30, 1905, is $28,201.60, all for improvement, with which the breakwater between Smuttynose and Cedar islands has been completed to the height of 15 feet above mean low water, completing the project.

The mean range of tides is 8.6 feet.

The commerce benefited by the improvement is inconsiderable, but the harbor is of value as a harbor of refuge in the open sea 6 miles off the coast.

A report of a survey of the Smuttynose Island breakwater is published in the Annual Report, Chief of Engineers, for 1875, Part 2, page 421. A description of the harbor, with survey and estimate for the new breakwater, is in the Annual Report for 1900, page 1172.

July 1, 1904, balance unexpended	$5,551.34
June 30, 1905, amount expended during fiscal year, for works of improvement	3,752.94
July 1, 1905, balance unexpended	1,798.40

(See Appendix A 20.)

21. Cocheco River, New Hampshire.—[This work was in the charge of Col. W. S. Stanton, Corps of Engineers, to March 31, 1905.] Appropriations amounting to $10,060, made from 1829 to 1837, inclusive, had been applied to the reduction of obstructions in the

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natural channel prior to the systematic improvement of this river, begun in 1870, when it was found to have a good channel not less than 6 feet deep at mean low water from its confluence with the Piscataqua River to the Lower Narrows, about 1½ miles below the lowest bridge at Dover. Above the Lower Narrows the channel was obstructed by ledges and shoals upon which at mean low water the depth was from 6 inches to 2 feet. The original project for systematic improvement, adopted by the act of March 3, 1871, was to obtain a channel 40 feet wide and 4 feet deep at mean low water from the Lower Narrows to the head of navigation at Dover. Under the original and amended projects completed in 1888 the amount expended prior to operations under the existing project, including the expenditures from 1829 to 1837, was $170,060.

The existing project, adopted by the act of September 19, 1890, is to obtain a channel 60 to 75 feet wide and 7 feet deep at mean low water (in rock 50 feet wide and 7½ feet deep) from the mouth of the river to the head of navigation, at an estimated cost of $175,000. By the act of June 13, 1902, this project was extended to include the restoration of the channel in the Lamprey River, which from 1881–1883, under specific appropriations, had been dredged at mean high water 100 feet wide and 12 feet deep to the Lower Narrows and 40 feet wide and 11 feet deep to the wharves at Newmarket, N. H.

To June 30, 1905, there had been expended on the existing project on Cocheco River, all for improvement, $111,034.68, and on Lamprey River, all for maintenance, $8,267.53—total, $119,302.21—with which the channel in the Lamprey River had been restored to the full authorized dimensions, and a channel had been obtained in the Cocheco River of the full projected width and depth, except for a distance of 1,400 feet about three-fourths of a mile below Dover, over which the greatest continuous depth is 6½ feet. The removal of ledges and shoals obstructing the channel in this locality and the redredging of the basin at Dover will complete the channel called for in the project.

The maximum draft that can be carried over the shoalest part of the locality under improvement is, in Cocheco River, 6½ feet at mean low water; in Lamprey River, 11 feet at high water.

The mean range of tides is 6.8 feet.

The head of navigation is at the lowest bridge at Dover, to which point, 3 miles from its confluence with the Piscataqua River and 13 miles from its outlet to the sea, the Cocheco River is navigable in fact.

The commerce benefited by the improvement consists chiefly of coal and building materials, and amounted in 1901 to 199,890 tons, in 1902 to 121,000 tons, in 1903 to 200,526 tons, and in 1904 to 229,629 tons.

The original project adopted in 1871 is published in the Annual Report of the Chief of Engineers for 1871, page 858; the existing project, adopted in 1890, in the Annual Report for 1890, page 475. A map of Cocheco River, in the vicinity of Dover, may be found in the Annual Report for 1885, page 474.

The act of March 3, 1905, contained an appropriation of $21,711 for completing the improvement, making the total appropriations under the existing project $141,711.

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July 1, 1904, balance unexpended	$889.07
Amount appropriated by river and harbor act approved March 3, 1905	21,711.00
	22,600.07
June 30, 1905, amount expended during fiscal year, for works of improvement	191.28
July 1, 1905, balance unexpended	22,408.79
July 1, 1905, outstanding liabilities	50.00
July 1, 1905, balance available	22,358.79

(See Appendix A 21.)

22. Exeter River, New Hampshire.—[This work was in the charge of Col. W. S. Stanton, Corps of Engineers, to March 31, 1905.] In its original condition at mean high water, Exeter River was navigable from its mouth, in Great Bay, 7.8 miles, to Fernald's wharf in Exeter for vessels drawing 10 feet; thence to the upper wharves at Exeter, 0.5 mile, the depth was 5 feet.

The original project adopted by the act of June 14, 1880, was to obtain a channel 40 feet wide from the mouth, 8.3 miles to the upper wharves at Exeter, 12 feet deep at high water 5.6 miles to Oxbow, and 10 feet deep from Oxbow to Exeter. Under this project the amount expended prior to operations under the existing project was $35,000, with which the original project was completed.

The existing project, adopted by the act of March 3, 1899, is to obtain a channel 40 feet wide at mean high water, 12 feet deep to Oxbow, and 11 feet from Oxbow to Exeter, with a turning basin 200 by 110 feet at Exeter, estimated to cost (increased estimate) $19,000.

The amount expended under the existing project to June 30, 1905, is $18,254.42, all for improvement, with which a channel and turning basin of the dimensions prescribed have been obtained, completing the project.

The mean range of tides is 6 feet.

The head of navigation is at the upper wharves at Exeter, to which point, 8.3 miles above its mouth, the river is navigable in fact.

The original project is described in the Annual Report of the Chief of Engineers for 1875, page 427, and the existing project in report for 1897, page 818.

July 1, 1904, balance unexpended	$745.58
July 1, 1905, balance unexpended	745.58

(See Appendix A 22.)

23. Harbor of refuge at Little Harbor, New Hampshire.—[This work was in the charge of Col. W. S. Stanton, Corps of Engineers, to March 31, 1905.] In its original condition the entrance to Little Harbor was but 3 feet deep at mean low water, and its anchorage ground, 650 by 125 feet in area and 9 feet in depth at mean low water, was exposed to the full force of the sea.

The original, which is also the existing, project, adopted by the act of August 5, 1886, extended by act of August 11, 1888, and as reduced in 1894, is to obtain a channel 3,000 feet long, 100 feet wide, and 12 feet deep at mean low water, and an anchorage basin of the same depth 40 acres in area, and construct two breakwaters at the entrance, at an estimated cost, as revised in 1894, of $145,000.

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To June 30, 1905, the amount expended on the existing project is—for improvement, $133,227.33; for maintenance, $3,121.74; total, $136,349.07, with which the project has been completed.

The maximum draft over the shoalest part of the improved channel and basin is 11 feet at mean low water. The mean range of tides is 8 feet.

The commerce benefited is inconsiderable, and the improvement is designed to afford a harbor of refuge for yachts and coastwise vessels. During the year 1904, 466 vessels are reported to have anchored behind the breakwaters, including 101 steamers, 131 schooners, and 234 sloops.

The original project is published in the Annual Report of the Chief of Engineers for 1882, page 507; the modifications, with map of the harbor, in the report for 1887, page 470.

July 1, 1904, balance unexpended	$9,650.57
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	999.64
July 1, 1905, balance unexpended	8,650.93

(See Appendix A 23.)

24. Removing sunken vessels or craft obstructing or endangering navigation.—The wreck of the schooner *Olive Branch* was an obstruction to navigation of Penobscot River at South Brewer, Me. It was removed in October, 1904, at a total cost of $384.61.

(See Appendix A 25.)

IMPROVEMENT OF RIVERS AND HARBORS IN VERMONT, IN EASTERN MASSACHUSETTS, AND IN NEW YORK ON LAKE CHAMPLAIN.

This district was in the charge of Col. W. S. Stanton, Corps of Engineers, having under his immediate orders First Lieut. Gustave R. Lukesh, Corps of Engineers. Division engineer, Col. Chas. R. Suter, Corps of Engineers.

1. Newburyport Harbor, Massachusetts.—Prior to specific appropriations for Newburyport Harbor funds applicable to Merrimac River, of which it is the estuary, were devoted to removing a sand bar and constructing a breakwater at the river's mouth, 1828 to 1836, and to removing obstructing ledges, piers, and wrecks, 1870 to 1880. In its original condition the outlet of the Merrimac River, which between Plum Island and Salisbury Point was 1,000 feet wide and 30 feet deep at mean low water, was obstructed by a sand bar, nearly a mile outside, through which, in 1880, a narrow channel about 7 feet deep at mean low water was maintained by the current of the river.

The original project, adopted by the act of June 14, 1880, which is the existing project, is to create at the outer bar a permanent channel 1,000 feet wide and at least 17 feet deep at mean low water, by constructing two converging jetties, projecting, one from the north shore 2,910 feet, the other from the south shore 1,500 feet, their outer ends 1,000 feet apart, which, with the protection of the beach in their vicinity, was estimated in 1881 to cost $365,000. The direction of jetties and shore protection was modified in 1883, and in 1882 the partial closing of Plum Island Basin with a timber dike about 800 feet long

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and 5½ feet above mean low water was added to the project, increasing the cost (as estimated in 1884) to $375,000. In 1884 a modification of the project provided for extending both jetties 610 feet parallel to the axis of the channel, and in 1886 for increasing that extension to 1,000 feet, increasing the cost of the work, as estimated in 1897, to $599,547.49.

To June 30, 1905, the amount expended on this project was $349,145.59, of which $1,741.38 was for maintenance; in addition $500 was expended in 1901 for removal of North rock under authority of act of March 3, 1899. The expenditure for maintenance in the fiscal year 1905 was $1,093.92, with which 300 feet of the south jetty was retopped. With the expenditure for improvement the north jetty has been completed for a total length of 2,705 feet, and the south jetty for 2,247 feet; the Plum Island basin has been closed with a timber dike 817 feet long, 5½ feet high above mean low water, except near the middle, where a weir 150 feet long and 2 feet above mean low water was left temporarily; and two sand catchers, respectively 480 and 572 feet in length, have been built in rear of the south jetty. Both jetties are 15 feet wide on top, which is in a plane 12 feet above mean low water, and have slopes of 1 on 2 on the seaward face and 1 on 1 on the shoreward face.

June 30, 1905, the maximum draft that can be carried over the bar at mean low water is 12 feet. The mean range of tides is 7.7 feet.

The commerce of the harbor, chiefly coal, amounted in 1903 to 140,518 tons, and in 1904 to 159,102 tons. Of the latter amount 76,527 tons was reshipped to points on the Merrimac and Powow rivers.

It is reported that the improvement made has reduced freight rates 25 cents per ton, and that if the projected depth of 17 feet at mean low water be obtained over the outer bar it would still further reduce the freight rates 15 to 25 cents per ton.

The available balance will be applied to extension and necessary maintenance of jetties.

The original project, as reported by a Board of Engineers, with map of the harbor, is published in Annual Report of the Chief of Engineers for 1881, page 502; the modifications in jetties and shore protection, in reports for 1883, page 437, and 1884, page 494; and the parallel extension of the jetties, with map and additional estimate, in report for 1897, page 825.

July 1, 1904, balance unexpended		$32,716.60
Amount appropriated by river and harbor act approved March 3, 1905		30,000.00
		62,716.60
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$12,768.27	
For maintenance of improvement	1,093.92	
		13,862.19
July 1, 1905, balance unexpended		48,854.41
July 1, 1905, outstanding liabilities		1,723.20
July 1, 1905, balance available		47,131.21
July 1, 1905, amount covered by uncompleted contracts		14,411.93
Amount (estimated) required for completion of existing project		201,547.49

(See Appendix B 1.)

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2. Merrimac River, Massachusetts.—In its original condition the Merrimac River had a practicable channel 7 feet deep at mean low water from its mouth 9 miles to South Amesbury, but besides being narrow and crooked the channel was obstructed by ledges, bowlders, and shoals.

The original projects appear to have been—

(1) For improving the bar at the mouth of the river, by erection of piers or other works, adopted by act of May 23, 1828; subsequently improved under separate project for "Improving Harbor at Newburyport, Mass."

(2) For the improvement of the river above the mouth, by the removal of the remains of a dam at the upper falls and of a rock at the lower falls, of Gangway rock in Newburyport Harbor, and a wreck near the mouth of the river.

Upon the original and modified projects, prior to operations under the existing project, there were expended: Upon the project of 1828, $67,466.72, and upon the project of 1870, as largely extended by the acts of June 23, 1874, and June 3, 1896, $187,000; total, $254,466.72.

The existing project, adopted by the act of March 3, 1899, is to obtain a channel 7 feet deep at mean low water, 150 feet wide, from Newburyport 14½ miles to Haverhill, at an estimated cost of $171,442.70.

The amount expended on the existing project to June 30, 1905, is $79,423.59, all for improvement, with which the channel has been completed to the full projected width and depth up to the highway bridge at Haverhill by dredging through eight shoals, aggregating 3 miles in length, except for a length of 800 feet above Rocks bridge, 6½ miles below Haverhill, where the channel has been dredged to the width of only 100 feet.

The head of navigation is at the hat factory, one-half mile above the railroad bridge at Haverhill, to which point the stream is navigable, in fact, 17½ miles above its mouth in Newburyport Harbor.

June 30, 1905, the maximum draft that can be carried at mean low water over the shoalest part of the improved channel below the highway bridge at Haverhill is 7 feet.

The mean range of tides is, at the mouth of the river, 7.7 feet, and at Haverhill bridge 4.6 feet, at low-water stage of the river.

The commerce of the river is in coal, lumber, etc., for the cities and towns along its banks, reported to amount in 1904 to 76,527 tons, an increase of more than 25 per cent in three years. The improvement of the channel is reported to enable the delivery of these commodities by water at rates 35 to 50 cents per ton less than by rail.

The available balance will be applied to continuing the project by dredging and rock excavation from the lower (highway) bridge 3,400 feet to the Boston and Maine Railroad bridge at Haverhill.

The project of 1870–1874 is published in the Annual Report of the Chief of Engineers for 1869, page 421; as extended in 1874, in report for 1876, page 165; as extended in 1896, in report for 1896, page 616; and the existing project adopted in 1899, in report for 1897, page 865.

The report of examination and survey of the river, with estimate of cost to deepen the channel to 9 feet at mean low water, made in November, 1903, in pursuance of a provision in the river and harbor act of June 13, 1902, is published in Annual Report for 1904, pages 872–878.

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July 1, 1904, balance unexpended	$576.41
Amount appropriated by river and harbor act approved March 3, 1905	40,000.00
July 1, 1905, balance unexpended	40,576.41
July 1, 1905, outstanding liabilities	176.24
July 1, 1905, balance available	40,400.17
Amount (estimated) required for completion of existing project	51,442.70

(See Appendix B 2.)

3. Powow River, Massachusetts.—In its original condition the Powow River had a practicable channel 4 feet deep at mean high water, extending 9,600 feet from its confluence with the Merrimac River to the wharves at Amesbury.

The original project, adopted by the act of August 11, 1888, which is also the existing project, is to dredge the channel 9,600 feet long to the wharves at Amesbury to the width of 60 feet and depth of 12 feet at mean high water, at an estimated cost (increased estimate) of $100,000.

To June 30, 1905, the amount expended was $50,940.72, all for improvement, with which a channel of the full projected length and depth has been dredged, 45 feet wide, from Amesbury to the mouth of the river, except for a distance of 650 feet at its lower end, where it is 30 feet wide.

The head of navigation is at the dam at Amesbury, to which point, about 5 miles above Newburyport Harbor, the stream is navigable in fact.

June 30, 1905, the maximum draft that can be carried at mean low water over the shoalest part of the improved channel is 4.5 feet.

The mean range of tides is 6.7 feet.

The commerce benefited by this improvement consists chiefly of coal for local consumption, of which about 10,000 tons was carried up the river in 1904.

The project, with report of survey of the Powow River, is published in the Annual Report of the Chief of Engineers for 1885, page 549, and the modified estimate for its completion in the Annual Report for 1897, page 829.

By section 7 of the river and harbor act aproved March 3, 1905, the provisions of river and harbor acts theretofore passed providing for the prosecution of work upon this project were repealed.

July 1, 1904, balance unexpended	$59.28
June 30, 1905, covered into surplus fund United States Treasury	59.28

(See Appendix B 3.)

4. Essex River, Massachusetts.—In its original condition Essex River had a channel not less than 6 feet deep at mean low water from its mouth in Ipswich Bay for a distance of about 2½ miles; but thence for 2½ miles to the head of navigation—in fact, at the railroad bridge at Essex—the channel was narrow, crooked, and shallow, having a greatest continuous depth of 1.7 feet, navigation being further impeded by bowlders obstructing the channel.

The original project, adopted July 13, 1892, which is also the existing project, is to obtain a channel 4 feet deep at mean low water and 60 feet wide to the head of navigation, at an estimated cost of $25,000; modified, March 23, 1899, by limiting the improvement to the channel below the bridge at Essex, which had been rebuilt without a draw.

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To June 30, 1905, the amount expended was $21,459.21, all for improvement, with which, it was reported February 2, 1901, a channel was dredged of the full projected dimensions from the mouth up to the highway (draw) bridge at Essex.

Complaint was made, however, in May, 1905, of an obstruction in mid-channel, consisting of a group of several bowlders about 1,300 feet below the head of navigation, lying within the scope of the approved project of improvement. These bowlders were removed in June, 1905.

The maximum draft that can be carried, June 30, 1905, over the shoalest part of the locality under improvement is reported to be only 1 to 3 or, possibly, 4 feet. The mean range of tides is 8.8 feet.

No freight is carried on the river, but the improvement is for the purpose of permitting the exit of about thirty fishing schooners, which are built annually on the river, each of about 125 tons register, at an average cost of $12,000.

The project, with map and report of survey, is published in the Annual Report of the Chief of Engineers for 1891, pages 676–678.

July 1, 1904, balance unexpended	$3,540.79
July 1, 1905, balance unexpended	3,540.79
July 1, 1905, outstanding liabilities	265.00
July 1, 1905, balance available	3,275.79

(See Appendix B 4.)

5. Harbor of refuge, Sandy Bay, Cape Ann, Massachusetts.—In its original condition this bay, whose southerly shore extends about 2 miles westerly from the point of Straitsmouth Island, and thence about 2 miles northerly to Andrews Point, had a good holding ground of sand mixed with mud, and a depth of 7½ to 15 fathoms at mean low water, but was fully exposed to easterly, northeasterly, and northerly gales. The original project adopted by the act of July 5, 1884, was to build a breakwater consisting of a mound of rubblestone to the grade of 22 feet below mean low water, 40 feet wide on top, to be surmounted by a masonry wall, and to extend from Averys ledge a little west of north 3,600 feet to Abners ledge, thence 5,400 feet northwesterly in the direction of Andrews Point, covering an anchorage of about 1,377 acres.

This project, with the cross section of the breakwater as modified by a Board of Engineers February 13, 1900, is the existing project, the breakwater to consist of a mound of rubblestone built to the grade of 12 feet below mean low water, where it will have a width of 117 feet, its harbor slope to be 1 on 1, its seaward slope 1 on 1 up to 25 feet below mean low water, and 1 on 2 thence to the top, 12 feet below mean low water; the rubble mound to be surmounted with a core of rubblestone, to be faced with selected stone to be laid horizontally on the sea face, to weigh not less than 8 tons each, and to be laid with a batter of 1 on 2, and on the harbor face to weigh not less than 3 tons each and be laid with a batter of 1 on 1; to be surmounted at grade 17 above mean low water with a single course of capstones, whose upper surface shall be 22 feet above mean low water; at an estimated cost (as revised in 1900) of $6,904,952.25.

Work under this project is authorized to be done under continuing

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contract, which, however, shall not exceed $100,000, exclusive of the amount already appropriated.

The amount expended under the existing project to June 30, 1905, not including outstanding liabilities, is $1,350,042.93, all for improvement, with which 1,752,935 tons of rubblestone has been placed in the substructure of the breakwater, and its condition is approximately as follows:

In the southern arm for a length of 3,530 feet the mound of rubblestone has been completed up to the grade of 12 feet below mean low water, with the full width of 117 feet prescribed in the project; the rubble core of the superstructure has been built to the height of mean low water for 540 feet.

In the western arm, for a length of 1,710 feet from the angle, the mound of rubblestone has been likewise completed to the full height (12 feet below mean low water) and full width (117 feet) projected, except for a small bench on the inner slope 13 feet deep and 17 feet wide, and to the height of 22 feet below mean low water for the further length of 40 feet; a rubble core of the superstructure has been built to the height of mean low water for 1,310 feet and to the height of mean high water for 400 feet.

The draft is ample for the largest vessels; the mean range of tides is 8.6 feet.

The commerce of the harbor amounted in 1904 to 379,699 tons, of which 364,700 tons was stone. The improvement is chiefly of value in providing refuge for coastwise vessels, especially towed barges, which are frequently and suddenly in urgent need of shelter in fog and snowstorms.

The estimated amount that can be profitably expended will be applied to the further extension of the rubble in the western arm up to the plane of mean low water, and to placing a part of the selected stones on the faces of the southern and western arms.

For description of Sandy Bay and original project, see Annual Report of the Chief of Engineers for 1884, pages 565–577. For cross section, details of construction, and increase in cost, see report of Board of Engineers, Annual Report for 1900, page 1186.

July 1, 1904, balance unexpended	$92,855.66
Amount appropriated by river and harbor act approved March 3, 1905	100,000.00
	192,855.66
June 30, 1905, amount expended during fiscal year, for works of improvement	92,898.59
July 1, 1905, balance unexpended	99,957.07
July 1, 1905, outstanding liabilities	225.50
July 1, 1905, balance available	99,731.57
July 1, 1905, amount covered by uncompleted contracts	180,000.00
Amount (estimated) required for completion of existing project	5,454,952.25
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905 Submitted in compliance with requirements of sundry civil act of June 4, 1897.	100,000.00

(See Appendix B 5.)

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6. Harbor at Rockport, Mass.—In its original condition Rockport Harbor, a natural cove about 15 acres in area, was exposed to the full force of storms from north around to east, and furnished no shelter anchorage for shipping. A portion of the harbor had been inclosed by piers, built by private enterprise, from 1811 to 1817.

The original project, adopted by the act of July 4, 1836, was to construct, in accordance with a report and survey made in 1829, two piers or breakwaters at the mouth of the harbor, one extending easterly from Bearskin Neck and the other westerly from Norwoods Head.

The amount expended on the original project was $69,229.25, with which, from 1836 to 1839, two breakwaters of rubblestone were built extending, one 900 feet easterly from Bearskin Neck, and the other about 200 feet northerly from Norwoods Head, leaving an entrance channel 220 feet wide between their low-water lines. In 1900 these breakwaters had so far deteriorated that they no longer afforded the necessary protection to the harbor.

The existing project, adopted by the act of June 13, 1902, is to rebuild, with heavy rubblestone, to the height of 18.5 feet above mean low water, the two breakwaters at the entrance, and to remove the principal rocks in the harbor; estimated cost, $22,481.80.

To June 30, 1905, $22,000 had been expended under the existing project, all for improvement, with which the main breakwater, about 900 feet long, and the smaller breakwater, about 200 feet long, have been rebuilt with rubblestone to the height of 18.5 feet above mean low water, with a seaward slope of 1 on 2, a harbor slope of 1 on 1, and a width on top of 20 feet, and the principal rocks in the harbor removed.

At mean low water 12 feet draft can be carried between the breakwaters into the harbor, but the upper channel has shoaled so that but 6 feet can be carried to the outer ends of the first two wharves and about 4 feet to the third, and its navigation is difficult by reason of rocks projecting on either side.

The mean range of tides is 8.6 feet.

The commerce benefited by the improvement consists chiefly of coal, stone, and fresh fish, of which there were carried into the harbor in 1901 4,200 tons, in 1902, 2,091 tons, and in 1903, 4,371 tons, and in 1904, 2,450 tons.

It is reported that the completion of the project has been without effect on freight rates.

The existing project with report of survey and description of previous improvements may be found in the Annual Report of the Chief of Engineers for 1900, page 1175.

July 1, 1904, balance unexpended	$3,179.13
June 30, 1905, amount expended during fiscal year, for works of improvement	3,179.13

(See Appendix B 6.

7. Harbor at Gloucester, Mass.—In its original condition this harbor, which had a depth sufficient for the largest ships, contained several very dangerous submerged rocks and was entirely without protection against the sea and against heavy swells from the south.

The original project adopted by the act of June 10, 1872, appears to have been for removal of five rocks, at an estimated cost of $10,606.20.

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Under the original and modified projects the rocks were removed, Harbor Cove was dredged to the depth of 10 feet at mean low water, and the water front for a distance of 3,900 feet northeast from Fort Point was dredged to a depth of 15 feet at mean low water from the 15-foot contour to the wharf front, upon which there was expended prior to operations under the existing project (approximately) $86.000.

The existing project, adopted by the act of August 18, 1904, as curtailed by the act of June 13, 1902, is to build under continuing contract a breakwater from the shore about 2,250 feet to a point at or near Cat ledge, and upon completion of the breakwater to apply any balance remaining "toward the work of removing Round rock," at an estimated cost of $416,083.43.

The breakwater is to consist of a mound of rubblestone to be 31 feet wide at the top at mean low water, to be surmounted by a superstructure formed by two dry walls of heavy split stone, inclosing a core of rubblestone, and to be capped by heavy stones, forming a top course 10 feet in width, the slopes of the rubble substructure to be on the harbor side 1 on 1.3, on the seaward side 1 on 3 to grade 12 below mean low water, and 1 on 1.5 thence to the bottom.

The amount expended under the existing project to June 30, 1905, not including outstanding liabilities, is $344,927.50, all for improvement, with which 219,639 tons of stone has been placed in the breakwater, completing the superstructure for a length of 2,065 feet and the substructure its entire length of 2,250 feet, excepting the expansion at the outer end for a light-house site.

The maximum draft that can be carried June 30, 1905, at mean low water over the shoalest part of the locality under improvement is 10 feet.

The mean range of tides is 8.9 feet.

The commerce in 1903 amounted to 328,501 tons, and in 1904 to 263,526 tons, of which 110,000 tons were coal and 86,000 tons fish and salt. Passengers carried numbered about 85,000.

The available balance and the estimated amount that can be profitably expended will be applied to completing the breakwater and building to the grade of 20 feet above mean low water the mound of rubblestone for light-house at its end, and toward the removal of Round rock in accordance with the project.

A description of the original project is published in the Annual Report of the Chief of Engineers for 1871, page 870, and its modifications, with map, in the report for 1887, page 500.

The adoption and the commencement of work under the existing project are reported upon in the Annual Report of the Chief of Engineers for 1895, page 610.

July 1, 1904, balance unexpended	$109,820.66
Amount appropriated by sundry civil act approved March 3, 1905	50,000.00
	159,820.66
June 30, 1905, amount expended during fiscal year, for works of improvement	105,748.16
July 1, 1905, balance unexpended	54,072.50
July 1, 1905, outstanding liabilities	41,159.30
July 1, 1905, balance available	12,913.20

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July 1, 1905, amount covered by uncompleted contracts	$6,512.05
Amount (estimated) required for completion of existing project	17,083.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	17,083.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix B 7.)

8. Harbor at Manchester, Mass.—In its original condition Manchester Harbor had a good channel 100 feet wide and not less than 6½ feet deep at mean low water, extending from the bay 3,200 feet to Proctors Point. At that distance the channel shoaled rapidly to a depth of 1½ feet at the Narrows, 1,400 feet from Proctors Point, and for the remaining distance, 2,600 feet, to the town wharves there was no practicable channel at low water.

The original project, adopted by the act of August 11, 1888, was to dredge a channel 60 feet wide and 4 feet deep at mean low water from Proctors Point, a distance of 4,000 feet, to the town wharves, at an estimated cost of $14,300.

The amount expended under the original project and prior to operations under the existing project was $14,300, obtaining a channel of the length, depth, and width prescribed in the project, expanded opposite the town wharves to the width of 80 feet; but the dredged channel deteriorated rapidly and thereafter there was some shoaling at the entrance.

The existing project, adopted by the river and harbor act of March 3, 1899, is to dredge the natural channel to the depth of 6 feet at mean low water from that depth in the bay, a distance of 7,200 feet, to the town wharves, 100 feet wide at the entrance and at the sharpest bends and at least 75 feet wide throughout, with two turning basins, one 200 feet by 300 feet in area just below the drawbridge of the Boston and Maine Railroad and the other 125 feet by 250 feet at the town wharves, for which the estimated cost is $25,000.

Under this project to the close of the fiscal year ending June 30, 1905, the amount expended is $9,685.57, all for improvement, with which a channel has been obtained of the full projected width and depth from the entrance to a point 220 feet below the southwest corner of Read's wharf, except that two small ledges, projecting about 20 feet, obstruct the eastern side of the channel about west of Proctors Point.

The maximum draft that can be carried June 30, 1905, over the shoalest part of the locality under improvement is 2 feet at mean low water. The mean range of tides is 9 feet.

The commerce of the harbor benefited by the improvement consists chiefly of coal and building materials for local consumption, of which about 12,000 tons was reported received in 1900, 5,800 in 1901, 3,600 in 1902, 4,000 in 1903, and 1,775 in 1904.

The work done is of no commercial benefit and can have no appreciable effect on freight rates. The completion of the project would probably enable the local supply of coal and building materials to be brought in more cheaply.

The original project, adopted by the act of August 11, 1888, with map of survey, is in the Annual Report of the Chief of Engineers for 1888, page 466.

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The existing project, adopted by the act of March 3, 1899, with map of survey, is published in the Annual Report of the Chief of Engineers for 1897, page 869.

In pursuance of a resolution of the Committee on Rivers and Harbors of the House of Representatives the Board of Engineers for Rivers and Harbors has considered the project for this work, and in its report (Annual Report, 1904, p. 840) recommends, in order to make available for commerce the portion of the improvement already accomplished, that the United States complete the work under the existing project, but modified as follows: A channel 6 feet deep and 75 feet wide and at the turns 100 feet wide, to be excavated from the entrance to the town wharves, and a turning basin 125 feet by 250 feet at the town wharves, for the estimated cost, exclusive of amounts heretofore appropriated, of $18,117, toward which it is proposed to apply the available balance as a profitable expenditure.

July 1, 1904, balance unexpended	$314.43
July 1, 1905, balance unexpended	314.43
Amount (estimated) required for completion of existing project	15,000.00

(See Appendix B 8.)

9. Harbor at Beverly, Mass.—In its original condition this harbor had a practicable channel 18 feet deep at mean low water from Monument bar beacon about 1 mile to its head, about 600 feet below the highway bridge, sufficient for the commerce of the harbor and its three tributary streams called, respectively, North River, Essex Branch, and Beverly Creek; but the channel, which is circuitous in its passage through the shoals at the entrance, was found in 1900 to be "of insufficient width for safe navigation by heavy vessels."

The original project, adopted by the act of June 13, 1902, which is also the existing project, is to widen that part of the channel between Monument bar beacon and a point about 200 feet east of Rams Horn beacon to a width of about 200 feet, with the depth of 18 feet at mean low water, at an estimated cost of $10,000.

To the close of the fiscal year ending June 30, 1905, $8,146.53, not including outstanding liabilities, had been expended, all for improvement, with which a channel 18 feet deep and 200 feet in width had been dredged from the town wharves to the entrance to the harbor in Salem Bay, but the available width is reduced to 150 feet by obstructing ledges, uncovered in dredging, on which the least depth is 10 feet at mean low water.

The maximum draft that can be carried on June 30, 1905, at mean low water over the shoalest part of the locality under improvement is 18 feet. The mean range of tides is 9 feet.

The commerce of Beverly Harbor consists chiefly of coal and building materials, of which, in 1903, 93,085 tons was carried, and in 1904 about 138,843 tons, of which, in 1904, 103,000 tons was coal, an increase of more than 150 per cent since 1899.

It is expected by those locally interested in shipping that the completion of the project will effect a substantial reduction in freight rates, which to this time have not been appreciably affected by the improvement in progress.

A report of a survey of this harbor is published in the Annual Report of the Chief of Engineers for 1890, page 524. The existing

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project with report of survey is in the Annual Report for 1901, page 1064.

The available balance will be applied to prosecution of work in accordance with the existing project.

July 1, 1904, balance unexpended	$2,338.92
June 30, 1905, amount expended during fiscal year, for works of improvement	485.45
July 1, 1905, balance unexpended	1,853.47

(See Appendix B 9.)

10. Harbor at Salem, Mass.—In its original condition Salem Harbor, from its entrance between Winter Island and Naugus Head, had a channel of ample width, 18 to 25 feet deep at mean low water extending to within 2,500 feet of the entrance of South River at Derby wharf light, where for 1,500 feet the depth was 8 feet, and for the remaining 1,000 feet the depth was 6 feet to Derby wharf light, where, however, the channel was contracted to 25 feet in width. Thence, in South River to the head of navigation, the low-water channel was less than 1 foot in depth.

The original project, adopted by the act of March 3, 1873, as enlarged in 1890, was to dredge a channel 5,100 feet in length, 8 feet deep at mean low water from that depth in the harbor, 300 feet wide at the entrance, 150 feet wide off Derby wharf light, diminishing in width to 100 feet near the inner end of Derby wharf, and from that point to the head of navigation 50 feet wide and 6 feet deep at mean low water.

Under the original and enlarged projects completed in 1894, the amount expended prior to operations under the existing project was $52,368.66.

The existing project, adopted by the act of March 3, 1905, is to provide a channel 10 feet deep at mean low water from that depth in the harbor to the outer end of the wharves, 300 feet in width at the entrance gradually narrowing to 200 feet at Derby wharf light, at an estimated cost of $12,000 appropriated in full by the act of March 3, 1905.

No expenditure under this project has been made to June 30, 1905.

The maximum draft that can be carried, June 30, 1905, up to Derby wharf, the limit of the present improvement, is 8 feet at mean low water, and thence to the head of navigation in South River at Lafayette Street Bridge, 3 feet. The mean range of tides is 9.2 feet.

The commerce of South River affected by the project amounted in 1904 to 111,967 tons, mostly coal.

Available funds will be applied to dredging under the existing project.

The original and modified projects, with reports of surveys, are in the Annual Reports of the Chief of Engineers for 1873, pages 102 and 1110, and for 1890, page 529. Report of survey of the harbor, with map, is in the Annual Report for 1895, page 651; and of a survey with project for improving the river to the head of navigation, of which the present adopted project is a part, is in the report for 1904, page 878.

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Amount appropriated by river and harbor act approved March 3, 1905	$12,000.00
July 1, 1905, balance unexpended	12,000.00
July 1, 1905, outstanding liabilities	32.36
July 1, 1905, balance available	11,967.64

(See Appendix B 10.)

11. Sea wall at Marblehead, Mass.—The location of this sea wall, which is reported to have been built by the United States, but of which no record has been found in Government reports, along the seaward, southerly, side of the narrow beach about 2,000 feet long, which connects Marblehead Neck with the mainland and separates Marblehead Harbor from the sea on the south, is more fully described in the Annual Report of the Chief of Engineers for 1903, pages 753–757.

The original project appears to have been that adopted by the act of August 30, 1852, which was to repair this wall throughout its length of 2,000 feet at a cost of $500 appropriated by that act, and which was entirely expended for that purpose.

The existing project, adopted by the act of March 3, 1899, which appropriated $1,000 therefor, is "for the repair of the sea wall at Marblehead, Mass., made necessary by the great storm of November, 1898."

That storm, the most memorable and destructive that has occurred on this part of the New England coast in many years, in which a violent gale was accompanied by an excessive rise of tide to about 4.7 feet above mean high water, or about 2.5 feet above extreme high water of spring tides, washed a considerable quantity of beach shingle up the southerly side of the beach and over the wall into the roadway leading from the mainland to Marblehead Neck. It does not appear to have threatened to breach the beach from the southerly side, or to have imperiled the harbor. The effects of the storm are understood to have been repaired at the expense of the county.

The amount expended under the existing project to June 30, 1905, is $84, for the survey and inspection of the wall.

The report of the survey made in 1903 is published in the Annual Report of the Chief of Engineers for 1903, pages 753–757. The reports of former examinations may be found in the Annual Report for 1897, page 870; and for 1900, page 1169.

No further report will be submitted.

July 1, 1904, balance unexpended	$918.38
June 30, 1905, amount expended during fiscal year, for works of improvement	2.38
July 1, 1905, balance unexpended	916.00

(See Appendix B 11.)

12. Harbor at Lynn, Mass.—An area of shoals extends from the wharves at Lynn 2½ miles southerly to the sea. It is protected from the sea by the peninsula of Lynn Beach and Nahant.

In its original condition three narrow and crooked channels, in which the depth was but 6 feet at mean low water, extended from the wharves to the sea.

The original project, defined in the report of a Board of Engineers dated April 10, 1884, and as modified in 1888, was to dredge a chan-

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nel 200 feet wide and 10 feet deep at mean low water from the sea (at White rocks) a distance of 3,300 feet to a deep basin opposite Little Nahant, and from the basin nearly opposite Sand Point, a distance of 6,900 feet to a point 400 feet inside the harbor line, and an anchorage basin 500 feet by 300 feet and 10 feet deep at mean low water; the upper part of the channel to be maintained by occasional dredging, the lower part by a training wall joining the land at Little Nahant, at an estimated cost of $182,000.

The amount expended on this project was $122,063.56, all for improvement, with which the entire channel and the anchorage basin as prescribed in the project were completed.

The existing project, adopted by the river and harbor act of June 13, 1902, is to dredge the channel 200 feet wide from the sea to the anchorage basin and the anchorage basin itself to the depth of 15 feet at mean low water, at an estimated cost of $162,937. Under this project to the close of the fiscal year ending June 30, 1905, $25,069.91 has been expended, all for improvement, with which a channel has been obtained 15 feet deep at mean low water, with a width of 100 feet on straight, and 125 feet on curved, sections, and extending from the deep basin opposite Little Nahant, a distance of 4,600 feet, to the sea.

This work is being done under continuing contract, which provides for the completion of the improvement by June 30, 1907, to which purpose the available balance and the amount estimated as a profitable expenditure will be applied.

The maximum draft that can be carried June 30, 1905, over the shoalest part of the locality under improvement is 10 feet at mean low water. The mean range of tides is 9.3 feet.

The commerce of the harbor benefited by the improvement consists chiefly of coal, lumber, and building materials, of which about 290,364 tons was carried during the year. The deepening of the channel to 10 feet enables barges to carry full cargoes of coal to the wharves at Lynn during the highest stages of the tide; the improvement to 15 feet will enable the smaller or medium size barges to carry full cargoes of coal to the wharves at all stages of the tide and barges of the greatest draft during the higher stages.

It is reported that the cost of transportation has been reduced 25 cents a ton by deepening the channel to 10 feet, and will be further reduced 10 to 25 cents upon the completion of the 15-foot channel.

The original project approved by the Secretary of War April 21, 1884, is in the Annual Report of the Chief of Engineers for 1884, page 524, and the map of the harbor at page 532.

The existing project was published in the Annual Report of the Chief of Engineers for 1901, page 1093.

July 1, 1904, balance unexpended	$6,436.44
Amount appropriated by river and harbor act approved March 3, 1905	40,000.00
	46,436.44
June 30, 1905, amount expended during fiscal year, for works of improvement	69.91
July 1, 1905, balance unexpended	46,366.53
July 1, 1905, outstanding liabilities	488.40
July 1, 1905, balance available	45,878.13

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July 1, 1905, amount covered by uncompleted contracts	$135,980.85
Amount (estimated) required for completion of existing project	97,937.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	97,937.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix B 12.)

13. Mystic and Malden rivers, and Mystic River below the mouth of Island End River, Massachusetts.—(*a*) *Mystic River.*—In its original condition, the Mystic had a practicable channel 6 feet deep at mean low water extending to Dennings Landing, 3.9 miles above its mouth in Boston Harbor, and 4 feet deep at mean low water about 2,000 feet farther.

The original project for improvement, adopted by the act of July 13, 1892, which is also the present project, is to make the channel 100 feet wide and 6 feet deep at mean low water from the Boston and Maine Railroad (western division) bridge up about 1 mile to the first turn above Denning's wharf; and thence 2 miles to the head of navigation at Medford, 4 feet deep at mean low water, gradually narrowing from 100 feet to 50 feet at the upper end, at an estimated cost of $25,000.

The amount expended to close of the fiscal year June 30, 1905, is $15,000. With this expenditure a channel 100 feet wide and 6 feet deep at mean low water has been completed to the full length prescribed in the project, and the improvement has been carried a farther distance of 4,200 feet with the width and the depth of 4 feet prescribed.

The maximum draft that can be carried, June 30, 1905, at mean low water is 5½ feet up to the first turn above Denning's wharf, and thence to the head of navigation 1.3 feet. The mean range of tides is 9.8 feet.

The head of navigation is the upper limit of that part of the channel under improvement, at the stone bridge at Medford, to which point, 6 miles above its confluence with the Charles River in Boston Harbor, the stream is navigable in fact.

The commerce benefited by this improvement, chiefly coal, amounted in 1903 to 22,650 tons and in 1904 to 25,965 tons. It is reported that as the smallest barges go out of use the improvement will permit barges of the lightest draft remaining in service to deliver coal at Medford without the expense of lightering, which would be about 50 cents per ton.

A report, with map of the survey of Mystic River and description of the project, is in the Annual Report of the Chief of Engineers for 1891, page 674.

The available balance will be applied to dredging, in accordance with the existing project.

(*b*) *Malden River.*—In its original condition the Malden had a practicable channel 4 feet deep at mean low water, extending only 2,000 feet above its confluence with the Mystic.

The original project, adopted by the act of August 2, 1882, was to make the channel 100 feet wide and 12 feet deep at mean high water to the second bridge, about 1.8 miles above its confluence with the Mystic, at an estimated cost of $35,000.

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The amount expended on the Malden River under the original project and prior to operations under the existing project was $10,000, in obtaining a channel with a least width of 50 feet and 70 feet at turns, with a depth of 12 feet at mean high water from the mouth to the first bridge at Malden, a distance of 1¼ miles.

The existing project, adopted by the act of July 13, 1892, is to dredge a channel 12 feet deep at mean high water 100 feet wide to the first bridge, 1.6 miles above its confluence with the Mystic, and 75 feet wide about 1,200 feet farther to the second bridge, at an estimated cost of $37,000.

The amount expended under the existing project to June 30, 1905, is $25,536, of which $10,549.61 was expended for maintenance.

With it a channel was obtained 100 feet wide and 12 feet deep at mean high water up to the first bridge. The local officer has reported the river above this point to be unworthy of improvement by the United States at this time.

The maximum draft that can be carried at mean high water, June 30, 1905, over the shoalest part of the improved channed is 10.6 feet. The mean range of tides is 9.8 feet.

The head of navigation is at the first bridge at Malden, to which point the stream is navigable in fact, 1.6 miles above its confluence with the Mystic River.

The commerce in 1904 amounted to 75,225 tons, all coal. The improvement is reported to enable the smallest barges or larger barges with partial cargoes to deliver coal at Malden, saving the cost of lighterng—50 cents per ton.

The available balance will be applied to dredging for maintenance of improvement.

A report of the survey of Malden River and description of the original project is on page 532, Annual Report of the Chief of Engineers for 1881.

The modifications of the project are stated in the Annual Report of the Chief of Engineers for 1900, page 1191.

The existing project is described on page 672, Annual Report of the Chief of Engineers for 1891.

(*c*) *Mystic River below the mouth of Island End River.*—Island End River is 1¼ miles above the mouth of the Mystic, at the navy-yard in Charlestown, and 2,700 feet above the Chelsea drawbridge over the Mystic.

In its original condition the Mystic up to Island End River had a narrow channel 14.4 feet deep at mean low water, but so narrow above the drawbridge as to be barely practicable.

The original project, adopted by the act of March 3, 1899, which is also the existing project, is to dredge a channel 25 feet deep at mean low water and 300 feet wide, embracing 1.7 miles of the Mystic, extending from its mouth to a point 800 feet above Island End River, at a cost estimated in August, 1899, at $267,547.50 (reduced estimate).

To June 30, 1905, $68,755.69 (all for improvement, except $281.92 for maintenance) had been expended in obtaining a channel 25 feet deep at mean low water, with a minimum width of 100 feet up to Chelsea drawbridge and 150 to 300 feet in width from Chelsea bridge to a point just above the confluence of the Island End River.

The commerce of the river has doubled since 1901, and amounted in 1904 to 2,841,007 tons, three-quarters of which was coal.

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So far as the improvement has progressed, no effect on freight rates is appreciable.

The available balance will be applied toward obtaining the full projected channel width below Chelsea bridge.

The maximum draft that can be carried June 30, 1905, over the shoalest part of the locality under improvement is 25 feet. The mean range of tides is 9.6 feet.

July 1, 1904, balance unexpended	$5,708.31
Amount appropriated by river and harbor act approved March 3, 1905	50,000.00
July 1, 1905, balance unexpended	55,708.31
July 1, 1905, outstanding liabilities	64.59
July 1, 1905, balance available	55,643.72
Amount (estimated) required for completion of existing project	[a] 167,547.50

(See Appendix B 13.)

14. Harbor at Boston, Mass.—In its original condition the headlands and islands were without protection against the sea, which was extensively eroding them. Dangerous rocks obstructed the approach and entrance from Nantasket Roads to the lower main ship channel through the Narrows. That channel was 23 feet deep at mean low water with a least width of 150 feet. The upper main ship channel from President Roads to Boston had a least depth of 18 feet at mean low water with a least width of 100 feet. The channel from President Roads to Broad Sound in the ocean had a least depth of 29 feet at mean low water with a least width of 200 feet.

The original project, adopted by the act of March 2, 1825, was " for the preservation of the islands in Boston Harbor, necessary to the security of that place," and until 1866 all expenditures, amounting to $694,826.58, appear to have been applied to that purpose in the building and repair of sea walls. The amount expended upon them since 1866 can not be accurately stated.

The original project for the improvement of the harbor adopted by the act of March 2, 1867, was (as modified) to make the main ship channel from Nantasket Roads to Boston 23 feet deep at mean low water, 600 feet wide through the Narrows to President Roads, and 1,000 feet wide from President Roads to Boston.

Prior to operations under the six existing projects (three for the improvement of the main channels and three for the improvement of tributary channels) 3.75 miles of sea walls had been built, protecting the most exposed headlands and islands, and a channel had been completed 23 feet deep at mean low water from Nantasket Roads to Boston, with a least width of 625 feet in the Narrows and of 850 feet between President Roads and the city.

The amount expended on original and modified projects upon sea walls and channels, for improvement and maintenance, to June 30, 1905, exclusive of all expenditures upon operations under the six existing projects, is $2,519,303.82.

The existing projects are—

[a] For Mystic River below the mouth of Island End River.

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1. Adopted by the river and harbor act of July 13, 1892. To widen the main ship channel, from Nantasket Roads to Boston, to 1,000 feet, and to deepen it to 27 feet at mean low water, at an estimated cost of $1,250,000, subsequently increased to $1,488,751. The rock excavation in the lower main ship channel is being done under a continuing contract.

2. Adopted by the river and harbor act of March 3, 1899. To widen the Broad Sound channel to 1,200 feet, and to deepen it to 30 feet at mean low water, at an estimated cost of $455,000. Under continuing contract.

3. Adopted by the river and harbor act of June 13, 1902. To provide channels 35 feet deep at mean low water, 1,200 feet wide from the navy-yard at Charlestown and the Chelsea bridge and Charles River bridge to President Roads, and 1,500 feet wide from President Roads through Broad Sound to the ocean, at an estimated cost of $7,994,248.68. This estimate differs from any made in the project quoted in the act as the basis of the appropriation, owing to the different width of the channels adopted. (To avoid a large amount of rock excavation the 35-foot channel from President Roads to Broad Sound is in a different location from the 30-foot channel.) Under continuing contract.

Under the project of July 13, 1892, to June 30, 1905, not including outstanding liabilities, the amount expended was $1,372,802.48, of which $58,085.20 was for maintenance. The expenditure for maintenance during the fiscal year ending June 30, 1905, was $40,335.78, with which in the lower main ship channel extending from President Roads to Boston light 73,441 cubic yards of gravel, cobblestones, sand, clay, and mud was removed from many small shoals. With the total amount expended under this project to June 30, 1905, the upper and lower main ship channels, from Boston to President Roads and from President Roads to the sea, have been dredged to the width of 1,000 feet and depth of 27 feet at mean low water. Twenty ledges in the lower channel and 10 groups of ledges in the upper channel, covering 4.18 acres, have been removed to the depth of 27 feet at mean low water, embracing 13,063 cubic yards of rock excavation. Ledges still to be removed restrict the width of the channel (27 feet deep at mean low water) to 500 feet in the upper and 650 feet in the lower channel.

The maximum draft that can be carried at mean low water, June 30, 1905, over the shoalest part of the locality under improvement is 27 feet.

A map of the project is in the Annual Report of the Chief of Engineers for 1894, page 554.

Under the project of March 3, 1899, to June 30, 1905, the amount expended, not including outstanding liabilities, was $358,299.06, all for improvement, with which a channel 1,200 feet wide and 30 feet deep at mean low water was dredged from President Roads to Broad Sound, embracing the dredging of 928,524.9 cubic yards of sand, gravel, and clay, and 184,299 cubic yards of bowlders, and the removal of 156 cubic yards of ledge.

The maximum draft that can be carried at mean low water, June 30, 1905, over the shoalest part of the locality under improvement is 30 feet.

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The project is published in Annual Report of the Chief of Engineers for 1898, page 886.

Under the project of June 13, 1902, to June 30, 1905, the amount expended, not including outstanding liabilities, was $764,525.83, all for improvement, with which 3,502,732.5 cubic yards of mud, sand, gravel, and clay, and 7.755 cubic yards of bowlders were dredged from seven separate areas, amounting to 167.1 acres, and to the depth of 35 feet below mean low water, except five areas, aggregating 5.7 acres, which were dredged to solid rock.

The estimated amount that can be profitably expended will be applied to dredging and rock excavation under continuing contracts.

A map of the project is published in the Annual Report of the Chief of Engineers for 1903, page 768.

The mean range of tides is 9.5 feet at Boston light and 9.6 feet in the upper harbor.

The foreign exports and imports for the port of Boston during the calendar year ending December 31, 1902, amounted in value to $174,135,076, being an increase of $107,448,455 over the valuation in 1867, when the systematic improvement of the channels was begun.

As to the effect of the improvement on freight rates, the general manager of the principal foreign steamship lines entering this port states that about 30 years ago steamers were employed with a loaded draft of 20 feet to 24 feet; 22 or 23 years ago, of 25 to 26 feet; 14 years ago, 27 or 28 feet; 10 years ago, 28 feet 9 inches; later, 31 feet, and recently one of 33 feet 10½ inches. He states, generally—

that freight rates, caused by the larger class of steamers being used, are about 50 per cent less than they were some 15 or 20 years ago, when very much smaller steamers were engaged in the trade.

Tributary channels.—(*a*) *Charles River.*—In the original condition of the 9 miles of natural channel of this river, from its mouth to the dam at the head of navigation at Watertown, the depth at mean low water, from the mouth 4¾ miles to the Western Avenue Bridge, was not less than 7 feet, except in several places, covering about 1¼ miles, below Brookline bridge, where the depth varied from 4½ to 7 feet. From Western Avenue Bridge 2½ miles to the Arsenal Street Bridge the depth was 4 feet. Thence 1¾ miles to the dam it varied between 0 and 9½ feet.

The original project, adopted by the act of June 14, 1880, which is also the existing project, is to widen and deepen the natural channel so that at mean low water it shall be from its mouth to Western Avenue Bridge 200 feet wide and not less than 7 feet deep; thence to Market Street Bridge 80 feet wide and 6 feet deep; thence to the dam 60 feet wide and 2 feet deep; at an estimated cost of $125,000.

The amount expended to June 30, 1905, is $57,500, all for improvement, with which the channel has been completed as prescribed in the project up to the Arsenal Street Bridge (now called also Western Avenue Bridge).

The maximum draft that can be carried June 30, 1905, at mean low water over the shoalest part of the locality improved is 6 feet. The mean range of tides is 9.3 feet.

The head of navigation is at the dam at Watertown, the upper limit of that part of the channel under improvement, to which point, 9 miles above its confluence with Mystic River in Boston, the stream is navigable in fact.

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The improvement serves the local commerce in coal, which in 1904 amounted to 112,000 tons, enabling it to be delivered without breaking cargoes at Boston, saving the cost of one handling and the greater cost of transportation from Boston by rail.

The district officer is of opinion that so much of the existing project as provides for a channel from Brackett's wharf to Market Street Bridge, a distance of about 1,300 feet, and from Market Street Bridge to the dam at Watertown, is unworthy of prosecution by the General Government. This opinion is concurred in. The river and harbor act of September 19, 1890, appropriated $20,000 for continuing improvement of Charles River:

Provided, That no expenditure of said twenty thousand dollars shall be made until the draws in the Arsenal Street and Market Street bridges shall be made to conform to the projected channel without cost to the United States.

The Arsenal Street Bridge has been altered to conform to the projected channel, and as the Market Street Bridge is above the limits to which it is now believed that the channel should be extended, it is recommended that Congress authorize the expenditure of the $20,000 appropriated in 1890 in obtaining a channel of the projected width and depth to Brackett's wharf and in maintaining the Charles River improvement.

A full description of the project, together with map of the river showing the progress of the improvement to this date, is on page 512, Annual Report of the Chief of Engineers for 1884.

(*b*) *Fort Point channel.*—In its original condition the mid-channel depth was 12 feet at its mouth and 16 feet thence to the Federal Street Bridge, excepting at the draw in the Congress Street Bridge, where it was 14.5 feet at mean low water.

The original project, adopted by the act of August 5, 1886, which is also the existing project, is to dredge a channel 175 feet wide and 23 feet deep at mean low water from the entrance about 4,190 feet to near Federal Street Bridge, at an estimated cost of $100,000, reduced in 1887 to $78,750.

To June 30, 1905, there had been expended $18,027, all for improvement, with which a channel was obtained of the width and depth prescribed in the project from its entrance to the Congress Street Bridge, with an extension carried through the north draw to near the western extremity of the "rest pier."

The maximum draft that can be carried June 30, 1905, at mean low water over the shoalest part of the improved channel is 23 feet. The mean range of tides is 9.6 feet.

The head of navigation is the southern extremity of South Bay, at Massachusetts avenue, Boston, Mass., to which point, about 2 miles from the entrance to the channel in Boston Harbor, the channel is navigable in fact.

The commerce benefited by this improvement consists of coal, sugar, building materials, and miscellaneous merchandise, which amounted in the calandar year 1904 to 1,488,565 tons.

The available balance will be applied to the continuation of the improvement.

For a description of the project see Annual Report of the Chief of Engineers for 1888, page 452.

(*c*) *Chelsea Creek.*—In its original condition it had a channel of practicable width extending 11,000 feet from its confluence with

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Mystic River in Boston Harbor and 18 feet deep at mean high water, except on a bar about 2,000 feet below its head, upon which the depth was 17 feet. In the 3,300 feet from the head of the 18-foot channel to the head of navigation the depth gradually shoaled to 13 feet at mean high water.

The original project adopted by the act of June 3, 1896, which is also the existing project, is to make the channel about 5,500 feet in length next below the head of navigation, 150 feet wide, and 18 feet deep at mean high water, at an estimated cost of $65,000.

The amount expended under this project to June 30, 1905, not including outstanding liabilities, is $12,002.94, all for improvement, with which a channel has been dredged 75 feet wide and 18 feet deep at mean high water through a bar 2,000 feet below its head, and 50 to 150 feet wide, 14 feet deep at mean high water, and 2,800 feet in length from the head of the 18-foot channel to Proctor's wharf, 700 feet below the head of navigation.

The head of navigation is at the bridge of the Boston and Maine Railroad, to which point the stream is navigable in fact 700 feet above Proctor's wharf and 2.7 miles above its confluence with Mystic River.

June 30, 1905, the maximum draft that can be carried at mean high water over the shoalest part of the improved channel is 14 feet. The mean range of tides is 9.6 feet.

The commerce benefited by this improvement, consisting chiefly of coal, amounted, in 1903, to 10,330 tons, and in 1904 to 4,655 tons.

A report of the project and survey is in Annual Report of the Chief of Engineers for 1895, page 648.

The available balance will be applied to dredging toward completion of the project.

PROJECT FOR GENERAL IMPROVEMENT.

July 1, 1904, balance unexpended		$59,981.44
Amount appropriated by river and harbor act approved March 3, 1905		100,000.00
		159,981.44
June 30, 1905, amount expended during fiscal year, for maintenance of improvement		1,083.91
July 1, 1905, balance unexpended		158,897.53
July 1, 1905, outstanding liabilities		526.84
July 1, 1905, balance available		158,370.69
Amount (estimated) required for completion of existing project		73,500.00

PROJECT OF 1892 FOR 27-FOOT CHANNEL.

July 1, 1904, balance unexpended		$335,166.94
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$162,037.35	
For maintenance of improvement	40,335.78	
		202,373.13
July 1, 1905, balance unexpended		132,793.81
July 1, 1905, outstanding liabilities		9,249.84
July 1, 1905, balance available		123,543.97
July 1, 1905, amount covered by uncompleted contracts		63,761.74

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PROJECT FOR 30-FOOT (BROAD SOUND) CHANNEL.

July 1, 1904, balance unexpended	$120,154.80
June 30, 1905, amount expended during fiscal year, for works of improvement	23,453.86
July 1, 1905, balance unexpended	96,700.94
July 1, 1905, outstanding liabilities	11,328.09
July 1, 1905, balance available	85,372.85
July 1, 1905, amount covered by uncompleted contracts	12,493.40

PROJECT FOR 35-FOOT CHANNEL.

July 1, 1904, balance unexpended	$853,860.57
Amount appropriated by sundry civil act approved March 3, 1905	970,000.00
	1,823,860.57
June 30, 1905, amount expended during fiscal year, for works of improvement	518,386.40
July 1, 1905, balance unexpended	1,305,474.17
July 1, 1905, outstanding liabilities	129,373.85
July 1, 1905, balance available	1,176,100.32
July 1, 1905, amount covered by uncompleted contracts	1,774,017.23
Amount (estimated) required for completion of existing project	5,924,248.68
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	600,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix B 14.)

15. Weymouth and Town rivers, Massachusetts.—(*a*) *Weymouth Fore River (below Weymouth Fore River bridge).*—The improvement embraces only that portion of the river extending from its mouth in Hingham Bay about 3½ miles up to Weymouth Fore River bridge, at Quincy Point, about 1,000 feet above its confluence with Town River.

In its original condition the channel had a depth of 18 feet at mean low water with a least width of 300 feet up to a point about 1 mile below the bridge aforesaid, the 18-foot channel extending 3,400 feet above that point, but too tortuous for safe navigation of large vessels. In the remaining 1,800 feet to the bridge, the channel, when surveyed, was 150 feet wide and 13 feet deep at mean low water, but, before the adoption of the project, had been increased without expense to the United States to the width of 200 feet and depth of 15 feet at mean low water.

The existing project, adopted by the act of March 3, 1905, is to dredge a channel 300 feet wide and 18 feet deep from the termination of the natural 18-foot channel to the Weymouth Fore River bridge, a distance of about 1 mile, at an estimated cost of $57,500.

The act of March 3, 1905, appropriated the full amount of the estimate with the proviso:

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That no part of this sum shall be expended until the Secretary of War shall have received satisfactory assurance that the improvement of that portion of the Weymouth River which lies above the improvement herein mentioned, and of the Town River, except so much as is herein provided for, shall hereafter be maintained by the State of Massachusetts, or other agency, without expense to the Government of the United States.

By a resolution of the legislature, approved by the governor May 26, this assurance was given by the Commonwealth of Massachusetts and accepted by the Secretary of War June 7, 1905.

To June 30, 1905, no expenditure had been made. The maximum draft that can be carried at mean low water over the shoalest part of the channel to be improved is 15 feet. The mean range of tides is 9.5 feet.

During the calendar year 1904 the total commerce of the river was 139,819 tons, of which 131,819 tons was carried into the shoal upper channels of Weymouth and Town rivers.

This improvement is of importance chiefly to the Fore River Ship Building Company, which builds at its extensive plant at Quincy Point large passenger and freight steamers, cruisers, and battle ships up to 16,000 tons with 24 feet 6 inches draft, and which during the year 1904 completed the U. S. cruiser *Des Moines*, of 3,500 tons; Fall River Line freight steamer *Boston*, of 3,900 tons; two steel car floats of 1,300 tons each; two barges of 500 tons each, and had under construction the U. S. battle ships *New Jersey*, *Rhode Island*, and *Vermont*, aggregating 46,000 tons, and the Fall River Line passenger steamer *Providence*, of 3,900 tons, and docked and repaired 10 other vessels of various classes, besides smaller craft.

The head of navigation is 2.7 miles above this improvement at East Braintree, to which latter point the navigable length of Weymouth River from its mouth in Hingham Bay is 6.2 miles.

A report of the survey of Weymouth Fore River is in the Report of the Chief of Engineers for 1904, pages 891–898.

The available balance will be applied to dredging in prosecution of the project.

(*b*) *Weymouth Fore River above Weymouth Fore River bridge and Weymouth Back River.*—In its original condition Weymouth Fore River had a navigable channel 13 to 18 feet deep at mean low water from its mouth, in Hingham Bay, 3½ miles to Weymouth Fore River bridge, and for 2,200 feet above that bridge the depth at mean low water was 12 feet; 4,000 feet farther the depth was 6 feet in a channel of practicable width, and 7,000 feet farther it was 3 feet, but the channel was too narrow to be practicable.

Weymouth Back River had a practicable channel not less than 200 feet wide and not less than 12 feet deep at mean low water from its confluence with Weymouth Fore River, 8,000 feet to the wharf of the American Agricultural Chemical Company, except on its bar, 400 feet across, one-fourth of a mile above its mouth, where the depth was 11 feet, and except the 2,000 feet next below that wharf, where the depth gradually shoaled from 12 feet to 6 feet at mean low water.

The original project, adopted by the act of September 19, 1890, which is also the existing project, is to obtain in Weymouth Fore River a navigable channel 6 feet deep at mean low water for the farther distance of 7,000 feet, 100 feet wide, 4,400 feet to near Weymouth Landing, 80 feet wide thence 1,650 feet to Braintree bridge, and 50 feet

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wide thence 950 feet above that point; as extended by the act of August 18, 1894, to dredge in Weymouth Back River a channel 12 feet deep at mean low water 200 feet wide through the bar and to extend the channel 12 feet deep at mean low water and 200 feet wide 2,200 feet to the wharf of the American Agricultural Chemical Company, at an estimated cost for Weymouth Fore River of $40,000 and for Weymouth Back River of $22,000, a total of $62,000.

The amount expended on this project to the close of the fiscal year ending June 30, 1905, is, for Weymouth Fore River, not including outstanding liabilities, $37,460.88, and for Weymouth Back River $11,753.59; total, $49,214.47, all for improvement.

This expenditure has resulted in deepening the channel in Weymouth River to 6 feet at mean low water through the entire 7,000 feet of the river embraced in the project, with a width of at least 100 feet for a distance of 3,725 feet from its lower end, 60 feet for a farther distance of 1,650 feet, and of the full projected widths for the upper 1,625 feet of the improvement. In Weymouth Back River, of the 2,400 feet of the channel embraced in the project, 400 feet on the bar has been dredged to the full width and depth prescribed in the project, and the 2,000 feet extending to the American Agricultural Chemical Company's wharf to the depth of 12 feet at mean low water and the width of 125 feet.

The maximum draft that can be carried, June 30, 1905, at mean low water over the shoalest part of the locality under improvement is, in the Weymouth Fore River, 5½ feet, and in the Weymouth Back River 10 feet. The mean range of tides is 9.4 feet.

The head of navigation is the dam at East Braintree, the upper limit of that part of the channel under improvement, to which point, 2.9 miles above its confluence with Town River, the stream is navigable in fact.

Under a contract soon to be made the available balance will be applied to maintenance in redredging to restore a practicable channel of the depth of 6 feet from Richards' wharf to the head of the improvement and to improvement in widening the channel, when the project will be discontinued and the maintenance of the improvement left to the State of Massachusetts.

The commerce benefited by the improvement comprised in 1903 in Weymouth Fore River 92,759 tons and in Weymouth Back River 132,600 tons, and in 1904 in Weymouth Fore River 95,483 tons and in Weymouth Back River 124,691 tons. In 1904 in Weymouth Fore River 86,441 tons, or 92 per cent, was coal, and in Weymouth Back River 118,000 tons, or 94 per cent, was raw and manufactured fertilizer products.

The project for improvement of the river above the bridge, with report of survey, is in Annual Report of the Chief of Engineers for 1890, page 522.

A report of the survey of Weymouth Back River is in the Annual Report for 1891, page 683.

Available funds will be applied to dredging the channel to projected dimensions.

(*c*) *Town River.*—In its original condition Town River had a good channel, not less than 7 feet deep at mean low water, extending 4,000 feet from its confluence with Weymouth Fore River

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At that distance the channel suddenly shoaled to less than 4 feet, and was 1 to 2 feet deep for a distance of 3,300 feet, and was about 18 inches above low water for a farther distance of about 1,200 feet to the upper wharves at Quincy.

The original project adopted by the river and harbor act of June 3, 1896, which is the present project, is to dredge the channel 4,500 feet long, to the upper wharves at Quincy, to the width of 100 feet and depth of 4 feet at mean low water, at a cost, estimated March 24, 1897, of $25,000.

To June 30, 1905, the amount expended was $17,864.35, all for improvement.

With this expenditure the lower 1,400 feet and the upper 1,000 feet of the channel 4,500 feet long have been dredged to the width of 50 feet, and the intermediate 2,100 feet to the full width of 100 feet and the depth of 4 feet at mean low water.

The maximum draft that can be carried on June 30, 1905, at mean low water over the shoalest part of the locality under improvement is 2 feet. The mean range of tides is 9.4 feet.

The head of navigation is at the upper limit of the improvement, at Quincy, Mass., to which point, about 1½ miles above the confluence with the Weymouth Fore River, the stream is navigable in fact.

The balance available will be applied to completing the project and to dredging for maintenance, when the future maintenance of the improvement will be left to the State of Massachusetts.

The annual commerce of Town River amounted in 1902 to 99,373 tons and in 1904 to 43,976 tons, of which, in 1904, 85 per cent was stone.

The original project, with report of survey, is in the Annual Report of the Chief of Engineers for 1891, page 679.

July 1, 1904, balance unexpended	$15,921.18
Amount appropriated by river and harbor act approved March 3, 1905	67,327.41
July 1, 1905, balance unexpended	83,248.59
July 1, 1905, outstanding liabilities	99.63
July 1, 1905, balance available	83,148.96
Amount (estimated) required for completion of existing project	[a] 9,500.00

(See Appendix B 15.)

16. Harbor at Scituate, Mass.—In its original condition the depth on the bar was about 2.5 feet at mean low water, and the entrance was obstructed by many sunken bowlders; of the low-water area of about 57 acres, 6 acres had a depth of at least 3 feet at mean low water and there was little protection against the sea.

The original project seems to have been to protect the beach between Cedar Point and the mainland on the northerly side of the entrance to the harbor, upon which, prior to operations under the existing project (in 1829 to 1852) $1,090.98 was expended in building 450 linear feet of brush and stone bulkhead and 385 linear feet of stone apron 10 feet wide.

The existing project, adopted by the act of June 14, 1880, is to build, of rubblestone, a north breakwater 800 feet and a south breakwater 730 feet long, to dredge an anchorage basin of 30 acres and an

[a] For Weymouth Back River.

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entrance channel 2,700 feet long and 300 feet wide, with depths at mean low water of 15 feet at the entrance, 12 to 15 feet between the breakwaters, 12 feet immediately back of the south breakwater, 10 feet in the anchorage basin, and 3 feet in the channel to the wharves, at an estimated cost of $100,000 for the breakwaters and of $190,000 for the dredging; total, $290,000.

Up to the close of the fiscal year ending June 30, 1905, there had been expended on the work under the existing project $103,500, of which $1,989.11 was expended for maintenance in 1900 and 1901. The amount previously expended for maintenance is not ascertainable.

With that expenditure all known bowlders obstructing the entrance to the harbor have been removed; the anchorage basin, 350 feet by 400 feet, has been dredged 7 feet at mean low water, and the channel from the sea to the basin has been dredged 7 feet deep, 100 feet wide, and 1,600 feet long; the channel, 2,150 feet long from the anchorage basin to the town wharves has been dredged 3 feet at mean low water at least 100 feet wide; and 720 linear feet of the north breakwater and 450 linear feet of the south breakwater have been built.

The maximum draft that can be carried at mean low water, June 30, 1905, over the shoalest part of the locality under improvement is through the entrance channel and basin 7 feet and through the channel from the basin to the town wharves 26 inches at mean low water. The mean range of tides is 9.8 feet.

In pursuance of a resolution of the Committee on Rivers and Harbors of the House of Representatives, the Board of Engineers for River and Harbors has considered the project for this work, and in its report, published in Annual Report of the Chief of Engineers for 1903, pages 777–780, concurs in the opinion of the district officer that this place is not worthy of further improvement as a harbor of refuge, but in order to realize the greatest advantage from work already done, recommends the discontinuance of the present project for the improvement of Scituate Harbor and the adoption of a project for obtaining a channel 6 feet deep at mean low water and 100 feet wide from the entrance to the docks, at the cost of $18,000.

The improvement of the channel has admitted to the wharves barges carrying 700 to 800 tons of coal each, in place of schooners carrying 150 to 200 tons, and is reported to have reduced freight rates 50 to 75 cents a ton, which it is reported would be further reduced about 25 cents a ton if the channel be deepened to 6 feet, as recommended.

The commerce benefited by this improvement consists of coal and building materials, of which 8,623 tons was received in 1903 and 11,330 in 1904, an increase of 31 per cent.

The existing project, as reported by a Board of Engineers, September 18, 1880, with map of the harbor, is published in Annual Report of the Chief of Engineers for 1881, page 523.

(See Appendix B 16.)

17. Harbor at Duxbury, Mass.—This harbor has two channels leading from deep water in the "Cow Yard" in Plymouth Harbor. The easterly channel to the east of Captains Hill is in Duxbury Bay, an extensive area of sandy shoals separated from the ocean by Duxbury Beach, a slender beach about 4½ miles in length; the westerly channel,

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known as the Miles channel, leads into Kingston Bay, west of Captains Hill.

In its original condition the easterly channel had a practicable width with a depth of 6 feet at mean low water to a point 2,600 feet from the wharf at Duxbury, in Duxbury Bay, and the Miles channel a depth of 8 feet at mean low water and a practicable width to a point 2,100 feet from the wharf at Duxbury, in Kingston Bay.

The original projects appear to have been—

1. For the protection of the beach, authorized by the act of July 4, 1836, by building groins of stakes and brush.

2. For the improvement of the channel, authorized by the act of June 10, 1872, to extend the Miles channel by dredging to the depth of 8 feet and width of 200 feet for a distance of 2,300 feet up to a point 200 feet above the wharf at Duxbury, in Kingston Bay.

On these projects there was expended prior to operations under existing project $25,000, with which some protection was given to Duxbury Beach, and the Miles channel was extended the aforesaid distance with the aforesaid depth and width.

The existing project, approved by the Secretary of War August 12, 1899 (a modification of a project submitted November 28, 1887), is to dredge a channel 6 feet deep at mean low water 60 feet wide, increasing to 100 feet on the curve, from the southerly wharf at Duxbury, in Duxbury Bay, 3,600 feet to the head of the easterly channel, at an estimated cost (as increased in 1899) of $17,820.

To the close of the fiscal year ending June 30, 1905, there had been expended under the existing project $12,000, all for improvement. With this expenditure the easterly channel has been extended with the depth of 6 feet the entire distance of 3,600 feet to the wharf, with a width of 80 feet at the wharf, 60 feet at the turn, and 40 feet elsewhere.

The maximum draft that can be carried over the shoalest part of the improvement at mean low water June 30, 1905, is 2 feet. The mean range of tides is 9.3 feet.

The commerce, consisting of coal and lumber, amounted in 1904 to 1,494 tons.

The project for beach protection, adopted in 1836, is in the Annual Report of the Chief of Engineers for 1866, Part 2, page 36.

The original project for improving the harbor is in Annual Report of the Chief of Engineers for 1872, pages 947 and 964.

The existing project (without modifications approved August 12, 1899) is in Annual Report of the Chief of Engineers for 1888, page 473, together with maps of the harbor. No map or description of the channel as modified under the project of 1899 has been published.

Amount (estimated) required for completion of existing project---- $5,820.00

(See Appendix B 17.)

18. Harbors at Plymouth and Provincetown, Mass.—(*a*) *Harbor at Plymouth.*—In the original condition of the harbor the channel and low-water line were about 2,500 feet from the wharf at Plymouth. Long Beach, between the harbor and the ocean, was, for the most part, low and narrow, and liable to inroads by the sea that would injure or destroy the harbor.

All projects and expenditures prior to 1875 appear to have been for the construction of works for the preservation of the beach.

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The original project for the improvement of the channel, adopted by the act of March 3, 1875, was to dredge a channel, 100 feet wide and 6 feet deep at mean low water, through the flats from the channel in the inner harbor to Long Wharf in Plymouth, at an estimated cost of $28,000.

Prior to operations under the existing project, $198,859.22 had been expended in preserving Long Beach and in dredging under the project of March 3, 1875, as modified, which resulted in obtaining a channel 150 feet wide and 9 feet deep and a basin directly in front of the town wharves 866 feet long, 150 feet wide, and 9 feet deep. Of this amount $60,727.52 was expended for maintenance.

The existing project for the protection of the beach, adopted by the act of March 3, 1899, is to strengthen the sections of beach damaged by the great storm of November, 1898, and to restore Eel River to its former course, discharging into the head of the harbor from its course into the sea, to which it was changed by the storm. The estimated cost was $95,700.

The amount expended on the work of improvement under the existing project to the close of the fiscal year ending June 30, 1905, is $72,434.18, with which 11,843 linear feet of rubblestone dike was built on Long Beach, which has resulted in strengthening the beach by the accretion of a large volume of sand and beach shingle; Eel River was restored to its former course, and 536 linear feet of stone dike was built to prevent the river from being again turned into the sea. In addition to the aforesaid amount expended under the present project, $3,954.42 has been expended for maintenance in redredging the turning basin which had been dredged at the wharves under the project of March 3, 1875.

In the report of January 20, 1899, submitting the project with estimate of cost it was said:

> The following estimate for this work should be considered approximate only, for the reason that further changes are likely to occur before the work can be accomplished, which changes may materially increase or diminish the amount of work necessary to restore the beach to a safe condition.

The accretion of the beach before the stone dike was built materially diminished the cross section of a considerable part of it, and permitted its extension to protect other places where further erosion has occurred.

The balance available June 30, 1905, is sufficient for contingencies for the preservation of the beach.

It is reported by the harbor master at Plymouth that the improvement of this locality by the United States has effected a saving of 50 cents per ton in freight rates.

The commerce of the harbor consists of coal and lumber, of which 24,765 tons was received in 1899 and 49,386 in 1904, an increase of about 100 per cent in five years.

The maximum draft that can be carried, June 30, 1905, at mean low water, over the shoalest part of the locality under improvement is 7.5 feet. The mean range of tides is 10.1 feet.

The original project for dredging is published in the Annual Report of the Chief of Engineers for 1874, Part 2, page 348. A map of the dredged channel and basin is printed in the Annual Report of the Chief of Engineers for 1888, page 460.

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(*b*) *Harbor at Provincetown.*—This is an important harbor of refuge in the bight at the extremity of Cape Cod.

In its original condition the width and depth of its entrance and the depth of its anchorage were ample for the largest vessels, but actual or threatened inroads by the sea across the low and narrow part of the cape east of the town, and at intervals along about 1½ miles of the narrow beach southwest of the town, were a serious menace to the harbor.

The original project, adopted by the act of May 20, 1826, was "for the preservation of the point of land forming Provincetown Harbor."

The project from 1826 continuously to this date has been, by building dikes and groins and by other sand-catching devices, to arrest the erosion and promote the accretion of the barrier of beach and sand dunes which protects and preserves the harbor.

The amount expended to June 30, 1905, is $207,553.77, all applied to improvement.

The result of the expenditure has been the preservation of the barrier of beach and sand dunes essential to the preservation of the harbor.

The maximum draft that can be carried, June 30, 1905, to the anchorage is ample for the largest vessels.

The balance available will be applied to works of protection for preserving and strengthening the beach that preserves the harbor.

A description and plan of works are in the Annual Reports of the Chief of Engineers for 1876, 1879, and 1886, pages 181, 273, and 574, respectively.

A special project for the protection of the most slender part of the beach southwesterly of Provincetown is published in Annual Report of the Chief of Engineers for 1897, page 878.

The commerce of this port, amounting in 1904 to about 21,480 tons, is a small factor in this improvement compared with the preservation of this very excellent and important harbor of refuge.

July 1, 1904, balance unexpended	$27,323.84
Amount appropriated by river and harbor act approved March 3, 1905	5,000.00
	32,323.84
June 30, 1905, amount expended during fiscal year, for works of improvement	14,305.25
July 1, 1905, balance unexpended	18,018.59
July 1, 1905, outstanding liabilities	1,282.10
July 1, 1905, balance available	16,736.49
July 1, 1905, amount covered by uncompleted contracts	410.00
Amount (estimated) required for completion of existing project	[a] 20,700.00

(See Appendix B 18.)

19. Channel between North and South Hero islands, Lake Champlain, Vermont.—By the original project, adopted by the act of July 4, 1836, this channel, sometimes called the "Gut," was deepened by dredging to 8 feet at mean low water. The work was completed in 1839, at a total expense of $21,000.

In 1881 it was found by survey that the channel, about 1½ miles long, had an average depth of 10½ feet, with sufficient width, except

[a] For Plymouth Harbor.

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that it was obstructed at its western entrance by a bar through which the channel was 40 feet wide and 7 feet deep, and at its eastern entrance by a bar through which the channel was 100 feet wide and 8 feet deep.

The existing project, adopted by the act of August 11, 1888, is to obtain a channel 150 feet wide and 10 feet deep at both entrances, at an estimated cost of $14,300. The dredging was done in 1889 and the channel reported as completed.

Complaint having been made of obstructions in the west entrance, the channel was examined in 1897, when it was reported that there was a good channel at the eastern entrance of the full depth and width prescribed in the project, but at the western entrance there was a dangerous bowlder in mid-channel, and the channel was 1 to 2 feet shallower in the middle, 2 to 4 feet shallower at its edges, and 25 feet narrower than the project prescribed.

To June 30, 1905, the amount expended under the existing project (as reported June 30, 1890) is $8,594.78 from the appropriation of $10,000 made by the act of 1888.

This channel is the main water connection between the commercial channel on the western and Swanton Harbor and St. Albans Bay on the eastern side of the lake, and is generally used by steam and sailing vessels plying in that part of the lake, but the amount of commerce benefited by the improvement can not be accurately stated. Two steamers, carrying freight and considerable numbers of passengers, each pass through this channel twice daily during the season of navigation.

The existing project, with report of survey, is published in the Annual Report of the Chief of Engineers for 1897, page 3299, which contains also a report of the condition of the improvement.

Amount (estimated) required for completion of existing project---- $4,300.00

20. Harbor at Burlington, Vt.—Before improvement there was ample depth of water along the docks and wharves, but they were without protection against wind and seas from Lake Champlain. In the greatest exposure during the prevalent northwesterly gales the wind has a sweep obliquely across the lake of about 10 nautical miles.

The original project, adopted by the act of July 4, 1836, was to build a breakwater parallel with the shore and about 1,000 feet from the docks and wharves.

Under the original and modified projects the amount expended for construction prior to the adoption of the project of 1886 was $501,811.07, with which 3,551 feet of breakwater was built.

The existing project, adopted in 1886, is to extend the breakwater 1,500 feet (500 feet northerly and 1,000 feet southerly), at an estimated cost of $150,000, enlarged in 1894 and 1902 to embrace repairs and replacing the crib superstructure (4,157 feet) with one of stone or concrete, at a cost estimated at $173,750, a total of $323,750. Completion of repairs is authorized to be done under continuing contract.

Under the existing project there was expended to June 30, 1905, $149,603.55, of which $59,738.69 was applied to extending the breakwater 606 feet (364 feet northerly and 242 feet southerly), making the total length of the structure 4,157 feet; and the sum of $89,864.86

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was applied to repairs and completing the rebuilding of 1,820.75 feet of superstructure.

The extreme variation of level of water surface is 6½ feet and the usual variation about 4 or 5 feet.

The commerce amounted in 1903 to 106,763 tons and in 1904 to 107,421 tons, of which in 1904 63 per cent was coal, 30 per cent building materials, and 7 per cent general merchandise.

The estimated amount that can be profitably expended will be applied to rebuilding the superstructure of 551 feet of breakwater.

A description of the existing project for repairs and maintenance may be found in the Annual Report of the Chief of Engineers for 1901, page 1072, and a description and history of the work in the Annual Report for 1897, page 3296.

July 1, 1904, balance unexpended	$43,116.48
Amount appropriated by river and harbor act approved March 3, 1905	20,000.00
	63,116.48
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	21,220.03
July 1, 1905, balance unexpended	41,896.45
July 1, 1905, outstanding liabilities	5,009.20
July 1, 1905, balance available	36,887.25
July 1, 1905, amount covered by uncompleted contracts	16,960.62
Amount (estimated) required for completion of existing project	141,855.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	20,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix B 19.)

21. Otter Creek, Vermont.—In its original condition Otter Creek had a practicable channel averaging in depth 10½ feet from its mouth in Lake Champlain up 8 miles to Vergennes, but in that distance there were seven shoals, aggregating about 1 mile in length, upon which the depth was 7 to 8 feet.

The original project, adopted by the act of June 10, 1872, which is also the existing project, is to dredge to the depth of 8 feet "at Burlington gauge," the basin at Vergennes from the steamboat landing up as far as Potash Brook, and a channel of the same depth by dredging at six other localities between the steamboat landing and the mouth of the river; also to dredge from a point opposite Potash Brook "along the west shore a channel of the same depth, 100 feet wide, as far as the Horse Nail Company's wharf at the foot of the falls;" estimated cost, $58,146.

In 1882 the estimated cost of the project was increased to $73,748.80, to provide for the removal of 1,772 cubic yards of rock from a shoal at the steamboat landing about 2,200 feet below the falls.

To June 30, 1905, the amount expended is $62,500, all for improvement except $2,246.50 for maintenance. With this expenditure the improvement has been completed in accordance with the project, except the channel 100 feet wide along the west shore to the Horse Nail Company's wharf at the foot of the falls, which, instead of dredging as originally estimated, required the excavation of the lower

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4 feet of its depth in solid rock for a distance of about 500 feet below the falls, and in which a channel of the required depth and 40 feet in width has been completed 350 feet long up to the downstream corner of the Horse Nail Company's wharf.

In 1896 (the latest record permitting comparison) the total commerce on Otter Creek up to the public landing at Vergennes, to which the project has been completed, was 9,052 tons, of which only 925 tons was carried above the public landing to the Horse Nail Company's wharf, to which point the completion of a channel of the dimensions prescribed in the project will require excavation for a length of about 500 feet, depth of 4 feet, and further width of 60 feet in solid rock. Since the Horse Nail Company's factory was burned about two years ago no freight has been delivered there.

The local officer has reported the creek above the public landing at Vergennes to be unworthy of further improvement by the United States at this time.

The head of navigation, in fact, is at the wharf of the National Horse Nail Company at the foot of the falls at Vergennes, 8 miles above the mouth of the river in Lake Champlain.

The commerce benefited by the improvement consists principally of coal and lumber, and amounted in 1903 to 5,300 tons and in 1904 to 6,150 tons.

The original project is published in the Annual Report of the Chief of Engineers for 1872, page 273; the increased estimate in the report for 1882, page 711, and a description of the work done in the execution of the project in the report for 1897, page 3299.

Amount (estimated) required for completion of existing project---- $11,248.00

(See Appendix B 20.)

22. Harbor at Plattsburg, N. Y.—In its original condition the harbor at Plattsburg was without protection against wind and sea from the south and southeast.

The original project for improvement adopted by act of July 4, 1836, was to build a breakwater or pier. Under the original and modified projects $185,440.76 was expended prior to operations under the existing project, with which a breakwater was built, maintained, and extended to a length of 1,565 feet, consisting finally of a substructure of timber cribs filled with stone and a superstructure of stone, and with which also shoals between the breakwater and wharves and a sand bar at the southeast corner of the south wharf were dredged.

The present project is "for maintenance and restoration," adopted by the act of June 13, 1902, which appropriated $5,000 for that purpose without previous estimate.

To June 30, 1905, there was expended under the existing project $4,848.33, with which the pierhead at the south end of the breakwater, consisting of a timber crib filled with stone, was rebuilt above the water line and minor repairs were made to the timber crib pierhead at the north end of the breakwater, and a channel 80 feet wide and 9 feet deep at extreme low water was dredged from the 9-foot curve in the harbor through the sand bar at the southeast corner of the south wharf 800 feet long to the northerly corner of the south wharf and extending for 215 feet farther, to near the steamboat landing, with a width of 20 feet.

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June 30, 1905, the maximum draft that can be carried over the shoalest part of the locality under improvement is 9 feet at extreme low water. The extreme variation of level of water surface is 6½ feet and the usual variation about 4 or 5 feet.

The commerce amounted in 1904 to 261,107 tons, fully 90 per cent of which is reported to be general merchandise.

The harbor and works for its early improvement are described in the Report of the Chief of Engineers for 1867, page 235.

July 1, 1904, balance unexpended	$227.52
June 30, 1905, amount expended during fiscal year, for works of improvement	75.85
July 1, 1905, balance unexpended	151.67

(See Appendix B 21.)

23. Narrows of Lake Champlain, New York and Vermont.—In its original condition the 15 miles of this waterway, extending from the northern terminus of the Champlain Canal, at Whitehall, northerly to Benson Landing, Vt., had a narrow and tortuous channel not more than 9½ feet to 10 feet deep on the shoals at low water.

The original project, adopted by the act of August 5, 1886, was to obtain, by dredging and by a small amount of rock excavation, a channel with a least width of 150 feet and depth of 12 feet at low water from Whitehall to deep water below Benson Landing, a distance of 15 miles. On the original project (as extended in 1890 to widen and straighten the middle reaches of the channel) the amount expended prior to operations under existing project was $63,500.

The existing project, adopted by the act of March 3, 1899, is to widen the channel and restore it to the depth of 12 feet at mean low water in five localities; also to provide fenders for protecting barges from collision with the rocky banks of the channel at Puts rock, the Narrows, and Pulpit Point, at an estimated cost of $22,500.

To June 30, 1905, the amount expended under the existing project was $22,788.39, all for improvement, with which the project has been completed, except the providing of fenders along the rocky banks at the Narrows and Pulpit Point. Available funds will be applied to this latter work and to dredging.

To June 30, 1905, the maximum draft that can be carried over the shoalest part of the locality under improvement is 12 feet at low water. The extreme variation of level of water surface is 6½ feet, and the usual variation about 4 or 5 feet.

From the foot of the canal at Whitehall to the head of Lake Champlain at Crown Point the navigable length of the Narrows is 37 miles. From Whitehall navigation is continued to the Hudson River and Erie Canal by the Champlain Canal, which is 65 miles long, from the southern extremity of the Narrows at Whitehall to Troy, N. Y.

The commerce consists principally of coal, pulp wood, building material, and general merchandise, and amounted in 1903 to 590,789 tons, and in 1904 to 651,592 tons, of which 30 per cent was coal and 33 per cent pulp wood.

The original project, with report and map of the survey of the channel, is published in the Annual Report of the Chief of Engineers for 1885, pages 2312 and 2315, and the existing project in the Annual Report for 1897, page 3302, and 1898, page 1046.

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July 1, 1904, balance unexpended	$1,292.88
Amount appropriated by river and harbor act approved March 3, 1905	2,500.00
	3,792.88
June 30, 1905, amount expended during fiscal year, for works of improvement	81.27
July 1, 1905, balance unexpended	3,711.61

(See Appendix B 22.)

24. Removing sunken vessels or craft obstructing or endangering navigation.—(*a*) *Wreck of steamship Kiowa off Point Allerton at entrance to Boston Harbor, Massachusetts.*—The wreck of this steamer near the track of deep-draft vessels was reported to the Department June 30, 1904, as a dangerous obstruction to navigation. Proposals were obtained after newspaper advertisement and a contract made under which the removal of the wreck and cargo was completed on January 18, 1905, at a total cost to the United States of $8,800.

(*b*) *Canal boats in Lake Champlain, New York.*—Canal boat *Julius Fulton, jr.*, sunk by the ice during the winter of 1903–4 in about 3 feet of water alongside the wharf of the Rutland Railroad Company at Rouse Point, N. Y., and canal boats *Russell Wright*, sunk October 29 in 8 feet of water, and *Anna Weightman*, sunk November 13, 1904, in 5 feet of water, both the latter opposite the docks at Port Henry, N. Y., with cargoes of 160 tons iron ore each, were removed after advertisement for thirty days under a contract with the lowest bidder. Work was commenced April 25, completed May 31, and final report submitted June 9, 1905. The total cost amounted to $2,300.

(*c*) *Schooner Albert H. Harding at entrance to Pigeon Cove Harbor, Cape Ann, Massachusetts.*—This wreck on May 13 floated from the shore and sunk in mid-channel about 150 feet seaward from the entrance to Pigeon Cove Harbor, where it constituted a very dangerous menace to navigation. The owner having in writing abandoned the wreck, proposals were obtained by circular letter and its removal under informal agreement was completed June 12 at an expense of $300, allotted May 26, 1905.

(See Appendix B 23.)

IMPROVEMENT OF RIVERS AND HARBORS IN SOUTHEASTERN MASSACHUSETTS AND IN RHODE ISLAND.

This district was in the charge of Lieut. Col. J. H. Willard, Corps of Engineers. Division engineer, Col. Chas. R. Suter, Corps of Engineers.

1. Harbors at Hyannis and Nantucket, Mass.—(*a*) *Harbor of refuge at Hyannis.*—The harbor of Hyannis lies on the south shore of the peninsula of Cape Cod and about 15 miles to the westward of the heel of the cape and is an important harbor of refuge.

This harbor before improvement was an open roadstead, exposed to southerly storms.

In the years 1827–1838 a breakwater 1,170 feet long was constructed of riprap granite, covering an anchorage of about 175 acres, the entrance to which has a depth of about 15.5 feet.

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Between the years 1852 and 1882 extensive repairs were made, increasing the width of the base of the breakwater and the size of the stone forming its sides and top.

The sum of $123,431.82 had been expended at this harbor prior to operations under existing project.

The existing project, approved in 1884, provides for dredging to 15.5 feet at low water about 36 acres area north of the existing breakwater, so as to increase the deep-water anchorage by that amount, all at a total estimated cost at that time of $45,743.20, increased $30,568.94 in accordance with the report of December 2, 1899, by river and harbor act of June 13, 1902, making the total estimated cost $76,312.14.

The act of 1902 consolidated the works of Hyannis and Nantucket, appropriating therefor $35,000, of which an allotment of $20,000 was made for Hyannis Harbor and $15,000 for Nantucket.

The act of 1905 appropriated $80,000 for these two works, of which $10,000 was allotted to Hyannis Harbor and $70,000 to Nantucket.

At the adoption of the existing project the 15.5-foot depth anchorage covered only about 47 acres, and the 36 additional acres to be dredged carried a depth of from 7 to 15.5 feet of water at low water.

The amount expended on the existing project up to the close of the fiscal year ending June 30, 1905, exclusive of outstanding liabilities, was $63,591.93, none of which was applied to maintenance. Of the 36 acres, 34.5 has been deepened to 15.5 feet, and two cuts 25 feet wide and 13 feet deep at mean low water have been made in the channel leading to the wharf of the New York, New Haven and Hartford Railroad Company.

The mean rise and fall of the tide is about 3 feet.

The principal value of this harbor to commerce is as a harbor of refuge for coasters and fishing vessels. The actual commerce of the place is, in general, agricultural products, coal, and fish, aggregating 13,600 tons. The increase of anchorage area will afford refuge for more and larger boats.

The unexpended balance, together with the allotment of $10,000 of the appropriation of March 3, 1905, will be applied to completing the 15.5-foot deep anchorage area by dredging. The additional work proposed is for the extension of benefits, and will complete the project.

For map, see Annual Report of the Chief of Engineers for 1884, page 592, and for 1903, page 788.

A plan of the works may be found in the Annual Report of the Chief of Engineers for 1885, pages 560 and 621, and report of survey of 1899 in the Annual Report for 1900, page 1284.

(*b*) *Harbor of refuge at Nantucket, Mass.*—This harbor is the only one between the harbors of Marthas Vineyard (Vineyard Haven and Edgartown) and Provincetown, a distance of 100 miles, except the small harbor of Hyannis, on the north side of Nantucket Sound. It has considerable area, with a depth of water in excess of 12 feet, and the object of the improvement is to make it a harbor of refuge for vessels plying between ports north and south of Cape Cod. Incidentally it forms a commercial harbor for the island of Nantucket, and it is the only one on the island. So far as known it has never been used to any extent as a harbor of refuge.

In its original condition the channel entrance was obstructed by a bar 1.5 miles in width, on which there was only 6 feet of water at

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low tide, the channel being very crooked and subject to changes in location. Between 1829 and 1844 an ineffectual attempt was made to dredge a channel through the bar; $45,734.75 was expended prior to beginning operations under the existing project.

The present project, adopted in 1880 and modified in 1885, provides for the construction of two jetties, one on each side of the entrance, and for dredging when necessary, in order to obtain a channel depth of from 12 to 15 feet at low water. Estimated cost, $375,000, exclusive of cost of dredging.

The amount expended on the existing project up to the close of the fiscal year ending June 30, 1905, exclusive of outstanding liabilities, was $275,373.73, of which $7,210 was expended in repairs to the west jetty and $5,000 to the east jetty.

About 83 per cent of the west jetty and 53 per cent of the east jetty have been constructed. The least depth in the channel is 8 feet. The dredging in the jetty channel has been commenced.

The mean rise and fall of the tide is about 3 feet.

During an unusually severe storm in December, 1896, a breach was made through the Haulover beach between the ocean and the head of the harbor. The breach still remains open, and it is believed that its influence has been to retard the deepening of the jetty channel.

A large portion of the 3,955 feet of the west jetty, built prior to 1884, has been damaged somewhat by storms and ice, and, having no core of small stone, allows considerable sand to pass through it. This should be repaired so as to be as sand tight as possible and raised to its original height. It is estimated that $30,000 will be required to complete the repairs in addition to the estimated cost of the project.

The approved project for this work contemplates building two converging jetties and the excavation by dredging of so much of the channel as may not be deepened by the tidal scour. Owing to the uncertainty as to the amount of dredging that would be required, no estimate for that feature of the work has been heretofore included in the amount required to complete the project. By authority of the Chief of Engineers, $50,000 of the allotment of the funds appropriated by the river and harbor act of March 3, 1905, has been assigned to dredging, and the estimate for the completion of the project should be increased by that amount in addition to the $30,000 for maintenance referred to above.

Further work under the project will consist in raising the incomplete portions of both jetties and extending the same with a view to the extension of the benefits to be derived from the improvement.

The entire commerce of Nantucket is carried on at this harbor, amounting in 1904 to about 38,594 tons. The effect of this work will be to afford a place of refuge easy of access and secure from storms for coasters and fishing vessels.

The original reports upon which the existing project was based and subsequently modified may be found in the Annual Reports of the Chief of Engineers for 1880, page 432, and for 1885, pages 563–578, and map of present conditions at page 790 in same report for 1903.

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July 1, 1904, balance unexpended	$35,067.70
Amount appropriated by river and harbor act approved March 3, 1905	80,000.00
	115,067.70
June 30, 1905, amount expended during fiscal year, for works of improvement	33,350.68
July 1, 1905, balance unexpended	81,717.02
July 1, 1905, outstanding liabilities	241.65
July 1, 1905, balance available	81,475.37
July 1, 1905, amount covered by uncompleted contracts	73,970.00
Amount (estimated) required for completion of existing project	45,000.00

(See Appendix C 1.)

2. Harbor at Vineyard Haven, Massachusetts.—Vineyard Haven is a deep indentation on the northern shore of Marthas Vineyard Island, on the southern side of Vineyard Sound.

The headlands on either side of the entrance to the harbor were gradually wearing away and the adjacent parts of the harbor were shoaling. The mean range of tide is 1.7 feet.

The existing project of April 11, 1888, as modified in 1889, provides for the protection of the "Chops" (or headlands) from erosion and the intervening harbor from being filled with the eroded material, the whole to be done by means of stone sea walls and jetties built along the beach in front of the bluffs at both headlands. The total cost was estimated in 1889 at $60,000, the whole of which has been appropriated.

The sum of $55,387.35 had been expended on this work up to June 30, 1905, by which there had been built a series of riprap jetties and sea wall, which appear to have afforded the needed protection. For details of construction, see Annual Report of Chief of Engineers for 1896, page 632.

This harbor, being at present the most accessible refuge for the immense fleet of coasting vessels plying between points north and south of Cape Cod, is more extensively used than any other on the southern coast of New England. Additional work in this locality would be for the extension of benefits.

The report upon which the protective works were based is printed in the Annual Report of the Chief of Engineers for 1882, at page 592, and further information, with maps, in Annual Report of Chief of Engineers for 1887, pages 572–580, and for 1893, page 812. The report of a preliminary examination of the harbor is printed in Annual Report of the Chief of Engineers for 1900, page 1289.

The river and harbor act of June 13, 1902, provides that—

> A board of engineers shall be appointed by the Secretary of War, who shall make * * * an examination of Vineyard and Nantucket sounds, and the east shore of Cape Cod, with a view to reporting upon the relative merits of each of said proposed localities for harbors of refuge. * * *

The report thus called for is printed at page 949 of the Annual Report of the Chief of Engineers for 1904. Further work at this harbor will depend upon the action taken upon the report of this Board.

July 1, 1904, balance unexpended	$4,612.65
July 1, 1905, balance unexpended	4,612.65

(See Appendix C 2.)

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3. Improvement of Little Harbor, Woods Hole, Mass.—Little Harbor, Woods Hole, is at the heel of Cape Cod on the south coast of Massachusetts, separated from Great Harbor by Parkers Neck, and opens into Vineyard Sound. It is about three-eighths of a mile in length and about one-eighth of a mile wide.

Before improvement the ruling depth on the bar at the entrance to the harbor was 7½ feet at mean low water, and at extreme low water, with northwesterly winds of autumn and winter, there would not be more than 5½ feet.

The original project for the improvement of this harbor, approved March 3, 1879, provided for dredging a channel 10 feet deep at mean low water and 130 feet wide through the bar at the entrance, and extending it through the harbor to the wharf of the United States Light-House Establishment. This work was completed in 1879 in connection with the work of deepening and widening the channel through the strait connecting Great Harbor, Woods Hole, with Buzzards Bay.

The existing project, adopted March 3, 1905, provides for dredging a channel 12 feet deep at mean low water and 150 feet wide from Vineyard Sound to the wharf of the Light-House Establishment, and a turning basin 300 feet wide in front of the wharf, at an estimated cost of $18,000.

The amount expended on the existing project up to June 30, 1905, was $16.63, by which a contract for the work had been entered into and the work of dredging had been commenced.

The depth of water over the bar June 30, 1905, is 10 feet through a narrow channel; the mean rise and fall of the tide is 1.65 feet.

The handling of light-house supplies, buoys, etc., will be mainly benefited by this improvement.

The funds available will complete the project.

Further information may be found in the Annual Report of the Chief of Engineers for 1874, page 275; for 1879, page 299; for 1880, page 367, and for 1904, page 930.

Amount appropriated by river and harbor act approved March 3, 1905	$18,000.00
June 30, 1905, amount expended during fiscal year, for works of improvement	16.63
July 1, 1905, balance unexpended	17,983.37
July 1, 1905, outstanding liabilities	60.00
July 1, 1905, balance available	17,923.37
July 1, 1905, amount covered by uncompleted contracts	13,860.00

(See Appendix C 3.)

4. Woods Hole channel, Massachusetts.—Woods Hole is a waterway or strait connecting Buzzards Bay and Vineyard Sound and lying near the southwestern part of Cape Cod, Massachusetts. The name is also applied to the village in the near vicinity and to the Great Harbor and Little Harbor.

Before improvement the entrance to Little Harbor was obstructed by a bar with but 7.5 feet on it at mean low tide. Great Harbor has ample depth. In the strait the channels were crooked and obstructed by bowlders, and the velocity of the currents at certain stages of the tide was from 5 to 7 miles per hour. The site of the wharves and

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basins of the United States Fish Commission and Revenue-Marine Service was a submerged point of land from the shore of Great Harbor.

The original project of 1879 provided for making a channel through the bar at the entrance to Little Harbor and widening and deepening the channel through the strait. The project of 1883, extended in 1884 and 1886, provided for the construction of retaining walls on shore, a stone pier, and a wooden wharf, mainly for the use of the United States Fish Commission and incidentally for the use of other branches of the public service, all of which work had been completed prior to 1889.

The amount expended on the original and modified projects prior to beginning operations on the existing project was $113,599.92, by which the entrance to Little Harbor had been dredged to 10 feet depth, and a direct channel 9 feet deep had been dredged through the strait, where none previously existed. The retaining walls, stone pier, and wooden wharves at the United States Fish Commission had also all been built and repaired.

The existing project, that of June 3, 1896, provides for deepening the channel through the strait to 13 feet at mean low water and widening the same to 300 feet; estimated cost, $396,000.

The amount expended on the existing project up to the close of the fiscal year ending June 30, 1905, exclusive of outstanding liabilities, was $60,000, resulting in the removal of all obstructing shoals in the main channel to a depth of 13 feet at mean low water, excepting two small shoal spots on the northern edge of the channel near Devils Foot Island, and the shoal at the eastern end of the channel, through which there is a clear 13-foot channel 225 feet wide.

The mean rise and fall of the tide is about 4 feet at the Buzzards Bay end of the channel and 1.65 feet at the Vineyard Sound end.

The commerce of Woods Hole was about 25,315 tons for 1904, no account being kept of vessels passing through the strait.

Further work will consist in widening the main channel to the full 300 feet, with a depth of 13 feet, and dredging its southern branch to the same width and depth, all of which is for the extension of benefits already secured.

The prices at which the contracts for this work have been let have been much less than the original estimates, and the relative proportion of the large bowlders to the smaller and lighter material less than the estimated amount based on previous work, so that the indications now are that the amount, $70,000, appropriated, in addition to the $100,000 authorized by the act of March 3, 1905, will go much further than had been anticipated and may possibly complete the new work projected.

For reports on original project see Annual Report of the Chief of Engineers for 1875, page 272. For reports upon which existing project is based see same for 1903, page 860, and for 1895, page 750, and for map of present condition see report for 1903, page 793.

Amount appropriated by river and harbor act approved March 3, 1905	$70,000.00
July 1, 1905, balance unexpended	70,000.00
Amount (estimated) required for completion of existing project	266,000.00

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Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905 ..... $100,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix C 4.)

5. Improving Buzzards Bay, Massachusetts, by removing Weepecket rock.—Weepecket rock lies in Buzzards Bay, off Uncatena Island, and is in almost the direct line of travel from New Bedford to Woods Hole. It is submerged and at low water has only about 2 feet depth over it. In foggy weather it is a menace to vessels entering the Woods Hole strait from the Buzzards Bay end.

No work has heretofore been done by the Government toward the removal of this rock.

The existing project, adopted March 3, 1905, provides for the removal of the rock to a depth of about 10 feet, the depth of the surrounding bottom, at an estimated cost of $2,500.

The amount expended upon the existing project up to the close of the fiscal year ending June 30, 1905, was $16.63, exclusive of outstanding liabilities, by which a contract for the removal of the rock was entered into and the work commenced.

All commerce passing through the strait at Woods Hole will be benefited by the removal of this rock.

The available funds will be sufficient to complete the project.

For further information see Annual Report of the Chief of Engineers for 1904, page 945.

Amount appropriated by river and harbor act approved March 3, 1905	$2,500.00
June 30, 1905, amount expended during fiscal year, for works of improvement	16.63
July 1, 1905, balance unexpended	2,483.37
July 1, 1905, amount covered by uncompleted contracts	1,380.00

(See Appendix C 5.)

6. Harbor at New Bedford, Mass.—New Bedford is on an estuary of Buzzards Bay, and is the port of the cities of New Bedford and Fairhaven.

Before improvement the channel had a depth of 12.5 feet at mean low water. The improvement of this harbor has been carried on under a number of distinct projects, the first being the removal of a wreck and dredging the sand bar formed by it in 1836–1839, on which $10,000 was expended. The projects of 1874 and 1877 provided for a channel 300 feet wide and 15 feet deep at mean low water from the deep water just above Palmers Island to the wharves of New Bedford. This work was completed in 1877 at a cost of $20,000.

The project of 1887 provided for a channel 200 feet wide and 18 feet deep from Buzzards Bay to New Bedford, and was completed at a cost of $35,000.

The project of 1896 provided for dredging an anchorage area one-half mile long, 600 feet wide, and 18 feet deep at mean low tide on the north side of the channel leading from Fairhaven to New Bedford, and was completed at a cost of $56,882.82.

The project of 1899 provided for a channel 250 feet wide and 18 feet deep at mean low water from the anchorage basin through the

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new drawbridge between Fish and Popes islands to the deep water above, and was completed at a cost of $34,000.

The existing project was adopted by the river and harbor act of March 3, 1905, and provides for dredging a channel 18 feet deep and about 150 feet wide along the city wharf front immediately above and below the New Bedford and Fairhaven bridge, and dredging to the same depth a turning area connecting the channel above the bridge with the channel dredged in 1899 through the drawbridge, at an estimated cost of $11,000.

At the adoption of the existing project shoals of from 12 to 18 feet depth of water cut off a portion of the wharf front from communication with those portions of the harbor which had been improved under previous projects.

The amount expended upon this project up to June 30, 1905, exclusive of outstanding liabilities, was $977.40. All dredging contemplated under the 1905 contract was completed June 21, 1905, and secures a depth of 18 feet at mean low tide between the wharves, near the bridge, and other improved portions of the harbor. At the close of the dredging operations a rock was uncovered just north of Fish Island which was of such size as to make it highly probable that it was a portion of a ledge. There is but 15.5 feet of water over the shoalest portion of this rock. A further examination will be made of it by a diver.

Eighteen feet of water at mean low tide can now be carried from Buzzards Bay through the harbor to the deep water above the drawbridge connecting Fish and Popes islands and to the wharves above and below the bridge.

The mean range of the tide is about 4.2 feet.

The commerce of the harbor amounted to about 775,000 tons in 1904. The effect of the deep water on commerce is the use of deeper-draft vessels than formerly, larger cargoes, and a consequent reduction in water freight charges.

For more extended information, see Annual Reports of the Chief of Engineers for 1875, Part 2, page 282; 1888, page 514; 1893, page 816; 1896, page 672; 1897, page 930; 1900, page 1295.

July 1, 1904, balance unexpended	$826.18
Amount appropriated by river and harbor act approved March 3, 1905	11,000.00
	11,826.18
June 30, 1905, amount expended during fiscal year, for works of improvement	977.40
July 1, 1905, balance unexpended	10,848.78
July 1, 1905, outstanding liabilities	10,733.95
July 1, 1905, balance available	114.83

(See Appendix C 6.)

7. Taunton River, Massachusetts.—This river rises in Norfolk County, Mass., and empties into Mount Hope Bay at Fall River.

In its original condition the channel was narrow and obstructed by bowlders, and from Berkley bridge to Taunton the depth was in places not more than 5 feet at mean high water. A vessel of 30 tons burden was as large as could go up to Taunton. From 1870 to 1879,

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$63,000 was appropriated to secure 9 feet depth at high water. This work was completed in 1879.

The existing project, adopted July 14, 1880, provides for the widening and depening of the river so as to secure a channel of at least 12 feet depth at high water, with 100 feet width from its mouth up to Berkley bridge (above Dighton); thence 12 feet depth with 80 feet width (100 feet width at bends) up to Briggs shoal; thence 11 feet depth with 80 feet width up to the "shipyard;" thence with 11 feet depth with 60 feet width up to Weir bridge, Taunton; all at a total cost estimated in 1893 at $125,000, all of which has been appropriated.

The amount expended on the existing project up to June 30, 1905, exclusive of outstanding liabilities, was $130,000 by which all projected work had been practically completed and the shoals offering the greatest obstruction to the navigation of the river had been redredged. About $24,000 of the above amount has been expended in the maintenance of the channel. Vessels of 11 feet draft can reach Taunton at high water, but at some points the 11-foot channel is very narrow. It is estimated that $5,000 every four years will be required to maintain the channel.

The head of navigation is at Weir bridge. No portion of the river has been improved above this point.

The mean range of the tide is about 5¼ feet at Dighton and 3.4 feet at Taunton.

The $5,000 appropriated by the river and harbor act of March 3, 1905, will be applied to redredging portions of the channel which have shoaled since the original dredging.

The tonnage of 1904 was about 588,100 tons.

Further work on this river will be for the maintenance of benefits secured by the improvement.

For more extended information, see Annual Reports of the Chief of Engineers for 1880, page 375; 1884, page 606; 1888, page 515, and 1893, page 824.

Amount appropriated by river and harbor act approved March 3, 1905	$5,000.00
July 1, 1905, balance unexpended	5,000.00

(See Appendix C 7.)

8. Sakonnet River, Rhode Island.—Sakonnet River is an arm of the sea between the island of Rhode Island and the mainland, extending from the ocean to Mount Hope Bay, around the head of Rhode Island. It is at present obstructed at its upper end by a causeway, known as the "Stone Bridge," extending across it. This causeway has two openings, one covered by a draw which is of insufficient width and depth for the needs of commerce, but the causeway offers such obstruction to the ebb and flow of the tides that the currents through the openings make the passage dangerous even to boats of such dimensions as could pass through them under ordinary circumstances.

The existing project, adopted July 3, 1896, provides for increasing the width and depth of the draw opening in the Stone Bridge owned by the State of Rhode Island so as to provide an opening 100 feet wide and 25 feet deep at mean low water, estimated to cost $40,000.

No work had been done and no funds expended prior to May, 1905, when preliminary steps were taken and a project for the expenditure of the funds with specifications for the work were approved.

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The long delay in the execution of this work was owing to the fact that the proposed work involved the total destruction of the present bridge and the existing highway, while no provision was made for rebuilding the bridge or restoring the highway. Until the State of Rhode Island granted the Federal Government the unconditional right to proceed with the work authorized by Congress, and provided either for the restoration or the discontinuance of the bridge and highway, the Secretary of War could not proceed with the work. The authorities of the State had repeatedly been advised of the existing complications and of the importance of having the legislature take the proper action to remove them.

The necessary legislative action having been taken and a board of State commissioners having commenced the reconstruction of the approaches to the bridge, no further obstacles remain to delay the work under the existing project.

Proposals for deepening and widening the draw passage were received June 28, 1905.

July 1, 1904, balance unexpended	$40,000.00
June 30, 1905, amount expended during fiscal year, for works of improvement	1.44
July 1, 1905, balance unexpended	39,998.56
July 1, 1905, outstanding liabilities	31.65
July 1, 1905, balance available	39,966.91

(See Appendix C 8.)

9. Pawtucket River, Rhode Island.—This river, a portion of which is called Seekonk River, is the upper portion of the Providence River, the navigable portion extending from Pawtucket to Providence. Before improvement the channel in the river was narrow and had a ruling depth of about 5 feet at mean low water. Between 1867 and 1873 $52,000 was appropriated to dredge the channel to 7 feet depth. This work was finished in 1876. The project of July 5, 1884, provides for the deepening of the river so as to secure a channel of at least 12 feet depth at low water with 100 feet width from its mouth, at Providence, up to Grant & Co.'s wharf at Pawtucket, and thence 12 feet depth with 40 feet width, through a ledge rock for a short distance farther, to Pawtucket bridge, the head of navigation, all at a total cost estimated in 1883 at $382,500, of which $284,000 has been appropriated.

The river and harbor act of March 3, 1899, modified this project so as to provide for straightening that portion of the channel between Tenmile River and Bucklins Island. The project, with its modification, has been completed, with an expenditure of $282,444.91. This gave the channel 12 feet depth, but at a few points it has slightly shoaled and needs a small amount of dredging to restore the original depth.

The existing project, adopted by the river and harbor act of March 3, 1905, provides for deepening the channel to 16 feet at mean low water with 100 feet width and a channel through the ledge rock at Pawtucket of 16 feet depth at mean low water and 50 feet wide, at an estimated cost of $237,875.

Preliminary investigation has been made with a view to submitting a project for the expenditure of the appropriation of March 3, 1905.

The mean rise and fall of the tide is about 5 feet.

The effect of the improvement is to cause the use of vessels of deeper

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draft than formerly, larger cargoes, and cheaper rates. The completed channel has already been a great benefit to the commerce of the river, which in 1904 amounted to a tonnage of 219,135.

For more extended information see Annual Reports of the Chief of Engineers for 1884, page 608; 1893, page 677; 1900, page 1302.

July 1, 1904, balance unexpended	$1,574.68
Amount appropriated by river and harbor act approved March 3, 1905	30,000.00
July 1, 1905, balance unexpended	31,574.68
Amount (estimated) required for completion of existing project	207,875.00

(See Appendix C 9.)

10. Providence River and Harbor and Narragansett Bay, and Green Jacket shoal, Rhode Island.—(*a*) *Providence River and Harbor and Narragansett Bay.*—The object of this improvement is to furnish a wide and deep channel for foreign and coastwise commerce from the ocean to Providence, and to provide a deep-water anchorage for that harbor.

Before the improvement of the river in 1853 the available low-water depth was limited to 4.5 feet. Between 1852 and 1873 $59,000 was expended in securing first 9 feet and then 12 feet depth of channel.

The approved project of 1878, as modified in 1882, provided for deepening the river and deepening and widening its anchorage basins so as to secure a channel of at least 25 feet depth at low water with 300 feet width from the deep water of Narragansett Bay up to Providence, R. I., and so as to secure anchorage basins of 20 feet depth with 600 feet width, 18 feet depth with 725 feet width, 12 feet depth with 940 feet width, and 6 feet depth with 1,060 feet width from Fox Point to Fields Point, all at a total cost estimated in 1882 at $675,000. This project was completed in 1895.

The total amount expended prior to operations under the project of 1896 was $698,490.60.

Another project originated in the river and harbor act of June 3, 1896, providing for securing a ship channel 400 feet in width and of a depth of 25 feet at mean low water from Sassafras Point, in Providence Harbor, through Providence River and Narragansett Bay by the most direct route practicable to the ocean by way of the "Western Passage," so-called, at an estimated cost of $732,820. This project was put under the continuing-contract system and has been completed.

Under date of June 11, 1904, the Chief of Engineers authorized the use of $2,000 of the balance remaining on hand of the appropriation for securing a channel through the Western Passage of Narragansett Bay for the removal of certain obstructing rocks in Dutch Island Harbor, Rhode Island.

The amount expended on the work under the project of 1896 up to the close of the fiscal year ending June 30, 1905, exclusive of outstanding liabilities, was $472,719.88, by which the channel 400 feet wide and 25 feet deep had been completed from Sassafras Point to the deep water of Narragansett Bay by the Western Passage.

The existing project, approved by the river and harbor act of June 13, 1902, provides for an enlarged anchorage area of 25 feet depth, extending the full width of the harbor from Fox Point on the north and Long Bed and Sassafras Point on the south, including the area known as Green Jacket shoal.

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The river and harbor act of March 3, 1905, placed this work under the continuing-contract system, and a contract for the work has been entered into for dredging all the soft material from the projected anchorage area. The removal of a small amount of hard material in the southeast corner of the area is to form the subject of another contract after the overlying soft material has been removed.

The amount expended on the existing project up to the close of the fiscal year ending June 30, 1905, was $96,108.21, by which all of the Green Jacket shoal, excepting a small triangular area in the extreme southeast corner of the shoal, and about one-half of the area between Wilkesbarre pier and Fox Point were dredged to the required depth.

Further work under this project will extend the benefits secured thus far.

The mean rise and fall of the tide is 4.7 feet.

The improvement in general has been of great benefit to commerce, which in 1904 amounted to 2,259,173 tons. No special benefit is apparent from the dredging in the Western Passage, the project for which originated in the river and harbor act of June 3, 1896. It cost about $468,174.59 and shortened the channel a little for a part of the commerce of Providence.

For more extended information see Annual Reports of the Chief of Engineers for 1878, page 235; 1882, page 557; 1884, with plan of the works, page 622; 1893, page 830; and for historical data connected with the improvement and details of 1902 project, 1900, pages 1257 and 1307.

(*b*) *Removal of Green Jacket shoal.*—This shoal was in that part of Providence River which constitutes the harbor of Providence. It laid off the wharves on the south front of the city and occupied a part of the harbor that is required for anchorage purposes, covering an area of about 18 acres between the 15-foot curves and about 30 acres in all.

In its original condition the shoal in many places carried only 1 foot of water and was a very troublesome obstruction.

The project for the removal of this shoal was adopted August 5, 1886.

The sum of $104,250 was expended on this work up to June 30, 1904, by which 23.8 acres out of the original 30 of this shoal had been dredged to 25 feet depth, and a 16-foot depth had been secured over the central and largest portion of the shoal, in addition to a 20-foot depth in the main channel, making an important addition to the anchorage facilities of Providence Harbor.

In the river and harbor act of June 13, 1902, provision was made for the removal of the remaining portions of this shoal in connection with the project for an enlarged anchorage area in Providence Harbor, and nearly all of the remaining portions of the shoal was removed under the appropriation made by that act.

The removal of the shoal enables vessels to anchor outside of the channel, and thus remove an obstruction to vessels going to or from the Providence wharves.

For more extended information see Annual Reports of the Chief of Engineers for 1885, page 598; 1893, pages 830–832; 1900, page 1307.

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July 1, 1904, balance unexpended	$12,248.96
Amount appropriated by river and harbor act approved March 3, 1905	100,000.00
Reimbursement	8.48
	112,257.44
June 30, 1905, amount expended during fiscal year, for works of improvement	4,875.26
July 1, 1905, balance unexpended	107,382.18
July 1, 1905, outstanding liabilities	53.74
July 1, 1905, balance available	107,328.44
July 1, 1905, amount covered by uncompleted contracts	400,000.00
Amount (estimated) required for completion of existing project	407,778.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	407,778.00

(See Appendix C 10.)

11. Harbor at Fall River, Mass.—Fall River lies at the mouth of Taunton River, in the northeastern angle of Mount Hope Bay, which empties into the ocean through Narragansett Bay and Sakonnet River. It forms the port of entry of the city of Fall River, the largest cotton manufacturing city in the United States.

Before improvement the depth of water in the reentrant in the wharf line north of the Old Colony Steamboat Company's wharf was only about 6 feet, and a considerable area of the harbor, especially in front of the upper wharves, carried much less depth of water than existed in its approaches.

The project of 1874 provided for deepening an area in front of the wharves immediately north of the Old Colony Steamboat Company's wharf 160 feet wide to 12 feet, and an additional width of 100 feet to 11 feet at mean low tide. This improvement was completed in 1878 at a cost of $30,000.

The existing project, approved by the river and harbor act of March 3, 1899, and enlarged by the act of June 13, 1902, provides for a channel 300 feet wide and 25 feet deep at mean low water along the city front between the Old Colony wharf and deep water at the upper end of the city front; also for a channel of the same dimensions through Mount Hope Bay to connect the deep water in front of the city with the deep water of Narragansett Bay, at a total estimated cost of $175,411.94. Provision was made in this act for placing the work under the continuing-contract system.

The sum of $173,396.50 had been expended on the existing project to June 30, 1905, by which the channel in front of the city and across Mount Hope Bay had been completed.

The mean rise and fall of the tide is about 4.7 feet.

The improvement will give increased facilities for deeper draft vessels.

For more extended information see Annual Reports of the Chief of Engineers for 1874, Part 2, page 284; 1895, page 272; 1897, page 931; also House Document No. 56, Fifty-fifth Congress, first session.

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July 1, 1904, balance unexpended	$44,163.95
June 30, 1905, amount expended during fiscal year, for works of improvement	42,148.45
July 1, 1905, balance unexpended	2,015.50

(See Appendix C 11.)

12. Harbor at Newport, R. I.—This harbor is at the main entrance to Narragansett Bay, and all the year it serves as an easily accessible harbor of refuge to foreign and coastwise commerce.

Before improvement the capacity of the inner harbor was limited by shoals, and it was not adequate to the number and size of the vessels seeking it for refuge. The southern or main entrance was obstructed by a bar which stretched out from Goat Island, and the northern entrance by a sharp rocky spit near Rose Island, and the general business wharves of the city could not be reached at low tide by vessels drawing more than 8 feet. The mean tidal range is about 3.75 feet. Between 1873 and 1875 $28,500 was appropriated to secure 12 feet depth in the harbor. This work was completed in 1876.

The approved project, adopted in 1880 and modified in 1882, 1883, 1884, 1890, and 1895, provides for the widening and deepening of the channel from Narragansett Bay into Newport, so as to secure 15 feet depth at low water with at least 750 feet width; for the extension of the 13-foot depth and 10-foot depth anchorage basins, and for dredging a channel 10 feet deep along the State harbor line southward to opposite the gas company's wharf; for the partial cutting off of the shoal spit at the southern end of Goat Island, and for the construction of jetties on the western shore of Goat Island, so as to protect the end of this island from erosion and to prevent the drift of sand, etc., around the island into the adjacent parts of the harbor and channel, and for the removal of Spindle rock, a sharp, rocky spit near Rose Island; all at a total cost estimated in 1895 at $206,200.

A small area of ledge rock was discovered in the fall of 1903 in the channel through the harbor opposite the Old Colony Steamboat Company's wharf, which had been the cause of serious injury to one of the boats of that company, and its removal was authorized by the Chief of Engineers with funds in hand. The rock was drilled for blasting during the winter, but owing to the unusually low temperature of the water the blasting was not done until June 27, 1904. The removal of this rock was completed early in the fiscal year.

The sum of $205,679.58 had been expended on this work up to June 30, 1905, by which the project had been completed.

As the improvement of this harbor has progressed there has been a large increase in the size and number of vessels using the harbor. The commerce for 1904 shows a tonnage of about 1,561,375 tons, principally fish, coal, and general merchandise.

For more extended information, see Annual Reports of the Chief of Engineers for 1873, page 29; 1881, page 562; 1882, page 561; 1883, page 494; 1884, page 624; 1891, page 736, and 1892, page 627.

A plan of the works may be found in the Annual Reports of the Chief of Engineers for 1885, page 604, and for 1893, page 838.

A report and estimate for a channel 18 feet deep through Newport Harbor is printed as House Document No. 121, Fifty-eighth Congress, second session, and at page 939, Annual Report of the Chief of Engineers for 1904.

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July 1, 1904, balance unexpended	$1,438.81
June 30, 1905, amount expended during fiscal year, for works of improvement	730.33
July 1, 1905, balance unexpended	708.48

(See Appendix C 12.)

13. Harbor at Coaster Harbor Island, Rhode Island.—Coaster Harbor Island lies off the northwestern part of the city of Newport, R. I. It is occupied by the United States Navy Department as a training station and site of the War College.

Between the years 1891 and 1893 a channel was dredged by the Government through the waterway separating the island from the city of Newport. This channel has filled up to a considerable extent, and with a view to restoring its usual depth and customary use allotments were made January 8 and May 14, 1904, from the appropriation "Emergencies in river and harbor works," act of June 6, 1900, of $4,661.87, and act of June 13, 1902, of $8,338.13.

The work proposed under these allotments is redredging the channel from the causeway connecting the island with Newport around the east and north sides of the island to Narragansett Bay with a minimum depth of 8 feet and width of 80 feet, with increased width opposite the boathouse of the training station.

Contract for the work was entered into May 31, 1904, at 21 cents per cubic yard, for about 60,000 cubic yards, work to begin in fifteen days after the approval of the contract by the Chief of Engineers and to be completed in three months.

The amount expended up to the close of the fiscal year ending June 30, 1905, was $12,984.49, by which the proposed work was completed.

No further work is proposed for this locality.

July 1, 1904, balance unexpended		$12,949.33
June 30, 1905, amount expended during fiscal year:		
Returned to Treasury	$15.51	
For maintenance of improvement	12,933.82	
		12,949.33

(See Appendix C 13.)

14. Harbor of refuge at Point Judith, Rhode Island.—Point Judith is the southeastern extremity of South Kingston, R. I., and marks the southwestern entrance to Narragansett Bay. A long ledge, known as Squid ledge, extends for nearly a mile in a direction south by east about 1.5 miles west of the point.

At the adoption of the project this place was especially dangerous for boats and tows to pass during storms, and even ordinarily bad weather.

The existing project of September 19, 1890, provides for the construction at this point of a national harbor of refuge nearly a mile square by means of stone breakwaters built partly on Squid ledge and planned so as to give protection against easterly, southerly, and westerly storms, the mainland itself forming a protection on the north, all at a total cost estimated in 1889 at $1,250,000. This project was modified by the report of a Board of Engineers convened to consider and report upon the construction of this harbor, which was approved November 16, 1896, and provided for raising the crest of

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the eastern arm and extending the western arm to its originally projected length, at an estimated cost of $444,311, and deferring the construction of the easterly detached breakwater as a part of the main project until the completion of the main breakwater should demonstrate its necessity or otherwise. The river and harbor act of June 13, 1902, made a further modification by providing for the construction of the easterly detached breakwater and continuing it to the shore, at an estimated cost of $196,193 for the detached breakwater and $187,558.80 for the shore extension, a total estimate for the project and its modifications of $2,078,062.80.

The river and harbor act of March 3, 1905, placed the construction of the easterly breakwater or shore arm of the breakwater under the continuing-contract system, appropriating $100,000 therefor and authorizing the expenditure of an additional $100,000.

The sum of $1,343,421.40 had been expended on this work up to June 30, 1905. By this expenditure the breakwater had been built to a total length of 6,970 feet, with a height of 10 feet above mean low water. It incloses an area of about 640 acres, of which 390 acres has over 25 feet of water and 198 acres additional over 18 feet, and the shore extension of the easterly detached breakwater had been completed for a distance of 593 feet from the low-water line on shore, the outer end reaching 16 feet depth.

Three hundred and five vessels have anchored behind the breakwater during the past year, of which 173 were schooners, 56 were sloops, 52 were steamers, 11 were barges, 8 were catboats, 2 were tugs, 1 was a collier, 1 was a torpedo boat, and 1 was a submarine boat.

A description of the works may be found in the Annual Report of the Chief of Engineers for 1890, page 595, and for 1893, page 840, and the reports of Boards of Engineers in the Annual Report of the Chief of Engineers for 1897, pages 920 and 937; 1903, page 809, and 1904, pages 949–954.

July 1, 1904, balance unexpended	$8,040.96
Amount appropriated by river and harbor act approved March 3, 1905	100,000.00
	108,040.96
June 30, 1905, amount expended during fiscal year, for works of improvement	1,423.75
July 1, 1905, balance unexpended	106,617.21
July 1, 1905, outstanding liabilities	80.00
July 1, 1905, balance available	106,537.21
Amount (estimated) required for completion of existing project	628,062.78
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	100,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix C 14.)

15. Entrance to Point Judith Pond, Rhode Island.—Point Judith Pond is a shallow salt pond, lying in the rear of the sandy beach of the Rhode Island shore, just west of Point Judith.

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The improvement desired at this place by the people of the neighborhood is widening and deepening the present opening into the pond and the construction of jetties for the maintenance of such opening.

The State of Rhode Island and the town of South Kingston are making the opening into the pond.

There is at present no approved project for the improvement of the pond entrance by the United States.

The river and harbor act of March 3, 1905, appropriated $2,000 for the improvement of this channel, in accordance with the report submitted in House Document No. 60, Fifty-eighth Congress, second session; which amount, together with the unexpended balances of previous appropriations, shall be applied to the extension of the jetties or in dredging, as the Secretary of War may deem most beneficial.

A survey of the locality has been made with a view to preparing a project for the expenditure of the funds.

Up to June 30, 1905, $1,463.39 had been expended in surveys and for the expenses of the Board of Engineers authorized by the river and harbor act of June 13, 1902.

For further information, see Annual Report of the Chief of Engineers for 1893, pages 841–879; also report of Board of Engineers authorized by the act of June 13, 1902, printed in House Document No. 60, Fifty-eighth Congress, second session, and at page 967, Annual Report of the Chief of Engineers for 1904.

July 1, 1904, balance unexpended	$8,730.56
Amount appropriated by river and harbor act approved March 3, 1905	2,000.00
	10,730.56
June 30, 1905, amount expended during fiscal year, for works of improvement	193.95
July 1, 1905, balance unexpended	10,536.61

(See Appendix C 15.)

16. Harbor of refuge at Block Island, Rhode Island.—This island is about 14 miles east of the eastern end of Long Island, and about 10 miles distant from the nearest point of the mainland.

The object of the improvement is to furnish a harbor of refuge for medium-draft vessels engaged in foreign and coastwise commerce.

Before the construction of the present harbor Block Island had no harbor at all.

The mean tidal range is about 3 feet.

Between 1870 and 1876 $285,000 was appropriated for a breakwater for a harbor for medium-draft vessels, this work being completed in 1878. Between 1880 and 1882 $25,000 was appropriated for dredging an inner basin and the protection of the shore next to the breakwater, this work being completed in 1884. In 1884 $15.000 was appropriated for additions to the old breakwater, this money being so spent and the work completed in 1884–85.

The project of 1884, as modified in 1888, provided for the construction of a harbor of refuge on the eastern side of the island, consisting of an enlarged inner harbor (or basin) 800 feet square for small vessels and an exterior harbor for larger ones, at a total cost estimated in 1888 at $75,000. This project was practically completed in 1893.

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The total expenditure prior to commencing work on the existing project was $399,000.

The existing project of June 3, 1896, provides for raising the entire breakwater to proper height and stopping sand leaks between certain points and dredging the main inner harbor to a depth of 10 feet, at an estimated cost of $83,985.

At the adoption of the present project this harbor was neither large enough nor well enough protected for the proper harborage of the craft seeking refuge at this place during storms and bad weather.

The sum of $47,842.27 had been expended on the existing project up to June 30, 1905, by which the entrance to the inner harbor, which had shoaled up from the drift of sand through the breakwater, had been partially dredged to a depth of 12 feet and redredged to a depth of 10 feet several times. The north wall of the enlarged inner harbor had been strengthened and repaired and the work of repairing the main breakwater and making it sand-tight had been completed for a length of 650 feet. About $17,839.74 of the above amount had been expended in maintaining the channel at the entrance to the inner harbor and repairing and strengthening the harbor walls.

The river and harbor act of March 3, 1905, appropriated $50,000 for completing the existing project.

Contracts were entered into with E. S. Belden & Sons, of Hartford, Conn., under date of June 12, 1905, for completing repairs to the breakwater, at the rate of $2.13 per ton of stone, and with the J. S. Packard Dredging Company, of Providence, R. I., under the same date, for dredging in the inner harbor at the rate of 24 cents per cubic yard. Up to the close of the fiscal year 1,571 tons of stone had been placed on the breakwater. The dredging had not commenced.

In 1904 the commerce amounted to about 162,915 tons, showing an increase over previous years.

The additional work required to complete the existing project is for the purpose of extending the benefits already secured by the improvement.

For more extended information see Annual Reports of the Chief of Engineers for 1877, page 202; 1879, page 313; 1880, page 390; 1881, page 563; 1882, page 563; 1884, page 628. A plan of the works may be found in the Annual Reports of the Chief of Engineers for 1885, page 609; 1888, page 506; 1893, page 844; 1896, page 674; also in House Document No. 60, Fifty-eighth Congress, second session, and page 954 of the Annual Report of the Chief of Engineers for 1904.

July 1, 1904, balance unexpended	$3,945.00
Amount appropriated by river and harbor act approved March 3, 1905	50,000.00
	53,945.00
June 30, 1905, amount expended during fiscal year, for works of improvement	1,896.10
July 1, 1905, balance unexpended	52,048.90
July 1, 1905, outstanding liabilities	30.00
July 1, 1905, balance available	52,018.90
July 1, 1905, amount covered by uncompleted contracts	45,300.00

(See Appendix C 16.)

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17. Great Salt Pond, Block Island, Rhode Island.—The Great Salt Pond is located about the center of Block Island, and contains an anchorage area of 150 acres for vessels drawing 18 feet and over. The work of converting the pond into a harbor of refuge by making a channel through the beach on the west, connecting it with deep water in the ocean, was started by the State of Rhode Island and the town of New Shoreham.

The channel, under the existing project of June 3, 1896, as modified in 1900, is to be 600 feet wide and have a central depth of 25 feet for a width of 150 feet, sloping gradually to 12 feet in a width of 504 feet, the channel seaward to be protected on the south by a jetty extending to 350 feet beyond the original 18-foot contour, and on the north by a jetty about 1,200 feet long, and the sides of the channel where it passed through the original beach to be protected by stone revetments and sand fences, at a total estimated cost of $305,000.

At the time the work commenced under the General Government a channel of varying width and depth had been dredged with the money appropriated by the State and town, which would permit of 12-foot draft being carried in, although there were two 9-foot spots left in mid-channel. The south jetty had been built out 837 feet, and a north jetty 250 feet long had also been built, but at a distance of 720 feet from the south jetty instead of 600 feet, as called for in the adopted project.

Up to June 30, 1905, $122,736.41 had been expended by the General Government on the existing project, of which $5,253.24 had been used for maintenance and repair. By this expenditure the south jetty had been extended 287 feet beyond the originally projected length, making a total length of 1,549 feet from the initial point on shore. Some damage done by a severe storm in the spring of 1900 had been repaired, and a channel 18 feet deep and 300 feet wide, with a central cut 25 feet deep and 35 feet wide, had been dredged; also a small amount of dredging had been done in removing a shoal which had formed near the outer end of the jetty.

The channel dredged in 1900 to a depth of 18 feet with a width of 300 feet, with a cut 25 feet deep through the center, has shoaled to some extent. The sides of this channel now have about 15 feet of water, from which it deepens to 18 feet toward the center. The 25-foot cut has shoaled to 19 feet near the outer end.

There remains, to complete the existing project, the construction of jetties as planned and dredging to secure the widths and depths projected.

The river and harbor act of March 3, 1905, appropriated $30,000 for this improvement. The approved project for the expenditure of the available funds contemplates the extension of the south jetty about 150 feet and widening the central 25 feet depth of the channel as much as the funds will allow.

The work required to complete the existing project is for the purpose of extending the benefits of the improvement.

The commerce of the Great Salt Pond is reported for the calendar year 1904 at 45,000 tons.

For more extended information see Annual Reports of the Chief of Engineers for 1896, page 620; 1900, page 1276.

The report of the examination by the Board of Engineers authorized by the river and harbor act of June 13, 1902, is printed in

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House Document No. 60, Fifty-eighth Congress, second session, and in Annual Report of the Chief of Engineers for 1904, page 949.

July 1, 1904, balance unexpended	$18,318.46
Amount appropriated by river and harbor act approved March 3, 1905	30,000.00
	48,318.46
June 30, 1905, amount expended during fiscal year, for works of improvement	1,054.87
July 1, 1905, balance unexpended	47,263.59
July 1, 1905, outstanding liabilities	44.46
July 1, 1905, balance available	47,219.13
Amount (estimated) required for completion of existing project	135,000.00

(See Appendix C 17.)

18. Removing sunken vessels or craft obstructing or endangering navigation.—Schooner Levi Hart and an unknown wreck; barkentine Albertina and schooner Viola May; schooner Frauline; schooner Richard S. Leaming; schooner at Nantucket Harbor, Massachusetts; schooner Anna Laura; steamship Aransas, and barge Moonbeam.—Schooner *Levi Hart* and an unknown wreck, sunk in Pollock Rip Slue, Massachusetts; removal completed in June, 1904. Barkentine *Albertina* and schooner *Viola May*, the former sunk on Chatham bar and the latter on Shovelful shoal, Massachusetts; removal completed in November, 1904. Schooner *Frauline*, sunk on Common Flat, Chatham, Mass.; removal completed in December, 1904. Schooner *Richard S. Leaming*, sunk off Cross Rip light-ship; 487 tons; removal completed in April, 1905. Schooner at Nantucket Harbor, Massachusetts, sunk in entrance channel to the harbor, subsequently believed to be the wreck of the schooner *Frank Palmer*; could not be located on arrival of wrecking party, evidently having been carried out to sea. Schooner *Anna Laura*, sunk 1¼ miles from Hardings Beach, Massachusetts; removal completed April 25, 1905. Steamship *Aransas*, of the Joy Line, 1,156 tons, sunk in Pollock Rip channel, Massachusetts, on the night of May 7–8, 1905; removal in progress at the close of the fiscal year. Barge *Moonbeam*, sunk off Point Judith, Rhode Island, on the night of May 3, 1905; work had not begun at the close of the fiscal year.

(See Appendix C 18.)

IMPROVEMENT OF RIVERS AND HARBORS IN CONNECTICUT AND OF PAWCATUCK RIVER, RHODE ISLAND AND CONNECTICUT.

This district was in the charge of Lieut. Col. Chas. F. Powell, Corps of Engineers, having under his immediate orders Capt. William Kelly, Corps of Engineers, until November 14, 1904. Division engineer, Col. Chas. R. Suter, Corps of Engineers.

1. Pawcatuck River, Rhode Island and Connecticut.—The navigable part of the Pawcatuck River extends 5 miles from Westerly, R. I., to its outlet in Little Narragansett Bay, and with the channel thence through the northern part of the bay 2½ miles to Stonington Harbor, which forms the approach from Long Island Sound to the bay and river under improvement.

Before improvement the channel of the river was crooked and

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obstructed by numerous shoals, on some of which there was 1 to 1½ feet of water; 4½ feet was the greatest depth which could be carried through the bay channel.

The original projects, that of 1871 for the river channel and that of 1876 for the channel across the bay, provided for depths of 5½ and 7 feet and widths of 75 and 200 feet, respectively. The expenditure on the original projects prior to operations under the existing project was $97,500.01.

The present project, approved July 24, 1896, and based on the report of the survey ordered in the river and harbor act of August 18, 1894, provides for a channel 10 feet deep from Stonington, Conn., to Westerly, with a width of 200 feet from Stonington to Avondale, R. I., a distance of about 4 miles; a width of 100 feet from Avondale to the lower wharves of Westerly, a distance of about 3 miles, and a width of 40 feet between the upper and lower wharves of Westerly, a distance of about one-half mile, at a total estimated cost of $200,361.60. The river and harbor act of March 3, 1905, appropriated $1,000 for the removal of obstructions at Watch Hill, at the southeastern part of the Little Narragansett Bay, as part of the improvement of the Pawcatuck River and the bay. On this project $37,166.84 had been expended to June 30, 1905, therewith completing the section 40 feet wide along the wharves of Westerly, extending the 100-foot channel downstream 1,800 feet, and making a part channel through Little Narragansett Bay. Of this amount $6,891.71 was applied to maintenance. The maximum draft which could be carried, June 30, 1905, was 8 feet in the bay channel, 7 feet in the river, and 6 feet near Watch Hill. The mean rise of tide is 2.6 feet at the mouth of the river and 2.3 feet at Westerly.

The effect of the improvement is to permit coal, lumber, and building material to be delivered in vessels at Westerly and to ship therefrom granite in vessels instead of by rail. The value of the tonnage for 1904 is computed to be $801,606.

Comparative tonnage.

	Tons.		Tons.
1896	39,086	1902	116,399
1898	131,602	1903	108,802
1900	57,530	1904	141,832

July 1, 1904, balance unexpended		$3,361.11
Amount appropriated by river and harbor act approved March 3, 1905		1,000.00
Amount allotted from appropriation for maintenance of river and harbor improvements, act of April 28, 1904		4,100.00
		8,461.11
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$363.53	
For maintenance of improvement	264.43	
		627.96
July 1, 1905, balance unexpended		7,833.15
Amount (estimated) required for completion of existing project		161,361.60

(See Appendix D 1.)

2. New London Harbor, Connecticut.—New London Harbor comprises the lower 3 miles of the Thames River, having a navigable width of one-quarter to 1¼ miles and depths of 26 feet or more in the

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main channel from Long Island Sound to the railroad drawbridge which crosses the river above the New London dock front. This channel, especially opposite New London, follows the east bank. Between it and the city docks is a nearly level area having a general depth of 10 to 15 feet. Heretofore vessels of 16 to 18 feet draft have been able at high tide only to reach some of the docks. Under a modification of the existing Thames River project, adopted in 1872, Shaws Cove, a branch of New London Harbor, had been dredged to 12 feet.

The original and present project of improvement of New London Harbor, adopted by the act of June 13, 1902, provides for a dredged ship channel 400 feet or more in width, 23 feet deep, and about 6,000 feet long. It is to leave the deep water of the river opposite Fort Trumbull on the west side, skirt the water front of the city, including that of Winthrop Cove to the Central Vermont Railroad bridge, and including the east side of the Central Vermont dock, and join the natural deep channel adjacent thereto, at a distance of about 4,000 feet upstream from the point of beginning. The estimated cost of the improvement is $145,000, and $1,000 per annum for maintenance. For map see House Document No. 392, Fifty-sixth Congress, first session. For report of examination of Winthrop Cove, with view of securing a depth of 30 feet, see pages 1004–1008, Annual Report of the Chief of Engineers, 1904.

The project dredging was completed under a continuing contract. Up to June 30, 1905, $129,541.02 had been expended on the project. This gives the 23-foot channel except at two small areas of ledge rock in the Fort Trumbull-Shaws Cove arm of the channel, where depths remain of about 18 feet, and at part of a city pipe sewer crossing the middle of the dredged channel, where the least depth is 21.6 feet; 23 feet can be carried to opposite all the principal docks by approach from the east end of the dredged channel. The mean rise of tide is 2.6 feet. The additional work proposed is to maintain the improvement and extend its benefits.

The tonnage of this port for the year 1904, principally coal, building material, oil, and steamboat freight, and exclusive of that pertaining to Shaws Cove and Thames River, is 745,856, whose value was $2,005,849, besides that of 433,533 tons of steamboat freight, mainly merchandise, of unknown value.

July 1, 1904, balance unexpended	$41,502.84
Amount appropriated by river and harbor act approved March 3, 1905	2,000.00
	43,502.84
June 30, 1905, amount expended during fiscal year, for works of improvement	26,043.86
July 1, 1905, balance unexpended	17,458.98

(See Appendix D 2.)

3. Thames River, Connecticut.—This is a tidal stream from Norwich, Conn., the head of navigation, to Long Island Sound, a distance of 15 miles. For 4 miles below Norwich the natural depths were 6 feet or more at low water, and width of 400 to 1,000 feet. Below this point depths were 13 feet or more, and widths 800 to 3,000 feet.

In 1836 the original project was adopted, providing for a channel 11 feet deep at low water, to be secured by dredging and building

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dikes. On this project $40,300 had been expended when, in 1839, work was stopped, the project not having been completed.

The existing project, adopted June 23, 1866, and modified in 1876, 1882, 1888, and 1892, is to dredge and build training walls to secure a channel 200 feet wide, with depths of 16 feet from above New London to Allyns Point, and 14 feet thence to Norwich; also to dredge Shaws Cove at New London to a depth of 12 feet. Estimates of cost were $457,620 for construction and $8,000 annually for maintenance.

Up to June 30, 1905, there had been expended $417,106.46 on this project and its modifications, of which $10,816.85 was applied to maintenance. Three of the five proposed training walls had been completed and the fourth nearly so. The proposed 16-foot channel had been completed to Allyns Point; thence to Norwich the project depth of 14 feet had been secured in a channel varying in width from 100 to 175 feet, which has since become narrower by shoaling. The proposed dredging in Shaws Cove had been completed. Mean high tide is 2.6 feet at New London and 3.1 feet at Norwich. The additional work proposed is for the extension of benefits by completion of the project.

Commerce at Allyns Point is coal, and at Norwich and intermediate landings it is mainly coal, lumber, and cotton and wool and steamboat freight. The value of the tonnage for 1904, exclusive of unknown value of 24,691 tons of steamboat freight, is $4,659,759, including $118,600 for Shaws Cove commerce.

The work done has reduced the cost of transportation by enabling freight to be brought in vessels of 16 and 18 feet draft instead of 8 feet. The river commerce of the present day could not be carried except for the increased depth thus obtained, and urgent requests have been received for a further increase in channel depths to accommodate the deeper-draft vessels now going to Allyns Point.

Comparative tonnage.

	Tons.		Tons.
1896	424,945	1902	355,074
1898	459,588	1903	409,997
1900	464,283	1904	346,791

July 1, 1904, balance unexpended	$9,251.17
Amount appropriated by river and harbor act approved March 3, 1905	34,100.00
	43,351.17
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	2,857.63
July 1, 1905, balance unexpended	40,493.54
July 1, 1905, outstanding liabilities	230.58
July 1, 1905, balance available	40,262.96

(See Appendix D 3.)

4. Connecticut River below Hartford, Conn.—The part of the river under improvement is 50 miles long from Long Island Sound to Hartford; beyond Hartford the river is navigable by means of a small private canal at Windsor Locks, Connecticut, 35 miles to Holyoke, Mass., although the navigation is limited by reason of low, fixed

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bridges and the inadequacy of the canal. Before beginning improvement below Hartford the available depth over Saybrook bar at the mouth of the river was 7 feet, and thence to Hartford at the shoalest of the river bars was about 5 feet.

In 1836 an appropriation was made for removing Saybrook bar; up to 1843 $23,471.57 had been expended thereon. An 11 to 12 foot channel had been dredged 50 feet wide and 1,500 feet long, but was nearly destroyed by following storms and freshets. No further work was done until 1870, when the present project was adopted, and which was modified in 1873, 1880, 1887, and 1890; for scope and other history of these modifications see pages 120 and 121, Annual Report of the Chief of Engineers, 1900. The present project, as defined by the last modification, consists in completing two jetties at the Saybrook bar to a height of 5 feet above high water and top width of 6 feet and side slopes of 1 on 1; raising the training wall, nearly 3,700 feet long, at the Hartford bars as may be found necessary by experience, but not to exceed 15 feet above low water; dredging the channel between the jetties to 12 feet depth and width of 400 feet, and maintaining the channel by annual dredging at the various river bars to about 10 feet depth at mean low water and to a width as near 100 feet as practicable, at an estimated cost—

For annual dredging	$10,000
Completing Saybrook jetties	60,000
Dredging channel between them	20,000
Raising Hartford dike	50,000
Total	140,000

The act of June 13, 1902, authorized an expenditure of $1,000 for removal of obstructions at mouth of Salmon River, a tributary to the Connecticut River.

The total amount expended on the present project to the close of the fiscal year ending June 30, 1905, is $513,838.62, of which about $286,739.77 was for maintenance.

The maintenance of the river-bar channels by annual dredging has been held paramount in the project; available funds heretofore were not sufficient for enlarging the jetties or dike or for dredging at Saybrook bar. The jetties have maintained a nearly 12-foot channel of narrow width, and annual dredging at the river bars has generally kept a half-width channel open, so that Hartford-New York steamers and barges drawing from 9 to 11 feet, according to river stage, have been but little detained or lightered, and then only at summer low river and before completion of the annual dredging. The maximum draft which could be carried at mean low water over the shoalest river bar on June 30, 1905, was 8½ feet. The mean rise of tide is 3.6 feet at Saybrook jetties and on low river 1.5 feet at Hartford.

Sketches of the Connecticut River from Hartford to Rocky Hill and of Saybrook bar are printed in the Annual Report of the Chief of Engineers for 1885, page 636. The river from the Sound to Hartford is shown on Coast Survey charts 253–256.

A report upon survey of the river between Hartford and Holyoke, under the act of June 13, 1902, is printed herewith as Appendix D 15. It is expected that report of the reexamination of Connecticut River

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between these points, authorized by the river and harbor act approved March 3, 1905, will be submitted to Congress at its next session.

Commerce is mainly in coal, lumber, building materials, and miscellaneous steamboat freight of a value of $2,282,503, not including an unknown value of 230,000 tons, principally merchandise, of steamboat freight.

The work done has reduced freights to Hartford and lower river ports materially. Coal is reported to be delivered at Hartford at $1 per ton less than at Springfield and Holyoke, Mass. Without the improvements there could be but little freight traffic on the river.

Comparative tonnage.

	Tons.		Tons.
1890	1,095,000	1903	681,000
1901	723,187	1904	675,000

July 1, 1904, balance unexpended	$7,407.08
Amount appropriated by river and harbor act approved March 3, 1905	40,000.00
Amount allotted from appropriation for maintenance of river and harbor improvements, act of April 28, 1904	12,000.00
	59,407.08
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	16,547.27
July 1, 1905, balance unexpended	42,859.81
July 1, 1905, outstanding liabilities	7,461.90
July 1, 1905, balance available	35,397.91
Amount (estimated) required for completion of existing project	100,000.00

(See Appendix D 4.)

5. Harbor of refuge at Duck Island Harbor, Connecticut.—Duck Island Harbor is a bay on the north shore of Long Island Sound, about 7 miles west of the mouth of the Connecticut River and midway between the harbors of New London and New Haven. Mean high tide is 3.8 feet.

The project for this improvement, adopted under the river and harbor act of 1890, and approved September 27, 1890, provides for the construction of three riprap breakwaters of 3,000, 1,750, and 1,130 feet length, respectively, inclosing and sheltering an area of about 115 acres, with two entrances. The project height of breakwaters is 10 feet above low water, with crown of 10 feet and slopes of 2 on 3 outside and 1 on 1 inside. The estimated aggregate cost is $463,540. For map see Annual Report of the Chief of Engineers for 1887, page 644.

To June 30, 1905, $114,202 had been expended, of which $202 was for maintenance, and 2,770 linear feet of the west breakwater had been built, but with reduced cross section, extending westwardly from Duck Island to a low-water depth of 17 feet. No work in furtherance of the project has been done during the past year from lack of funds.

The commerce to be benefited by this improvement is the passing commerce of Long Island Sound, which may find it necessary or convenient to seek shelter at this locality. Its value can not be satisfactorily estimated. During the year 1900, 1,707 vessels were reported as using the harbor of refuge.

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Amount appropriated by river and harbor act approved March 3, 1905	$6,000.00
July 1, 1905, balance unexpended	6,000.00
Amount (estimated) required for completion of existing project	349,540.00

(See Appendix D 5.)

6. Branford Harbor, Connecticut.—The part of this harbor under improvement consists of the lower part of a small tidal stream, about 1¾ miles long from the upper docks, emptying into a bay about 1½ miles long and 1 mile wide on the north shore of Long Island Sound east of New Haven. At the upper dock the stream is crossed by an earthen causeway and small drawbridge rarely opened; the stream is navigable by small craft to a fixed bridge about one-half mile above the drawbridge. The natural law-water depth across the mouth of the bay was about 16 feet, shoaling gradually to 8½ feet between two rocks, known as "The Mermaids," near the middle of the bay, and thence to the mouth of the river very uniform at 8½ feet. The channel through the river to the lower coal dock varies from 8½ to 12 feet or more. From the lower to the upper docks it gradually narrowed and shoaled, so that the controlling depth was somewhat less than 6 feet, and the width from 25 to 50 feet. Since the adoption of the present project a very general and uniform shoaling of 1 to 2 feet has taken place in the outer harbor, so that the controlling depth between "The Mermaids" and the mouth of the river, the shoalest place in the channel, is now only about 6 feet.

The original and present project, adopted by the act of June 13, 1902, is to dredge and maintain an 8½-foot channel, 100 feet wide, in the upper part of the river between the lower and upper docks, at a first cost subsequently ascertained to be $10,000, and otherwise to be in accordance with a report of a survey given in the Annual Report of the Chief of Engineers, 1901, page 1189 et seq. A channel of full project depth and 75 feet wide was dredged from the 8½-foot curve below the lower dock upstream to the upper docks. This work greatly facilitates the navigation of the upper part of the harbor, but the above-named shoaling in the lower harbor or bay should be removed to project depth in order to obtain the full benefit of the increased depth in the upper portion of the channel. The maximum depth that could be carried June 30, 1905, from the entrance of the harbor to the head of the projected channel was 6 feet, and through the portion of the channel under improvement 8½ feet. The mean rise of tide is 6 feet.

The amount expended on this project to June 30, 1905, is $4,840.12.

The commerce of this harbor is mainly coal, iron, and molding sand. Traffic for calendar year 1904 amounted to 22,910 tons, valued at $230,450, a decrease of 4,148 tons from that of 1903.

July 1, 1904, balance unexpended		$4,795.89
Amount appropriated by river and harbor act approved March 3, 1905		3,000.00
		7,795.89
June 30, 1905, amount expended during fiscal year, for works of improvement		4,636.01
July 1, 1905, balance unexpended		3,159.88
Amount (estimated) required for completion of existing project		2,000.00

(See Appendix D 6.)

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7. New Haven Harbor, Connecticut.—This is a bay on the north shore of Long Island Sound extending about 4 miles inland and from 1 to 2 miles wide. Mill and Quinnipiac rivers, navigable for about 1 and 3 miles, respectively, above their mouths, empty into the head of the harbor from the northeast. The original available low-water depth from the wharves to Cranes bar, one-third way down the harbor, was 9 feet; thence to Fort Hale, halfway down, it was 16 feet or over. Below Fort Hale was a broad bar of soft mud extending across the channel, with available depth of 13 feet. The harbor entrance was partly obstructed by several sunken rocks. In Quinnipiac River the available low-water depth was about 4 feet, and in the west branch of Mill River about 5 feet to the head of the present projected improvement. Above this point both rivers are for the most part available for navigation only at high tide. The entire east branch of Mill River ran nearly bare at low tide.

In 1870 a project was adopted for removal of sunken rocks at the harbor entrance. This work was not continued after 1875, when the harbor breakwaters were first proposed. In 1871 the project was extended to include deepening the harbor channel, the proposed depth and width being modified from time to time as appropriations were made, so that when the present project was adopted, March 3, 1899, it consisted in making a channel 16 feet deep and from 400 to 700 feet wide from Long Island Sound to the head of the harbor and in constructing a dike to contract the channel across Fort Hale bar, at a total estimated cost from beginning of $348,000. This project was nearly completed, the deficiencies being in the length of channel arm of the dike, which was about two-thirds the projected length, and in widening the channel across Fort Hale bar, which was only 200 feet wide. The total amount expended on previous projects was $325,695.66.

The present project, act of March 3, 1899, is to dredge a channel 20 feet deep, 400 feet wide, and 4 miles long, from Long Island Sound to Canal dock; thence one-half mile to Tomlinson bridge, of same depth and 300 feet wide; and three anchorage basins of 20, 16, and 12 feet depths, at a cost not to exceed $345,000, and, act of June 13, 1902, to extend the 12-foot improvement to the Quinnipiac and Mill rivers to Grand avenue, provided the cost did not exceed the total amount authorized in act of March 3, 1899. The project for the latter-named works, as approved January 27, 1903, is: A channel 12 feet deep and 200 feet wide in Quinnipiac River to Ferry Street Bridge; a channel 8 feet deep and 50 feet wide in Quinnipiac River, through the shoals at the ends of the natural channel between Ferry Street and Grand Avenue bridges, and a channel 12 feet deep and 200 feet wide in Mill River to the junction of the two branches above Chapel street and thence 12 feet deep and 75 feet wide up each branch to Grand avenue, and, as approved November 27, 1903, extension of the 8-foot channel in Quinnipiac River to Grand Avenue Bridge. The above project was completed April 26, 1904, mainly under continuing contract, and the improvement has been maintained.

For reference to maps and further details regarding the harbor and projects, see Annual Report of the Chief of Engineers, 1904, page 94.

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The amount expended on the existing project up to the close of the fiscal year ending June 30, 1905, was $288,799.61, of which $15,593.40 was for maintenance.

The maximum draft which could be carried June 30, 1905, through the main channel to Tomlinson bridge is 20 feet at mean low tide; above Tomlinson bridge the maximum low-water draft which could be carried up Mill River to Grand Avenue Bridge is 12 feet in both branches; up Quinnipiac River to Ferry Street Bridge, 12 feet, and from Ferry Street Bridge to Grand avenue a little more than 6 feet in the natural channel connecting the two portions of the dredged channel. The depth in this dredged channel is 8 feet. The mean rise of tide is 5.7 feet at entrance to the harbor and 6.6 feet at Tomlinson bridge.

The work done has enabled deeper-draft vessels to use the harbor than was formerly possible. Vessels drawing from 22 to 23 feet now regularly enter the harbor, and vessel drafts are now limited by the depth of water in the various berths and slips and not by the depth of the main channel.

The engineer officer in charge invites attention to and explains the commercial need of greater capacity of channel in the Quinnipiac River to Ferry Street Bridge.

The commerce of New Haven Harbor is mainly in coal, steamboat freight, shellfish and shells, lumber, steel billets, and pig iron. The tonnage for the calendar year 1904 was 1,511,427 tons, valued at $31,028,210.31, a decrease of 745,770 tons from that reported for 1903.

July 1, 1904, balance unexpended	$7,216.03
Amount appropriated by river and harbor act approved March 3, 1905	9,000.00
Amount allotted from appropriation for maintenance of river and harbor improvements, act of April 28, 1904	9,000.00
	25,216.03
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	15,637.40
July 1, 1905, balance unexpended	9,578.63
July 1, 1905, outstanding liabilities	71.65
July 1, 1905, balance available	48,006.98

(See Appendix D 7.)

8. Breakwaters at New Haven, Conn.—The original and existing project for this work, authorized by act of March 3, 1879, and approved January 31, 1880, and modified by act of September 19, 1890, in accordance with plans given in Annual Report of the Chief of Engineers, 1889, page 679, is to make a harbor of refuge at the entrance to New Haven Harbor by constructing four breakwaters—one 3,300 feet long, extending from Southwest ledge to Quixes ledge; one 5,000 feet long, extending from a point 1,000 feet north 54° east from Ludington rock in a direction south 54° west across the rock; one about 4,200 feet long, extending northwesterly from a point 6,000 feet south 54° west from Ludington rock; and one about 1,200 feet long, extending southwesterly from Morgan Point on the east side of the harbor entrance; the cross section of all these breakwaters to be 12 feet wide on top and 6 feet above mean high water, with outer slope 1 on 2 and inner slope 1 on 1. The estimated cost from the beginning in 1880 was $2,151,134. The anchorage which would

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be sheltered by the breakwaters exceeds 2,000 acres, and has depths of 9 to 26 feet. The mean rise of tide is 5.7 feet.

For original report on project, see Annual Report of Chief of Engineers, 1880, pages 449 et seq., and for modification of project and maps showing the location of the breakwaters as contemplated under the existing project, see Annual Report of the Chief of Engineers for 1889, page 678 et seq.; 1890, pages 624 and 625; and 1896, page 702.

No work was done during the fiscal year owing to lack of funds, and at its close the breakwater from Southwest ledge to Quixes ledge had been completed 3,450 long, and 4,500 feet of the Ludington rock and 1,805 feet of west breakwater had been built, but with steeper side slopes than called for by project. The total expenditure to June 30, 1905, was $877,921.24, of which $3,445.32 was for maintenance.

The commerce now benefited and to be further benefited by this work is mainly the passing commerce of Long Island Sound. The projected breakwaters provide also an outer anchorage for vessels bound to and from New Haven and help to protect the entrance to New Haven Harbor proper from seas and to diminish channel filling. For the calendar year 1904, 47,777 vessels were reported as passing or entering between the breakwaters, the number passing during dark nights or fogs not being observed. It is estimated that some 2,500 vessels sought refuge behind the breakwaters during that year. The additional work proposed is for extension of benefit to commerce.

July 1, 1904, balance unexpended	$1,819.84
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	741.08
July 1, 1905, balance unexpended	1,078.76
July 1, 1905, outstanding liabilities	25.84
July 1, 1905, balance available	1,052.92
Amount (estimated) required for completion of existing project	1,272,134.00

(See Appendix D 8.)

9. West River, Connecticut.—This river lies between the city of New Haven and the town of West Haven. The head of navigation is at a railroad bridge about one-half mile upstream from the Kimberly Avenue Bridge. About 500 yards below this drawbridge the river widens into a shallow bay and joins New Haven Harbor south of Oyster or City Point. The natural channel about 2,000 yards long through the middle of the bay carries less than 3 feet at its shoalest part; a channel leading from the harbor to docks at Oyster Point has a controlling depth of 4.5 feet, but between Oyster Point and the channel along the West Haven docks is a wide flat nearly bare at low tide.

The original and present project was adopted by the river and harbor act of March 3, 1905. It consists in dredging for a 9-foot channel, 100 feet wide, from the downstream corner of the 16-foot anchorage basin of New Haven Harbor, via Oyster Point and the dock frontage of West Haven, to Kimberly Avenue Bridge, at a cost of $38,500, and $500 for annual maintenance. The mean rise of tide is about 6.2 feet. The report of survey of West River is pub-

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lished at page 996 and following, Annual Report of the Chief of Engineers, 1904, and the survey map is printed in House Document No. 73, Fifty-eighth Congress, second session.

The principal articles of commerce are coal, oysters and shells, and building material; the estimated value of the total commerce for 1904 is $1,414,169.60.

Comparative tonnage.

	Tons.
1902	84,724
1904	122,366

Amount appropriated by river and harbor act approved March 3, 1905 $38,500.00
July 1, 1905, balance unexpended 38,500.00

(See Appendix D 9.)

10. Milford Harbor, Connecticut.—This harbor is on the north shore of Long Island Sound and consists of a broad open bay, from the head of which a small tidal stream extends nearly a mile inland to the head of navigation.

The original depth on the bar in the bay at the mouth of the river was less than 2 feet; in parts of the river the channel ran nearly bare. The original project adopted under the act of June 23, 1874, provided for a riprap breakwater 890 feet long from Welchs Point, on the east side of the mouth of the harbor, protection of the bluffs on the east shore from erosion by means of small stone jetties, a jetty on the east side to maintain the river-bar channel, and dredging a channel 4 feet deep and 100 feet wide across the bar, the whole estimated to cost $85,000. This project was modified in 1878 and 1879 to provide for extending the 4-foot channel 60 feet wide upstream to the town dock and for a training dike off Burns Point, on the west side of the river channel, nearly at right angles to the east-side jetty. The project thus modified was completed in 1880, except that the outer breakwater was not built, being deemed unnecessary in view of the provision of a harbor of refuge at New Haven. Under the act of June 14, 1880, a project was adopted for the extension of the 4-foot channel, 40 feet wide, upstream to the Straw Works wharf, and under the act of August 2, 1882, a revised project was adopted which provided for a channel 8 feet deep and 100 feet wide across the bar and upstream to Merwin's dock, at estimated cost of $11,000. In 1891 these projects were reported as completed and no further work necessary, except maintenance of jetties and dredged channels. It was stated in July, 1895, that as a result of private dredging there was a clear channel across the bar 12 feet deep and nowhere less than 80 feet wide. On the previous projects $45,500 and for surveys $1,600 were expended.

For further details regarding former projects, see Annual Report of the Chief of Engineers for 1893, page 929, and for report on which present project is based see Annual Report of the Chief of Engineers, for 1900, page 1357 et seq. For map, see House Document No. 280, Fifty-sixth Congress, first session.

The existing project, authorized by act of June 13, 1902, for completion, at a cost of $15,000, consists in dredging and maintaining a channel across the bar and through the lower harbor 100 feet wide and

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10 feet deep to Merwin's wharf, with an anchorage basin of same depth of about 6 acres area on the east side of the channel between the long dike and the harbor line, and a channel through the upper harbor from Merwin's wharf to the Straw Works wharf 90 feet wide and 6 feet deep. The estimated cost for maintenance was $1,000 biennially. The first cost of the improvement was subsequently ascertained to be $25,000. The amount expended on this project to June 30, 1905, is $15,132.87. The mean rise of tide is about 6.2 feet.

Under authority of the river and harbor act of April 28, 1904, work was begun under the present project on October 24, 1904, and at the close of the fiscal year the 10-foot channel had been completed; the 6-foot channel extended upstream to a point about 100 feet above the town dock; and a portion of the anchorage basin, about 2⅔ acres in area, adjacent to the 10-foot channel, dredged. The work done facilitates navigation in the lower part of the harbor, and the extension of the 6-foot channel to the town dock renders it practicable to land cargoes of coal at this dock, which it was formerly extremely difficult to do. The development of a portion of the anchorage basin greatly relieves congestion in the lower part of the harbor, due to the anchoring of small pleasure craft and oyster schooners in that portion of the harbor.

On June 30, 1905, a low-water draft of 10 feet could be carried over the bar and up as far as Merwin's wharf, and thence 6 feet draft to the town dock. Above the town dock a draft of about 3 feet can be carried to the Straw Works dock. No navigation is practicable above this dock.

The commerce of this harbor consists almost entirely of oysters, shells, and coal, the former predominating. Traffic for calendar year 1904 amounted to 21,304 tons, valued at $261,147.47, an increase of 1,123 tons over that last reported in 1903.

July 1, 1904, balance unexpended	$14,720.27
Amount appropriated by river and harbor act approved March 3, 1905	10,000.00
	24,720.27
June 30, 1905, amount expended during fiscal year, for works of improvement	14,853.14
July 1, 1905, balance unexpended	9,867.13
July 1, 1905, outstanding liabilities	1,302.45
July 1, 1905, balance available	8,564.68
July 1, 1905, amount covered by uncompleted contracts	6,461.57

(See Appendix D 10.)

11. Housatonic River, Connecticut.—This is a rapid river running southward through Massachusetts and Connecticut, emptying into Long Island Sound east of Stratford Point, about 5 miles east from Bridgeport Harbor. At Derby, 13 miles from its mouth, it receives the discharge of the Naugatuck River. Derby and Shelton are at the head of navigation. About a mile above there is a large power dam across the Housatonic River; above the pool of this dam the river is rocky and shoal.

The original depth on the worst bars in the river (6 in number) was from 3.5 to 4.5 feet. There was also a bar across the river mouth with about 4 feet depth.

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The original project for improvement was adopted under the act of March 3, 1871, which made an appropriation for beginning the work. This project provided for a jetty at Sow and Pigs reef; removing Drews rock; construction of breakwater at the mouth, and making a channel 7 feet deep and 200 feet wide through the bar at the mouth and 150 feet wide in the river, at total estimated cost of $404,961. In 1887 the estimates were revised and a modification of the project proposed for building a breakwater or jetty at the mouth of the river 5,750 feet long, extending about south-southeast from Milford Beach 3,250 feet, thence parallel to and 500 feet from the channel 2,500 feet farther, to the 12-foot curve in Long Island Sound, the inner arm of the jetty to be 3 feet above mean low water, top width 6 feet, side slopes 1 on 1; the outer arm to be 6 feet above high water, top width 12 feet, outer slope 1 on 2, inner slope 1 on 1; and for making a channel 7 feet deep and 200 feet wide at the outer bar and 100 feet wide through the river, at a total estimated cost of $202,000, and $4,000 annually for maintenance, all in addition to amount already expended. This modification was adopted under the act of August 11, 1888, and work on the breakwater was begun July 10, 1889. In 1893 the project was further modified to provide for building a small dike in the river below Stratford.

For maps, see Annual Report of the Chief of Engineers for 1882, page 116; and for reports on various surveys and projects see Annual Reports of the Chief of Engineers for 1871, page 781; 1887, Part 1, page 607; 1888, Part 1, page 554.

The present project for improvement is the project of 1871, subsequently enlarged or modified as above, and the estimated cost from the beginning is $275,500. Up to June 30, 1905, $240,360.16 had been expended on this project, of which $51,161.32 had been applied to maintenance. At that date the project was completed, except that the dike below Stratford was not built to the full projected length and the outer arm of the breakwater was only about 4 feet high above high water, 5 feet wide on top, and the side slopes much steeper than called for by the project. A channel of project dimensions had been dredged from the mouth of the river to Derby, but had deteriorated from the action of spring freshets and been redredged from time to time. On June 30, 1905, 8 feet draft could be carried across the outer bar and thence about 6 feet to Derby. The mean rise of tide at Derby is 4.2 and at the mouth of the river about 6.3 feet. The work done has enabled vessels to enter the lower river in safety, instead of waiting for high tide in an exposed situation outside. A large part of the commerce could not have been carried on without the improved channel. The navigable channel to Derby materially reduces freight rates at that and adjacent towns, as otherwise all freight would have to be handled by rail and with no competition.

The commerce is largely in coal. A considerable quantity of oysters and oyster shells is shipped from near the mouth of the river. The tonnage for the calendar year 1904 was 57,070, valued at $391,782.52, an increase of 2,483 tons over that reported for 1903.

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July 1, 1904, balance unexpended	$9,882.39
November 8, 1904, sales of condemned property	.35
Amount appropriated by river and harbor act approved March 3, 1905	10,000.00
Amount allotted from appropriation for maintenance of river and harbor improvements, act of April 28, 1904	3,950.00
	23,832.74
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	11,742.90
July 1, 1905, balance unexpended	12,089.84
July 1, 1905, outstanding liabilities	73.61
July 1, 1905, balance available	12,016.23
Amount (estimated) required for completion of existing project	37,000.00

(See Appendix D 11.)

12. Bridgeport Harbor, Connecticut.—This consists of a shallow bay about 1 mile wide at the mouth and 1½ miles long, into the extreme northwest corner of which empties the Pequonnock River, a small tidal stream navigable for about 1 mile and crossed by four drawbridges, and into the northeast corner of which another small stream about three-fourths of a mile long, known as Johnsons River, empties. Midway between these two streams is Yellow Mill Pond, a tidal basin about 1 mile in length. Black Rock Harbor, now considered part of Bridgeport Harbor, lies about 2½ miles to the westward. Both harbors are inner portions of a large bay of Long Island Sound lying between the eastern part of Stratford Point and and Fairfield reef. Black Rock Harbor is about one-half mile wide at the mouth and 1 mile long, with two branches at its head, the east one a mile long, known as Cedar Creek, and the west one about three-fourths of a mile long, known as Burr Creek. The original low-water depth on the bar at the mouth of Bridgeport Harbor was about 5 feet; in the Pequonnock River, from 2 to 5 feet; in Johnsons River the bed of the stream was nearly bare in its upper half; Yellow Mill Pond was generally 2 to 2½ feet deep and its upper part bare at low tide. The original depth in Cedar Creek was 2 to 4 feet, and in Burr Creek the bottom was nearly dry.

In 1836 Congress appropriated $10,000, and an equal amount in 1852, for improving the main Bridgeport Harbor. These sums were expended in dredging near the mouth of the harbor, making channels 60 to 100 feet wide and 8 feet deep or more at low tide. The depth did not prove permanent. In 1871 and at various times thereafter the original project was enlarged to afford a 15-foot main harbor channel, 12-foot channel 200 feet wide in Yellow Mill Pond to Stratford avenue, 9-foot Pequonnock River channel, 12-foot anchorage, and to protect the harbor entrance by two breakwaters, all estimated to cost $285,000. This project was completed in 1898, except as to capacity of the 15-foot channel.

The amount expended on the projects above named was $317,848.50.

At Black Rock Harbor, between 1836 and 1838, $21,500 was expended in building a sea wall across a breach in the southern part of Fayerweather Island. In 1884 a project was adopted for protecting the upper part of Black Rock Harbor by a breakwater about one-half mile long between Fayerweather Island and the mainland and for making a 6-foot channel 80 feet wide in Cedar Creek. To

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July 1, 1894, the channel had been made, the breakwater built to full length but with reduced cross section, and the project was considered as completed. Subsequently repairs were made on the old sea wall on Fayerweather Island. The amount expended for Black Rock Harbor as a separate improvement was $72,900.

For details of original projects and their modifications see Annual Reports of the Chief of Engineers, 1902, pages 133 and 134, and 1903, pages 116 and 117.

In the act of March 3, 1899, Congress adopted the present project for Bridgeport Harbor, which provides, at an estimated cost of not exceeding $300,000, for—

First. The main channel, 18 feet deep, 300 feet wide from the outer bar to the inner beacon, thence 200 feet wide to the lower or Stratford Avenue Bridge.

Second. Anchorage for deep draft, 18 feet, 500 feet wide and 2,000 feet long adjoining the main channel on the west, above the inner beacon; for light draft, 12 feet deep, 500 feet wide and 900 feet long adjoining the main channel on the west between the 18-foot anchorage and Naugatuck wharf, and of the same depth at east side of channel between the steel works point and the lower bridge.

Third. Pequonnock River channel from the lower bridge to the head of navigation, about 1 mile, 12 feet deep and 100 feet wide.

Fourth. Yellow Mill channel, from the main channel to the head of Yellow Mill Pond, about 1 mile, 12 feet deep and 100 feet wide.

Fifth. Johnsons River channel from the main channel to the head of navigation, about 1¼ miles, 9 feet deep and 100 feet wide.

Sixth. Black Rock channel from the head of Black Rock Harbor to the junction of Cedar and Burr creeks, thence up each of these creeks to the head of navigation, with lengths, respectively, of 1⅓ miles and one-half mile, 9 feet deep and 100 feet wide.

Seventh. The repair and maintenance of the outer and inner breakwaters of the main channel, and the one connecting Fayerweather Island with the mainland as now built, and the construction and maintenance of shore protection on Fayerweather Island to check the shifting of the beach.

An appropriation of $50,000 was made in the act cited and a continuing contract authorized. The work is in progress.

The amount expended on the existing project to June 30, 1905, is $79,414.17.

The net results are: A main channel 200 feet wide and 18 feet deep, project dimensions, from Stratford Avenue Bridge to the inner beacon; outside thereof the main channel has been dredged to project width and depth for about 3,700 feet, 225 feet wide and full depth for about 850 feet, and 200 feet wide and full depth for the remaining 1,450 feet to the outer end; the upper 12-foot anchorage and a portion of the 18-foot anchorage about 130 feet wide, adjacent to the channel, dredged; the Pequonnock River channel, 12 feet deep and 100 feet wide, completed to within about 500 feet of its upstream end; the Yellow Mill channel, 12 feet deep and 100 feet wide, completed to a point about 750 feet above the Stratford Avenue Bridge, and with partial width about 250 feet farther; the Johnsons River channel, 9 feet deep and 100 feet wide, completed to the turn above the shipyard; the 9-foot channel, 100 feet wide, in Black Rock Harbor and up Cedar Creek completed, and the Burr Creek channel of

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same projected dimensions dredged from the main channel to Dundon's dock, but owing to ledge rock full project dimensions were not obtained. Portions of this channel have subsequently filled in so that the available width is only about 50 feet in places and the limiting depth about 5½ feet. Also the east breakwater repaired and extended 380 feet, four jetties built for shore protection on the west side of Fayerweather Island, and the sea wall at the south end of the island repaired.

The maximum draft that could be carried June 30, 1905, through the improved channels at mean low tide is 18 feet through the main channel from the outer end to the lower bridge; in the Pequonnock River about 10½ feet to within about 500 feet of the upper end and thence about 6½ feet to the end; in the Yellow Mill channel, 12 feet to about 1,000 feet above the bridge; in Johnsons River, 9 feet to the turn above the shipyard; at Black Rock about 9 feet to the head of navigation in both branches of Cedar Creek; in Burr Creek about 5½ feet to its head. The mean rise of tide is 6.5 feet.

The work done in opening the main channel 200 feet wide and full project depth throughout its length enables the deepest draft vessels which at present ever enter this harbor to come in at any stage of the tide and with greater facility than formerly.

The commerce of this harbor is chiefly in coal, lumber, iron, building material, oysters, and general merchandise. Tonnage for calendar year 1904 was 864,800 tons, valued at $17,513,453.01, an increase of 67,410 tons over that reported for 1903.

July 1, 1904, balance unexpended	$76,926.57
Amount appropriated by river and harbor act approved March 3, 1905	10,000.00
	86,926.57
June 30, 1905, amount expended during fiscal year, for works of improvement	6,189.24
July 1, 1905, balance unexpended	80,737.33
July 1, 1905, outstanding liabilities	5,654.40
July 1, 1905, balance available	75,082.93
July 1, 1905, amount covered by uncompleted contracts	65,082.93

(See Appendix D 12.)

13. Saugatuck River and Westport Harbor, Connecticut.—For description of these localities and statement of work under original project, 1826, and its modifications to about 1871, see Annual Report of the Chief of Engineers, 1901, page 189. The total amount expended for the same is $19,444.

The present project was originally adopted under the appropriation made in 1892 for beginning work. It was to make a channel 4 feet deep and 60 feet wide up to Westport, at an estimated cost of $10,000. The work was completed in 1896. The mean rise of tide is about 7 feet.

The river and harbor act of 1894 ordered a survey of Westport Harbor, report of which is printed in the Annual Report of the Chief of Engineers for 1896, page 806, and with map in House Document No. 67, Fifty-fourth Congress, first session. It proposes a further improvement to provide for repairing the Cedar Point breakwater, removing a ledge opposite Stony Point, or dredging around it, and

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removing bowlders from the channel, at a total estimated cost of $8,000. Under the terms of the river and harbor act of 1896, appropriating $3,000 for improving Westport Harbor, Connecticut, the project of 1892 was extended to include this work, and the estimated cost was in consequence increased to $18,000.

A sketch of this river and harbor is printed in the Annual Report of the Chief of Engineers for 1894, page 670.

The total amount expended on the present project up to the close of the fiscal year ending June 30, 1905, was $12,921.44, of which $18.36 was for maintenance. The 4-foot channel had been completed to Westport, head of navigation, with width generally of 60 feet, and the Cedar Point breakwater had been repaired and extended.

Completion of the project requires further removal of bowlders and dredging to full project dimensions at the channel opposite Westport.

Improvements made have rendered navigation of the river practicable at less than half-tide stages by vessels plying there.

The commerce comprises coal, lumber, farm produce, and steamboat freight. The tonnage for calendar year 1904 was 25,461, valued at $394,843.25, an increase of 9,035 tons over that for 1903.

July 1, 1904, balance unexpended	$96.92
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	18.36
July 1, 1905, balance unexpended	78.56
Amount (estimated) required for completion of existing project	5,000.00

(See Appendix D 13.)

14. Harbors at Norwalk, Fivemile River, Stamford, Southport, and Greenwich, Conn.—(*a*) *Norwalk Harbor.*—This harbor consists of the tidal part of Norwalk River extending from Norwalk, the head of navigation, to the river mouth, about 3 miles, and of an outer or main harbor lying between Norwalk Islands and the mainland. South Norwalk is on the west bank, about 1½ miles below Norwalk. The original depth in the river up to South Norwalk was about 5 feet; between there and Norwalk the river bed was nearly bare at low tide.

The original project, adopted under the act of June 10, 1872, and modified by the terms of the act of June 14, 1880, provided for a channel 100 feet wide and 8 feet deep from the outer harbor to South Norwalk and thence 6 feet deep to Norwalk. This project was considered completed in 1892 at a cost of $83,000, although portions of the channel between Norwalk and South Norwalk were only 60 feet wide. The act of August 18, 1894, appropriated $15,000 for improving the inner harbor, and indicated the points where work was to be done. In accordance therewith a project was adopted for removing to 6 feet depth the shoal at Ferrys Point, below Norwalk, and, if funds permitted, for widening with depth of 9 feet the bend at Keysers Island near the river mouth. This project was completed in 1897 at a cost of $15,000.

The present project, adopted by act of June 3, 1896, provides for a channel 10 feet deep and 150 feet wide from the outer harbor to South Norwalk, widening two points near the entrance, and main-

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tenance of this channel and the 6-foot channel between South Norwalk and Norwalk, at estimated first cost of $62,000 and $2,000 annually for maintenance. The amount expended on this project to June 30, 1905, is $32,833, of which $13,856.27 was expended for maintenance. The maximum draft that could be carried June 30, 1905, to the South Norwalk docks was 10 feet and to the lower Norwalk docks 6 feet, and from the lower to the upper docks, where the head of the harbor forms a catch basin, about one-half that depth. The mean rise of tide is 7.1 feet.

For reference to reports and maps regarding this harbor and former projects, see Annual Report of the Chief of Engineers for 1904, page 103.

The commerce of this harbor is mainly in coal, oysters, lumber, building material, and general merchandise. Traffic for calendar year 1904 amounted to 199,599 tons, valued at about $9,155,786.40, a decrease of 23,793 tons from amount for 1903. A line of freight steamers makes daily trips to New York from Norwalk.

(*b*) *Fivemile River Harbor.*—This is a tidal inlet over a mile long, and from 100 to 1,000 feet wide. The natural low-water depth at the mouth was about 3 feet, shoaling to zero about half-way up the harbor and to about plus 2.5 feet at extreme head. The original and present project of improvement, approved September 7, 1888, under authority of the act of August 11, 1888, provides for a dredged channel 8 feet deep and 100 feet wide, extending up the harbor about 6,000 feet from its mouth; the estimated cost from the beginning, as revised in 1894, was $45,000. The amount expended on this project to June 30, 1905, is $27,000, of which $1,833.60 was expended for maintenance.

For further details regarding this harbor see page 192, Annual Report of the Chief of Engineers, 1901.

The result of the work to date is a channel of project dimensions, extending about 3,300 feet up the harbor and thence about 1,500 feet farther, with project depth and widths of from 50 to 70 feet. No dredging has been done above this point. The maximum draft that can be carried to the upper end of the improved channel is 8 feet, and no navigation is possible beyond this point except at high tide, when a draft of from 4 to 4½ feet can be carried about 2,000 feet farther to the head of navigation. The mean rise of tide is 7.2 feet.

The commerce of this harbor is practically confined to the oyster industry, which could not be carried on to its present extent without the improved channel. Traffic for calendar year 1904 amounted to 8,276 tons of oysters and oyster shells, valued at $140,005.46, a decrease of 4,847 tons from the tonnage reported for 1903.

(*c*) *Stamford Harbor.*—This consists of a bay on the north shore of Long Island Sound and of two tidal inlets known as the east and west branches extending to the head of navigation at the city of Stamford. The original depth in the west branch was from 1 foot to 3 feet, gradually increasing in the bay to a depth of 12 feet. The east branch was originally a small marshy creek, deepened by private dredging to a depth of about 8 feet and which had shoaled so that when work was begun by the Government in 1892 the available depth was only about 6½ feet.

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The original project, approved August 30, 1886, under authority of the river and harbor act of that year, was for a 5-foot channel 80 feet wide to the head of the west branch. This was considered completed in 1892 after an expenditure of $20,000, the channel being 5 feet deep and 100 to 140 feet wide at the bends, but only from 50 to 70 feet wide for the last thousand feet at the upper end.

The present project, approved July 21, 1892, under authority of the act of July 13, 1892, provides for a channel in the west branch 7 feet deep, 150 feet wide, and about 1¼ miles long, with a basin of same depth between harbor lines at the head of the harbor, and in the east branch, as approved October 5, 1892, a channel 9 feet deep and 100 feet wide for a length of about 8,535 feet and 50 feet wide for about 1,200 feet farther to the head of the harbor. The estimated cost was $123,500. A modification to give increased width at upper end of east branch was approved February 12, 1901. The amount expended on this project to June 30, 1905, is $50,924.37, of which $3,746.90 was expended for maintenance.

For reports on surveys and projects, see Annual Report of the Chief of Engineers, 1884, Part 1, page 672; 1891, Part 1, page 849; 1893, page 954 (map, p. 956).

The channel in the east branch now affords approximately project depth and widths of from 70 to 100 feet from the entrance to the steamboat dock. The section above this point is completed, the widths ranging from 65 to 70 feet. The channel in the west branch has been dredged to project dimensions from its outer end to the south end of the basin and with reduced width along the east side of the basin to the harbor line at the head, but it has since shoaled and narrowed, particularly at the upper end, so that the available depth which could be carried June 30, 1905, to the extreme head was not over 6 feet. At the close of the year a draft of about 9 feet could be carried through the east channel to its head. The mean rise of tide is 7.4 feet.

The commerce of this harbor consists mainly of coal, lumber, stone, sand, clay, ores, and steamboat freight. Traffic for calendar year 1904 amounted to 261,734 tons, valued at $17,062,387, an increase of 50,925 tons over that reported for 1903. A daily line of freight steamers, landing at the east branch, runs to New York. The improvements made have rendered it possible for these steamers to run on schedule time and to enter the harbor at any stage of the tide, which they were unable to do previously.

(*d*) *Southport Harbor.*—This is a tidal part of Mill River at town of Southport about 1 mile long and averaging less than 100 yards wide, 6 miles west of Bridgeport. The original depth was probably less than 2 feet at the entrance to the harbor, shoaling to about plus 1 foot at the upper end. Work was begun in this harbor by the Government in 1829, and prosecuted with various intermissions until 1878. During this time a dike inside and breakwater or jetty outside were built and a channel dredged 60 feet wide and 4 feet deep across the outer bar. In 1878 a project was adopted for dredging a channel 100 feet wide and 4 feet deep across the bar and upstream 1,200 feet from the outer end of the jetty, and thence in a bifurcated

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channel to the nearest docks. In 1882 this project was reported as substantially completed, $31,587.23 having been spent since the beginning of work in 1829.

The present project, approved November 8, 1902, under the act of June 13, 1902, is to dredge a channel 6 feet deep through the outer bar to the upper docks 100 feet wide to the turn above White rock and thence in two branches, each 60 feet wide; to repair the breakwater and to remove two points of ledge from the channel to a depth of 7 feet. The estimated first cost of this improvement was $13,200, and for yearly maintenance $300 to be expended biennially. The amount expended on the present project to June 30, 1905, is $8,578.16, of which $1,032.62 was for maintenance. For further details regarding this harbor and its former projects, see Annual Report of the Chief of Engineers 1897, page 986.

The improved channel permits vessels to enter the harbor without being compelled to wait outside the bar in an exposed situation for the tide to rise. The maximum draft that can be carried through the improved portion of the channel is 6 feet. Above this point, where no dredging has been done, a draft of 2½ to 3 feet can be carried to the docks at low tide. Above the upper end of the projected channels the harbor is navigable only at high tide, and for a distance of about half a mile. The mean rise of tide is 6.6 feet.

The commerce of this harbor consists mainly of farm produce, oysters, and coal. Traffic for calendar year 1904 amounted to 10,905 tons, valued at $135,268, a decrease of 14,793 tons from that reported for 1903.

(*e*) *Greenwich Harbor.*—This is a shallow bay about 2 miles east from the New York State line, extending about a mile northward from Long Island Sound. The original low-water depth was about 6 feet to the lower docks. Above this point it shoaled rapidly to 3 feet 1,000 feet above, and to about plus 2 at the head of the harbor. The original and present project, adopted in the act of June 3, 1896, is to dredge a channel 90 feet wide from the mouth of the harbor to the causeway at its head, a distance of about a mile, to be 9 feet deep to the steamboat dock and 6 feet deep above, the upper end to be enlarged to form a turning basin. The estimated first cost was $20,000. Page 105, Annual Report of the Chief of Engineers, 1904, gives a reference to report of examination upon which the project is based. The amount expended on this project to June 30, 1905, is $14,767, of which $2,854.34 was expended for maintenance. A channel of project depth extends from deep water outside to the head of the harbor, but with reduced width. The work done has enabled vessels to enter the harbor with 9 feet draft at low tide, thus permitting the regular steamer to make trips without waiting for tide. Above the steamboat dock a draft of 6 feet can be carried at low tide practically to the head of navigation. The mean rise of tide is 7.5 feet.

The commerce of this harbor consists mainly of coal, lumber, building material, and general merchandise. Traffic reported for calendar year 1904 amounted to 73,951 tons, valued at $1,469,752, a decrease of 46,222 tons from that reported in 1903.

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July 1, 1904, balance unexpended	$1,579.44
Amount appropriated by river and harbor act approved March 3, 1905	44,000.00
Amount allotted from appropriation for maintenance of river and harbor improvements, act of April 28, 1904	9,100.00
	54,679.44
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	10,181.97
July 1, 1905, balance unexpended	44,497.47
July 1, 1905, outstanding liabilities	112.42
July 1, 1905, balance available	44,385.05
Amount (estimated) required for completion of existing project	93,700.00

(See Appendix D 14.)

SURVEY OF CONNECTICUT RIVER BETWEEN HARTFORD, CONN., AND HOLYOKE, MASS., MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED JUNE 13, 1902.

Report by a Board of Engineers on survey of this locality pursuant to requirement of the river and harbor act approved June 13, 1902, was submitted August 11, 1904. The report was reviewed by the Board of Engineers for Rivers and Harbors. Improvement of the river by the United States in the manner proposed is not deemed advisable. The report was transmitted to Congress and printed in House Document No. 231, Fifty-eighth Congress, third session. (See also Appendix D 15.)

IMPROVEMENT OF RIVERS AND HARBORS IN NEW YORK ON LONG ISLAND SOUND AND ON THE SOUTHERN SHORE OF LONG ISLAND OF HUDSON RIVER AND HARBORS THEREON, AND OF HARLEM AND EAST RIVERS, NEW YORK.

This district was in the charge of Capt. Edward H. Schulz, Corps of Engineers, to March 17, 1905, and in the temporary charge of Col. W. R. Livermore, Corps of Engineers, since that date. Division engineer, Col. Amos Stickney, Corps of Engineers.

1. Port Chester Harbor, New York.—This harbor, situated at the boundary between the States of New York and Connecticut, consists of the tidal part of Byram River and of a bay at its mouth opening into Long Island Sound. The depth in the river before improvement was 1 foot, and Salt rock, in the river, and Sunken rock, in the bay, were considered to be dangerous obstructions.

The original project for this improvement was adopted in 1872, and modified in 1884 and 1888. It proposed to remove Salt rock to 9 feet below mean low water, to build a breakwater from Sunken rock to Byram Point, and to dredge and maintain a channel to the Port Chester wharves, at a total cost of $57,000. Up to 1899, at a total cost of $52,000, this project had been completed, except the dredging in the upper harbor.

The existing project, approved March 3, 1899, provides for a channel 12 feet deep and 70 feet wide from deep water in the bay up to the town wharf, and thence 9 feet deep and 60 feet wide to the steamboat wharf, the work to be done by dredging and rock removal. Estimated cost, $25,000.

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Up to June 30, 1905, there had been expended on the present project $29,438.09, of which amount $6,486.48 was for maintenance.

The work done under the present project has resulted in the completion of a channel of the proposed depth and width, except at and opposite the southerly point of Fox Island, where the width is reduced by ledges of rock to about 60 feet. The channel has probably deteriorated somewhat.

The maximum draft that could be carried June 30, 1905, at mean low water is estimated to be about 12 feet up to the town wharf, and thence 9 feet to the steamboat wharf, and above the steamboat wharf 2½ feet. Mean range of tides, 7.4 feet. The head of navigation is a fixed bridge at Mill street, about 900 feet above the steamboat dock. The total length of navigable channel from Long Island Sound to the bridge is about 1½ miles.

The commerce of this harbor, mainly in coal, building materials, manufactured goods, and farm produce, amounted to 140,000 tons, valued at $4,936,000, in 1898; to 169,500 tons, valued at $6,256,000, in 1899; to 181,000 tons, valued at $7,269,500, in 1900; to 327,500 tons, valued at $9,118,000, in 1901; to 237,000 tons, valued at $900,000, in 1902; to 240,000 tons, valued at $3,940,000, in 1903, and to 255,000 tons, valued at $4,590,000, in 1904.

The effect of the improvement has probably been to reduce the freight rates since the channel has been deepened.

Detailed description of this improvement is printed in Reports of the Chief of Engineers for 1897, pages 1084 and 1085, and 1900, page 1378. Sketches of the river and harbor are printed in the Annual Reports for 1885, page 658, and for 1889, page 716.

July 1, 1904, balance unexpended	$965.75
Amount appropriated by river and harbor act approved March 3, 1905	3,000.00
	3,965.75
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	403.84
July 1, 1905, balance unexpended	3,561.91
Amount (estimated) required for completion of existing project	2,000.00

(See Appendix E 1.)

2. Mamaroneck Harbor, New York.—This harbor, situated on the north shore of Long Island Sound, consists of a narrow inlet opening into a shallow, broad bay.

Before improvement the channel to the old steamboat wharf, half a mile up to the inlet, had a depth of 5 feet at mean low water, gradually decreasing to 1 foot at the upper wharves. Various rocks at or near the mouth of the inlet obstructed navigation.

The present project, approved August 2, 1882, and modified April 27, 1899, provides for the removal of Round rock to a depth of 4 feet, and Bush rock and Inner Steamboat rock to a depth of 7 feet, and for making a channel 7 feet deep and 100 feet wide from the harbor entrance to the upper wharves. Estimated cost, $43,000.

Up to June 30, 1905, there had been expended on this work $37,731.74, of which amount $2,628.50 was for maintenance.

The work under the present project has resulted in a channel with a uniform depth of 7 feet at mean low water, with a width of from

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70 to 100 feet from the harbor entrance to the turn at Hog Island, and thence 100 feet wide to the upper wharves. The channel has probably deteriorated somewhat.

The maximum draft that could be carried June 30, 1905, at mean low water is estimated to be about 7 feet. Mean range of tides, 8 feet. The head of navigation is a fixed bridge at the upper wharves. The total length of navigable channel from Long Island Sound is about 1 mile.

The commerce of this harbor is principally coal and building material and manufactured goods, amounting to 29,095 tons, valued at $482,092 in 1896; to 51,673 tons, valued at $877,180 in 1897; to 20,705 tons, valued at $51,598 in 1901; to 48,495 tons, valued at $75,000 in 1902; to 26,230 tons, valued at $337,000 in 1903; and to 49,589 tons, valued at $859,242 in 1904.

The effect of the improvement has probably been to reduce the freight rates since the channel has been deepened.

A detailed description of this improvement can be found in Report of the Chief of Engineers for 1900, page 1381. Sketch of harbor is printed in Report of the Chief of Engineers for 1903, page 859.

July 1, 1904, balance unexpended	$618.26
Amount appropriated by river and harbor act approved March 3, 1905	2,000.00
	2,618.26
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	350.00
July 1, 1905, balance unexpended	2,268.26
Amount (estimated) required for completion of existing project	5,000.00

(See Appendix E 2.)

3. Larchmont Harbor, New York.—This harbor, situated on the northwest shore of Long Island Sound, 4 miles distant from New York City limits, is about half a mile wide and five-eighths of a mile long. It is exposed to easterly and southerly storms. Two submerged rocks (Umbrella rock and Huron rock) formerly obstructed the entrance, which has a depth of 18 feet, gradually diminishing toward the head of the bay.

The original project for this improvement, adopted September 19, 1890, provided for building two breakwaters to protect the anchorage ground, one to extend from Umbrella rock to Umbrella Point and the other from Huron rock to Long Beach Point, at an estimated cost of $105,000. Work under this project was suspended in 1891 after the first appropriation of $5,000 had been expended in commencing the two breakwaters.

The present project, approved March 3, 1899, provides for building a breakwater extending southwardly 1,440 feet from the 6-foot curve off Long Beach Point and for the removal of Huron rock to a depth of 14 feet at mean low water. Estimated cost, $108,000.

Up to June 30, 1905, there had been expended on this project $59,531.31.

Under the present project the breakwater has been built to a length of 1,410 feet, and Huron rock and a portion of the adjoining ledge removed to depths of 14 and 12 feet, respectively.

The maximum draft that could be carried June 30, 1905, over the shoalest part of the entrance channel at mean low water was 18 feet.

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The general depth of the anchorage area of the harbor is from 6 to 12 feet at mean low water. The harbor is about half a mile wide and extends rather more than half a mile inland. It is a basin with no definite channel. Mean range of tides, 7.4 feet.

The commerce of the harbor is not large. It is mainly used by the Larchmont Yacht Club and also by coasting and fishing vessels for night anchorage and as a harbor of refuge.

Detailed description of this improvement is printed in the Report of the Chief of Engineers for 1900, pages 1383–1387. A sketch of Larchmont Harbor is printed in House Ex. Document No. 40, Fifty-first Congress, first session, and also in the Report of the Chief of Engineers for 1903, page 860.

The effect of the improvement has probably been to reduce the freight rates since the breakwater has been constructed.

July 1, 1904, balance unexpended	$720.93
Amount appropriated by river and harbor act approved March 3, 1905	5,000.00
	5,720.93
June 30, 1905, amount expended during fiscal year, for works of improvement	252.24
July 1, 1905, balance unexpended	5,468.69
Amount (estimated) required for completion of existing project	43,000.00

(See Appendix E 3.)

4. Harbor of Echo Bay, New York.—This harbor is on the north shore of Long Island Sound, 2 miles distant from New York City limits. It is landlocked, except toward the southeast, and has a good anchorage. Nearly all of the water transportation of the town of New Rochelle is carried on through this harbor.

The original project for improvement, adopted in 1875, provided for the removal of two ledges known as Start rock and Sheepshead reef, to 7 and 9 feet depth, respectively, at an estimated cost of $38,955.38.

Prior to 1902 the sum of $22,000 had been appropriated, with which Start rock was reported wholly, and Sheepshead reef partly, removed to the projected depths and a channel 40 feet wide and 4 feet deep at mean low water dredged from Beauford Point to within 300 feet of the head of the harbor.

The project adopted by the river and harbor act of June 13, 1902, contemplates completion of the original plan by the removal of the remainder of Sheepshead reef and Start rock at an estimated cost of $17,000.

The river and harbor act of March 3, 1905, authorizes the Secretary of War to cause an examination to be made of Long rock near the entrance to Echo Bay, and, in his discretion, if the interests of commerce demand, to cause the removal of such rock and to use any amount heretofore appropriated for Echo Bay improvement for such removal. A survey of the rock is now in progress.

On June 30, 1905, there had been expended on this project $8,451.72. This project of 1902 has been completed.

The maximum draft that can be carried to the public dock at Beauford Point is about 7 feet, and the general harbor anchorage ranges from 9 to 18 feet at mean low water. The mean range of tide is about

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7¼ feet. The head of navigation is at Town dock, a distance of 1,500 feet above Beauford Point. The harbor is about one-fourth mile wide and one-third mile long. The total length of navigable channel extending beyond the deep water of the harbor is about one-fifth mile.

The commerce of this harbor is principally manufactured goods and coal and building materials, and was reported as amounting to 99,000 tons, valued at $500,000, in 1902; to 129,400 tons, valued at $1,434,000, in 1903, and to 151,200 tons, valued at $1,647,500, in 1904.

For detailed description of work see Report of the Chief of Engineers for 1900, page 1429. A sketch of the locality is printed in the Report of the Chief of Engineers for 1903, page 862.

The effect of the improvement has probably been to reduce the freight rates since the rocks have been removed.

July 1, 1904, balance unexpended	$8,799.75
June 30, 1905, amount expended during fiscal year, for works of improvement	251.47
July 1, 1905, balance unexpended	8,548.28

(See Appendix E 4.)

5. Bronx River and East Chester Creek, New York.—(*a*) *Bronx River.*—This stream empties into the East River north of Hunts Point. The navigable part extends from its mouth to West Farms, a distance of 3 miles. At this point it is crossed by a dam.

The natural depth at the mouth was 4 feet at mean low water and decreased ascending the stream to less than 1 foot at the head of navigation.

The project for improvement, adopted by the act of June 3, 1896, provides for making a channel 4 feet deep and 100 feet wide at and near the mouth, thence decreasing in width to 50 feet at the head of navigation, the work to be done by dredging and rock removal. Estimated cost, $85,985.

Up to June 30, 1905, there had been expended on this improvement $35,000.

The work done under the present project has resulted in a channel with depths of from 3 to 6 feet at mean low water, and with a diminishing width of from 100 to 50 feet, except where reduced by ledges of rock, from the mouth to the turn east of the gas works; above this point the channel remains as previously reported.

The maximum draft that could be carried June 30, 1905, over the shoalest part of the channel at mean low water from the mouth to the turn east of the gas works was about 3 feet; above this point, 1 foot. The head of navigation is at the dam across the river, just beyond the dye works. The total length of navigable channel is about 3 miles. Mean range of tide is 6.6 feet at mouth and 6 feet at West Farms.

The commerce of this river is mainly coal, cotton goods, drugs for dyeing purposes, ice, and building materials. It amounted to 139,310 tons, valued at $526,025, in 1897; to 171,300 tons, valued at $1,985,700, in 1899; to 153,137 tons, valued at $500,000, in 1902; to 77,710 tons, valued at $536,400, in 1903, and to 42,286 tons, valued at $196,642, in 1904.

Details of improvement can be found in Report of the Chief of Engineers for 1900, pages 1389–1391.

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A sketch of a part of the stream is printed in Report of the Chief of Engineers for 1904, page 1016.

The effect of the improvement has probably been to reduce the freight rates since the channel has been deepened.

(*b*) *East Chester Creek.*—This is a small tidal stream emptying into Pelham Bay. It was originally navigable at high tide for vessels drawing 7 feet as far as Lockwoods, a distance of 2¼ miles.

The project for improvement, approved March 3, 1873, provided for a channel 100 feet wide and 9 feet deep, mean high water, from deep water in Pelham Bay to a point 3,000 feet above Lockwoods. Estimated cost, $136,500; subsequently reduced to $124,000.

Up to June 30, 1905, there had been expended on this work $106,500, of which amount $16,408.78 was for maintenance. Expenditure during the fiscal year was applied to maintenance.

The work done under the present project has resulted in a channel about 100 feet wide and 9 feet deep at mean high water from Pelham Bay to a point 3,000 feet above Lockwoods. It is probable that this channel has deteriorated somewhat.

The maximum draft that could be carried over the shoalest part of the channel on June 30, 1905, up to Lockwoods, is estimated to be about 9 feet at mean high water, and above this about 8 feet to the gas company's dock. Mean range of tides is 7.1 feet. The head of navigation in fact is at the upper end of the artificial channel. The total length of navigable channel is about 2¾ miles.

The commerce, mainly coal, building material, stone, and miscellaneous freight, amounted to 94,928 tons, valued at $2,199,186, in 1895; to 286,428 tons, valued at $1,957,224, in 1899; to 99,750 tons, valued at $870,500, in 1902; to 104,655 tons, valued at $572,800, in 1903, and to 146,955 tons, valued at $963,263, in 1904.

The effect of the improvement has probably been to reduce the freight rates since the channel has been deepened.

For detailed reports see Reports of the Chief of Engineers for 1897, pages 1089–1090, and 1904, pages 1016–1018. A sketch of the stream is printed in Report of the Chief of Engineers for 1904, page 1016. For references to reports on examinations and surveys see Report of the Chief of Engineers for 1904, page 112.

July 1, 1904, balance unexpended	$12,522.00
Amount appropriated by river and harbor act approved March 3, 1905	24,500.00
	37,022.00
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	12,522.00
July 1, 1905, balance unexpended	24,500.00
July 1, 1905, outstanding liabilities	21.00
July 1, 1905, balance available	24,479.00
Amount (estimated) required for completion of existing project	34,485.00

(See Appendix E 5.)

6. Harbors at Port Jefferson, Mattituck, Huntington, Glencove, Flushing Bay, Canarsie Bay, and Sag Harbor, New York.—(*a*) *Port Jefferson Harbor.*—This is a large and deep inland bay, situated on the north shore of Long Island, and connected with Long Island Sound by a narrow entrance.

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Before improvement the channel depth outside the entrance was but 4 feet at mean low water, whereas the depth in the harbor was 12 feet and more at low tide up to within 300 feet of the wharves of Port Jefferson village.

The first project for improvement was adopted in 1871 and completed in 1883, at a total cost of $79,000. Two jetties were built to shelter the inlet channel, one east of the inlet, 1,390 feet long, and one west, 940 feet long, both of scant cross section. A channel 8 feet deep at mean low water and 100 feet wide was dredged through the inlet and the shoal outside.

The existing project for improvement, approved September 19, 1890, and modified August 18, 1894, provides for dredging a channel through the harbor entrance 12 feet deep and 200 feet wide, to be protected by extending and enlarging the previously built jetties. Estimated cost, $145,000.

The expenditure on the present project up to June 30, 1905, amounted to $65,200. The expenditure during the fiscal year was applied to building a fence to prevent the drift of sand and in making surveys. Under the present project the east breakwater has been enlarged to a width on top of approximately 4 feet and height of 6 feet above mean high water, and is in an unfinished condition. The west breakwater has been enlarged to a width on top of 4 feet and height of 4 feet above mean high water, and is in good condition. The projected channel has been completed, but some shoaling has occurred. The harbor is about 2 miles long and three-fourths of a mile wide.

The maximum draft that could be carried over the shoalest part of the channel June 30, 1905, was 10.5 feet at mean low water. The total length of navigable channel from Long Island Sound to Port Jefferson wharves is about 2½ miles. Mean range of tides at entrance, 7 feet; at Port Jefferson wharves, 6.2 feet.

The commerce consists principally of coal, building materials, farm produce, fish, and general merchandise, and amounted to 24,940 tons, valued at $360,200, in 1898; to 42,130 tons, valued at $2,145,940, in 1899; and to 46,670 tons, valued at $776,000, in 1903.

The effect of the improvement has probably been to reduce the freight rates since the channel has been deepened.

For detailed report, see Report of the Chief of Engineers for 1900, page 1393. A sketch of Port Jefferson Harbor is printed in the Annual Report of the Chief of Engineers for 1900, page 866.

(*b*) *Mattituck Harbor.*—This harbor is a tidal inlet extending in a southerly direction from Long Island Sound to the village of Mattituck, Long Island. One mile above the mouth a tide mill dam with gates has been built across the stream. The depth at the entrance, which is obstructed by a shifting sand bar, is from 1 to 2 feet. Thence up to the mill dam from 2 to 7 feet at low tide, and above the latter the depth is 6 feet at high tide.

The project, adopted by the act of June 3, 1896, provides for a channel 7 feet deep at mean low water from the entrance to the dam, and 7 feet deep at mean high water above the dam to the village, the width to be 80 feet, except near the mouth, where it is increased to 100 feet; the entrance channel to be protected by two parallel jetties, 400 feet apart, extending out to the 9-foot curve. Estimated cost, $83,000.

Up to June 30, 1905, there had been expended upon the improvement $15,000.

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The west jetty has been built for a length of 680 feet, extending out to the 10-foot curve, and serves to some extent in fixing the channel entrance, but navigation will not be materially benefited until the other jetty has been built and the entrance channel deepened by dredging.

The maximum draft that could be carried June 30, 1905, over the shoalest part of the channel at mean low water is estimated to be about 1 foot.

The head of navigation is at the village of Mattituck.

The total length of the navigable channel from Long Island Sound to Mattituck is about 2¼ miles. The range of tide outside the entrance is 4.8 feet and below the mill dam, 2.2 feet.

The commerce consists principally of coal, building materials, fruits and farm produce, and general merchandise, and amounted to 56,602 tons, valued at $2,041,766, in 1904.

No change in freight rates has yet resulted, the work not being sufficiently advanced.

For detailed description of this work, see Annual Report of the Chief of Engineers for 1891, page 843, and 1897, page 1095.

(*c*) *Huntington Harbor.*—This harbor is a narrow tidal estuary extending inland from Huntington Bay, Long Island, in a southerly direction for a distance of about 2 miles.

Before improvement it had a natural available depth of nearly 8 feet, mean low water, for a stretch of 1¼ miles from the entrance southward, thence gradually decreasing to zero toward the head of the harbor.

In 1872 the first project was adopted, under which in 1873 a shoal at the harbor entrance was removed and a channel 2,200 feet long, 130 to 150 feet wide, and 8 feet deep at mean low water was dredged up to the town landings, at a total cost of $22,500. In 1884 this channel had completely filled up.

The present project, adopted September 19, 1890, provides for dredging and maintaining a channel 8 feet deep and 100 feet wide up to the upper wharves, to be protected by piling if necessary. Estimated cost, $32,000.

Up to June 30, 1905, there had been expended on this project $32,000, of which amount $2,510.94 was for maintenance.

The present project is completed, except as to the dredging or pile construction necessary to maintain the channel. For purposes of maintenance, the channel has been dredged 200 feet wide in lieu of pile protection.

The maximum draft that could be carried June 30, 1905, is estimated to be about 8 feet. The head of navigation is at a causeway about one-third of a mile above Town dock. The total length of navigable channel from Huntington Bay to the causeway is about 2 miles. Mean range of tide, 7.2 feet.

The commerce of the harbor consists mainly of coal, farm produce, building material, and miscellaneous merchandise, and amounted to 23,584 tons, valued at $473,109, in 1897; to 46,500 tons, valued at $605,000, in 1899; to 45,600 tons, valued at $768,000, in 1900; to 52,000 tons, valued at $875,800, in 1901; to 66,000 tons, valued at $1,086,000, in 1903; and to 94,950 tons, valued at $2,818,250, in 1904.

The effect of the improvement has probably been to reduce the freight rates since the channel has been deepened.

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For detailed description, see Report of the Chief of Engineers for 1897, pages 1100 to 1102. A sketch of the upper part of the harbor is printed in the Annual Report for 1904, page 1023.

(*d*) *Glencove Harbor.*—This harbor is a small tidal inlet on the east side of Hempstead Harbor, Long Island. Its channel is about 2 feet deep at mean low water, and a bar at the entrance has a foot less of depth. Before improvement, vessels waiting for tides to enter the harbor were exposed to storms from the north and northwest. Range of tide, 7.7 feet.

The existing project, approved August 11, 1888, and revised June 22, 1895, provides for the construction of a breakwater in Hempstead Harbor, extending from the northwest corner of Glencove dock west-southwestwardly toward Motts Point, so as to shelter the anchorage outside of Glencove Harbor. The breakwater is to have a length of 2,000 feet and to be built to a height of 3 feet above high water, with a top width of 5 feet. Estimated cost, $135,000.

Up to June 30, 1905, there had been expended in carrying out the work $69,000.

The breakwater is now 1,564 feet long, 3 feet wide on top, and 4 feet above mean high water, except for the outer 200 feet, which is 5 feet wide.

The commerce of the harbor is chiefly coal, grain, building materials, and general merchandise, and amounted to 8,549 tons, valued at $40,515, in 1904.

This improvement has no immediate effect on freight rates.

For details of improvement, see Report of the Chief of Engineers for 1897, page 1103. A map is printed in Report of the Chief of Engineers for 1889, page 728.

(*e*) *Flushing Bay.*—Flushing Bay is on the north shore of Long Island, about 14 miles by water from the Battery, New York City. The bay is about 1 mile wide and 2 miles long, the depth in the original channel being not much greater than elsewhere in the bay. Before improvement, the controlling depth up to Flushing was 3.9 feet, mean low water.

The existing project, approved March 3, 1879, and modified September 19, 1888, and June 9, 1891, provides for building a dike 4,663 feet long on the west side of the channel to protect it from filling, and for making and maintaining a channel 6 feet deep at mean low water up to the lower bridge at Flushing. Estimated cost, $173,500.

Up to June 30, 1905, there had been expended on this improvement $123,000. Expenditure during fiscal year was for office expenses. During progress of work it was repeatedly necessary to redredge some parts of the channel, so that it is not possible to state what part of above sum was used for maintenance.

No work was carried on during the year.

The project depth of 6 feet has been obtained, but the present width is insufficient for the needs of the locality. The dike, 4,663 feet long, is in bad condition. The outer part, 1,606 feet long, which was left partly completed in 1891, has since been nearly destroyed by storms and ice. Further work on the dike was discontinued.

The head of navigation is 1 mile above Strongs Causeway. The total length of the navigable channel is about 5½ miles. Mean range of tides, 7.1 feet.

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The maximum draft that could be carried June 30, 1905, was estimated to be about 7.5 feet at mean low water from East River to just beyond the Main Street Railroad Bridge.

The commerce consists chiefly of coal, building materials, dyewoods, and miscellaneous merchandise, and amounted to 163,395 tons, valued at $1,449,438, in 1897; to 158,755 tons, valued at $1,534,937, in 1899; to 200,473 tons, valued at $4,196,406, in 1901; to 186,000 tons, valued at $1,613,100, in 1902; to 110,100 tons, valued at $960,750, in 1903; and to 142,996 tons, valued at $2,599,488, in 1904.

The effect of the improvement has probably been to reduce the freight rates since the channel has been deepened.

For detailed description of improvement, see Report of the Chief of Engineers for 1897, page 1106. A map is printed in the Report of the Chief of Engineers for 1903, page 868.

Report of the examination authorized by the river and harbor act approved June 13, 1902, was submitted January 15, 1904, returned by the Board of Engineers for Rivers and Harbors for further information, which was furnished June 21, 1904. It is printed in House Document No. 98, Fifty-eighth Congress, third session.

(*f*) *Canarsie Bay.*—This bay forms the northwest part of Jamaica Bay at Canarsie Landing. The original depth from the landing to Big channel was 4.2 feet, and to Island channel 1.3 feet at mean low water.

The project for this improvement, approved June 14, 1880, and subsequently enlarged in 1889 and 1896, provides for the construction of two dikes and dredging between them where necessary to secure a channel 100 to 150 feet wide and 6 feet deep, connecting the steamboat dock at Canarsie with Big channel, Jamaica Bay; also for a channel 4 feet deep and about 50 feet wide running in a southwesterly direction from Canarsie Landing to Island channel, and for a channel 5 feet deep and 50 feet wide running in a northwesterly direction to Gophel channel. Estimated cost, $88,000.

Up to June 30, 1905, there had been expended in carrying out this improvement, $69,872.36. Expenditure during the year was for dredging.

The head of navigation is at Canarsie Landing.

The maximum draft that could be carried June 30, 1905, over the shoalest part of the channel at mean low water was 7 feet in the main channel, and is estimated to be about 2½ feet in the West Branch and 3 feet in the East Branch. The total length of navigable channel is about 1 mile. Mean range of tides, 4.7 feet.

The commerce of Canarsie is mainly building materials, fertilizers, fish, and coal, and amounted to 50,000 tons, valued at $427,375, in 1896; to 450,000 tons, valued at $2,000,000, in 1901; and to 124,594 tons, valued at $1,861,008, in 1904.

The commerce in Jamaica Bay has been greatly benefited by the improvement and freight rates reduced.

Details as to this improvement may be found in Report of the Chief of Engineers for 1897, page 1114. A sketch of Canarsie Bay is printed in the Report of the Chief of Engineers for 1904, page 1026.

(*g*) *Sag Harbor.*—This harbor lies on the northern shore of Long Island, about 24 miles west of Montauk Point. It is a small bay,

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sheltered by Long Island on the south and west and partly by Shelter Island on the north, and is open to the northeasterly storms.

The project adopted June 13, 1902, consists in constructing a breakwater 3,180 feet long from Conklin Point, at an estimated cost of $71,000.

There had been expended on this improvement on June 30, 1905, $13,500. The expenditure has been in completing the portion of breakwater built and extending it 584 feet to water 4 to 5 feet deep. It affords protection to small boats of light draft, but will not be of much benefit to commerce until extended into the deeper part of the harbor.

The maximum draft that can be carried through the harbor up to the wharves is about 12 feet. The mean range of tide is 2.5 feet.

This work is not advanced to a state necessary to affect freight rates.

For detailed report see Report of the Chief of Engineers for 1900, page 1451. A sketch of the harbor is printed in the Report of the Chief of Engineers for 1903, page 870.

The commerce of the harbor, mainly in general merchandise and fruits and farm products, amounted to 3,454 tons, valued at $187,015, in 1904.

July 1, 1904, balance unexpended		$22,108.66
Amount appropriated by river and harbor act approved March 3, 1905		62,500.00
Recovered on bond of Peter Lynam, failing contractor		2,296.00
Amount allotted from appropriation for maintenance of river and harbor improvements, act of April 28, 1904		2,400.00
		89,304.66
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$17,061.72	
For maintenance of improvement	119.30	
		17,181.02
July 1, 1905, balance unexpended		72,123.64
July 1, 1905, outstanding liabilities		174.69
July 1, 1905, balance available		71,948.95
Amount (estimated) required for completion of existing project		258,000.00

(See Appendix E 6.)

7. East River and Hell Gate, New York.—East River, a tidal strait separating New York City from Long Island, extends from the Battery to Throgs Neck, a distance of about 16 miles. In its original condition it was obstructed by rocks and reefs, especially in the part known as Hell Gate.

The improvement of this waterway was commenced in 1852, under a project prepared in 1848, which contemplated the removal of rocks at Hell Gate and Diamond reef.

The amount expended under this project was $33,861.59.

The existing project for improvement, adopted in 1868 and modified in 1870, 1874, 1884, 1889, 1891, and 1899, provides for the removal of rocky obstructions from the channel between the Battery and Baretto Point to depths varying from 18 to 26 feet, and for the construction of sea walls and dikes where necessary to guide the tidal currents. The cost of the work was estimated at $5,639,120.

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The amount expended in carrying out this project to the close of the fiscal year ending June 30, 1905, was $4,728,382.86, no portion of which was applied to maintenance.

This expenditure has resulted in the removal to the contemplated depths of Diamond reef, reef off Diamond reef, Coenties reef, Pilgrim rock, Charlotte rock, Hallets Point, Ways reef, Shell Drake, Scaly rock, reef at Middle Ground off Sunken Meadow, North Brother Island reef, reef off Baretto Point, Twenty-sixth Street reef, Man-o'-War rock, Third Street reef, and in the partial removal of Battery reef, reef off South Ferry slips, Shell reef, Ferry reef off Thirty-fourth street, Middle reef, including Flood rock, Gridiron, Hen and Chickens, and Negro Heads, Frying Pan, and Pot rocks.

A maximum draft of 26 feet could be carried at mean low water, June 30, 1905, through the main channel from the Battery to Long Island Sound. The total length of the waterway is about 16 miles and it is navigable throughout. The range of tide south of Hell Gate is from 4½ to 5 feet, and east of it from 5 to 7 feet.

The traffic on East River is very great and is intimately connected with that of New York Harbor proper. It is impracticable to show what proportion belongs to the East River, especially as the heaviest coastwise traffic passing through this waterway is carried on in vessels which do not enter or clear at the custom-house.

This being a connecting water, most of the freight carried is not local, and for that reason its effect on freight rates can not be determined.

Detailed descriptions of the locality, projects, and work done are printed in the Reports of the Chief of Engineers for 1868, page 741; for 1874, Part 2, page 164, and for 1897, page 1026.

July 1, 1904, balance unexpended	$8,894.80
Amount appropriated by river and harbor act approved March 3, 1905	200,000.00
Received from sale of condemned property	1,326.00
	210,220.80
June 30, 1905, amount expended during fiscal year, for works of improvement	3,927.96
July 1, 1905, balance unexpended	206,292.84
July 1, 1905, outstanding liabilities	257.58
July 1, 1905, balance available	206,035.26
Amount (estimated) required for completion of existing project	705,778.55

(See Appendix E 7.)

8. Harlem River, New York.—The Harlem River and Spuyten Duyvil Creek, both included in the improvement, are two waterways which join at Kingsbridge, N. Y., and separate Manhattan Island from the mainland. The narrow channel at their junction was obstructed by a ledge of rocks awash at low tide.

Before improvement the Harlem River had an available depth of 10 feet from the East River to Morris dock, except at Highbridge, where it was only 6 feet. From Morris dock to Fordham Landing there was a crooked channel 7 feet deep, and above the latter place the river could be used only by the smallest class of vessels.

Spuyten Duyvil Creek, from Kingsbridge to the Hudson, had a depth of 4 feet.

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The original project for improvement, adopted in 1874, provided for the removal of old bridge piers, Candle Factory reef, and bowlders at various places near the East River to a depth of 12 feet, the cost of the work being estimated at $167,875.56. In furtherance of this project $21,000 was expended.

The existing project, adopted June 18, 1878, and modified October 7, 1886, provides for a continuous channel 400 feet wide and 15 feet deep from the East River to the Hudson River, except just north of Highbridge, where the width was made 375 feet, and the rock cut through Dyckmans Meadow, where the width was reduced to 350 feet and the depth increased to 18 feet. The cost of the work was estimated at $2,700,000.

The amount expended in carrying on the work under the existing project to the close of the fiscal year ending June 30, 1905, was $1,320,000.

Expenditure during the fiscal year was for removing obstructions at Fourth Avenue Bridge.

On June 30, 1905, there was a continuous channel from the East River to the Hudson River, with a least width of 150 feet and a least depth of 15 feet at mean low water. The total length of the waterway is about 8 miles, and it is navigable throughout. The range of tides in Harlem River varies from 5.5 feet at Third Avenue Bridge to 3.8 feet at the mouth of Spuyten Duyvil Creek.

The commerce of this river, which is general in character, amounted to 7,533,594 tons, valued at $203,707,376, in 1895; to 6,910,386 tons, valued at $282,186,100, in 1903, and to 9,130,763 tons, valued at $231,384,004, in 1904.

The greater part of this is handled by the New York, New Haven and Hartford Railroad Company, principally on the lower part of the river, and therefore can not be considered as bearing on the general improvement.

For detailed descriptions see Reports of the Chief of Engineers for 1887, pages 665–689, and 1897, page 1019 et seq.

The effect of the improvement, according to the best information available, is that some reduction has been made in freight rates, but the principal benefit derived has been in the way of increased facilities for handling shipments, which make a material saving in the cost of transportation.

July 1, 1904, balance unexpended	$1,717.54
Amount appropriated by river and harbor act approved March 3, 1905	75,000.00
	76,717.54
June 30, 1905, amount expended during fiscal year, for works of improvement	1,717.54
July 1, 1905, balance unexpended	75,000.00
July 1, 1905, outstanding liabilities	3.50
July 1, 1905, balance available	74,996.50
Amount (estimated) required for completion of existing project	1,305,000.00

(See Appendix E 8.)

9. Newtown Creek, New York.—This creek, and inlet of the East River, extending inland between Kings and Queens counties, N. Y.,

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for a distance of about 4 miles, had a natural depth varying from 12½ feet at the mouth to 4 feet at the head of navigation.

The original project, adopted in 1880 and modified in 1884, provided for a channel 240 feet wide and 21 feet deep from the mouth to the Vernon Avenue Bridge, thence to the head of navigation on both branches for channels decreasing from 175 to 100 feet in width and from 18 to 10 feet in depth. The cost of the work was estimated at $255,500. In carrying out this project $197,500 was expended.

The existing project, adopted June 3, 1896, is to secure a uniform channel 125 feet wide and 18 feet deep from the East River to the head of navigation at Metropolitan avenue, at an estimated cost of $450,000. This estimate was subsequently reduced to $213,000.

The amount expended in carrying out this project up to the close of the fiscal year ending June 30, 1905, was $213,400, of which $14,792.61 was for maintenance.

Under the present project the channel has been completed, with the exception of the removal of some bowlders recently found near its edge. Dredging for maintenance will be necessary from time to time.

The head of navigation in each branch is at the Metropolitan Avenue Bridge.

The maximum draft that could be carried June 30, 1905, at mean low water was 18 feet. The total length of navigable channel is about 4 miles. The mean range of tide is about 4½ feet.

The commerce, consisting chiefly of coal, building materials, oil, ores, general merchandise, etc., amounted to 2,675,025 tons, valued at $90,535,640, in 1903, and to 3,771,726 tons, valued at $108,313,377, in 1904.

Freight rates have been greatly reduced as a result of this improvement.

Detailed descriptions of this improvement are printed in the Reports of the Chief of Engineers for 1896, pages 760–761, and 1900, page 1411. A sketch of the locality is printed in the Report of the Chief of Engineers for 1904, page 1034.

Amount appropriated by river and harbor act approved March 3, 1905	$5,000.00
July 1, 1905, balance unexpended	5,000.00
Amount (estimated) required for completion of existing project	14,792.61

(See Appendix E 9.)

10. Browns Creek, New York.—This is a narrow stream which empties into Great South Bay, Long Island, near Browns Point. It had originally a depth of from 1 to 3 feet at low water, a bar at the mouth having less than 1 foot.

The project for improvement approved September 19, 1890, provides for a channel 100 feet wide and 4 feet deep, to extend from deep water in the bay up to Sayville highway bridge, and to be protected at the entrance by jetties on both sides. Estimated cost, $46,000.

Up to June 30, 1905, there had been expended on this improvement $28,000, of which $3,000 was for maintenance.

The west jetty is 492 feet long and the east jetty 438 feet long, both with top width of 3 feet at 1 foot above high water, and both partly covered at the shore end by accretion. They are in bad condition. The dredged channel is 3,200 feet long, with a depth of 4 to 8

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feet at mean low water and width of 100 feet. Shoaling has taken place at end of jetties.

No work was in progress during the past year.

The head of navigation is at the Sayville highway bridge, about 1½ miles from the mouth.

The maximum draft that could be carried over the shoalest part at mean low water on June 30, 1905, was 4 feet, except at mouth, where considerable shoaling is reported. Mean range of tides, 1 foot.

Great benefit has resulted from the improvement to the fishing people in this locality in providing a harbor of refuge for small boats.

The commerce consists mainly of coal, building materials, and fish, and amounted to 10,700 tons, valued at $213,800 in 1898; to 11,642 tons, valued at $251,350 in 1899; to 17,025 tons, valued at $454,500 in 1901; to 17,630 tons, valued at $299,300 in 1902; to 20,380 tons, valued at $609,450 in 1903, and to 24,000 tons, valued at $807,075 in 1904.

This is mainly a harbor of refuge, and the improvement has had no appreciable effect on freight rates.

Details in reference to this work appear in Reports of the Chief of Engineers for 1897, page 1111, and for 1900, page 1417. A sketch of the creek is printed in Report of the Chief of Engineers for 1894, page 710.

Amount appropriated by river and harbor act approved March 3, 1905	$3,000.00
July 1, 1905, balance unexpended	3,000.00
Amount (estimated) required for completion of existing project	15,000.00

(See Appendix E 10.)

11. Great South Bay, New York.—The first project, approved September 19, 1890, provided for the improvement of the Patchogue River, a small inlet extending from Great South Bay, Long Island, to the village of Patchogue. This stream had, before improvement, a depth of 2 feet. The project provided for a channel about 5,000 feet long, 60 feet wide, and 6 feet deep, to be protected at its mouth against westerly storms by a jetty 1,700 feet long. Estimated cost, $40,000.

On June 30, 1902, there had been expended on this work $40,000, and the project was completed.

The present project, approved June 13, 1902, provides for dredging a channel from Fire Island Inlet, which connects Great South Bay with the ocean, to Patchogue, on Patchogue River. From the inlet to the central basin in Great South Bay the channel is to be 10 feet deep at mean low water and 200 feet wide. From the central basin to Patchogue the channel is to be 8 feet deep and 100 feet wide at mean low water. Estimated cost $66,000, and $2,000 annually for maintenance.

There had been expended in carrying on the work of the existing project to the close of the fiscal year ending June 30, 1905, $57,241.87. Expenditure during the fiscal year was for dredging and for survey to locate fish pounds obstructing navigation.

The present project is completed except at bars A and B. An injunction prevented the work being brought to a conclusion.

The head of navigation in Patchogue River is at a fixed bridge at Division street, Patchogue. The total length of navigable channel

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from Fire Island Inlet to Patchogue is about 17½ miles, and to Belleport 22 miles.

The maximum draft that could be carried June 30, 1905, over the shoalest part of the channel from Fire Island Inlet to central basin was 9.5 feet, and from central basin to Patchogue 6.5 feet. Mean range of tides, 1 foot.

The commerce consists mainly of coal, lumber, and fish. It amounted to 255,200 tons, valued at $3,702,000, in 1898; to 266,800 tons, valued at $3,808,500, in 1899; to 274,100 tons, valued at $3,919,000, in 1900; to 281,300 tons, valued at $4,025,000, in 1901; to 257,500 tons, valued at $4,000,000, in 1902; to 258,500 tons, valued at $3,995,000, in 1903; and to 257,879 tons, valued at $4,037,130, in 1904.

The effect of the improvement has probably been to reduce the freight rates since the channel has been deepened.

For details as to improvement see Patchogue River, Reports of the Chief of Engineers for 1897, page 1108, and 1901, page 1249. A sketch is printed in Reports of the Chief of Engineers for 1903, page 876.

July 1, 1904, balance unexpended	$16,783.19
Amount appropriated by river and harbor act approved March 3, 1905	2,000.00
	18,783.19
June 30, 1905, amount expended during fiscal year, for works of improvement	8,025.06
July 1, 1905, balance unexpended	10,758.13
July 1, 1905, outstanding liabilities	594.50
July 1, 1905, balance available	10,163.63

(See Appendix E 11.)

12. Hudson River, New York.—The portion of this river which is now under improvement is the stretch beginning at the State dam at Troy and extending downstream to Coxsackie, a distance of 28 miles. In its natural condition the channel was narrow and crooked, with a navigable depth of 4 feet between the State dam and Albany, of 7½ feet between Albany and New Baltimore, of 11 feet between New Baltimore and Coxsackie, and of 12 feet or more below Coxsackie.

The original project for improvement, adopted in 1834, modified in 1852 and again in 1866, had for its object the securing of a navigable channel of sufficient width and 9 feet deep between Troy and Albany and 11 feet deep between Albany and New Baltimore. In carrying out this work $1,667,938 was expended.

The existing project, approved July 13, 1892, for which a revised estimate was submitted to Congress February 1, 1898, and adopted March 3, 1899, provides for a 12-foot channel 150 feet wide from the State dam to the foot of Jacob street, Troy, thence gradually increasing in width to 400 feet at the foot of Broadway, Troy; thence 400 feet wide to Coxsackie. This work was estimated to cost $4,343,863.

The amount expended on the work under this project to the close of the fiscal year ending June 30, 1905, was $3,283,581.67, of which $230,350.24 was applied to maintenance of improvement.

In the item making appropriation for this improvement the river and harbor act of March 3, 1905, provides that $85,000 of the amount

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appropriated, or so much thereof as may be necessary, may, in the discretion of the Secretary of War, be expended for the removal of Stonehouse bar, opposite New Baltimore; and not exceeding $10,000 is authorized to be expended in providing a channel of access to the harbor at Tarrytown, N. Y., in accordance with plan presented in the Annual Report of the Chief of Engineers for 1900, page 1520. (See Tarrytown Harbor, New York, p. 133, herewith.)

The said act also authorizes and directs the Secretary of War to cause an examination to be made of the existing stone pier at Piermont with a view to determining whether the same should be removed in the interest of navigation.

The result of the above expenditure has been to provide a channel 11 feet deep, nowhere less than 60 and generally 180 to 320 feet wide, from Coxsackie to the foot of Broadway, Troy, N. Y., except at Stonehouse Bay and Bath Cross-over, where the depth had decreased to 10.5 and 10 feet, respectively, and a depth of 10 feet for a width of 60 feet from Broadway, Troy, to within 500 feet of the State dam. On the miter sill of the Sloop lock connecting the slack water above the State dam with the tidal water of the river, the depth is only 4.5 feet. The decrease in navigable depth was due to natural shoaling, there having been no dredging except at Mulls Crossover. The head of navigation for the tidal portion of the river is at the State dam.

The benefits to the work already done is shown by change which has been made by the towing lines, which formerly broke up the large tows below the bridges at Albany, but now takes them through to the locks at Troy with the heavy-draft boats, in considerably less time than formerly.

The total length of navigable channel under improvement in the Hudson River is 28 miles. The maximum draft that could be carried June 30, 1905, at mean low water was 10 feet from a point 500 feet from the Sloop lock to Coxsackie. The range of tides varies in dry seasons from 2.55 feet at State dam, to 2.84 feet at Albany, to 3.69 feet at Coxsackie.

The result of the expenditures has been to nearly complete the work of putting in good order the old pile dikes which, owing to age and ice, had so far deteriorated that they were of little service as training works. There still remains a large amount of dike work to be done before it can be expected that the river will maintain the depth of 12 feet at mean low water without having to resort to dredging periodically.

The commerce within the limits of the improvements now in progress amounted to 3,513,545 tons, valued at $150,893,030.41, in 1904, and consists principally of grain, fuel, lumber, building material, and ice.

The effect of the improvement has been to decrease freight rates since the channel has been improved.

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July 1, 1904, balance unexpended		$104,455.06
Amount appropriated by river and harbor act approved March 3, 1905		203,300.00
		307,755.06
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$74,576.18	
For maintenance of improvement	9,948.59	
		84,524.77
July 1, 1905, balance unexpended		223,230.29
July 1, 1905, outstanding liabilities		14,957.30
July 1, 1905, balance available		208,272.99
July 1, 1905, amount covered by uncompleted contracts		6,479.24
Amount (estimated) required for completion of existing project		1,067,406.68

(See Appendix E 12.)

13. Saugerties Harbor, New York.—Saugerties Harbor is the name applied to the mouth of Esopus Creek, which empties into the Hudson River from the west, about 100 miles above New York City, which creek is navigable at high water for a distance of about 6,000 feet from deep water in the Hudson River. Above the steamboat landing, which is a distance of about 4,500 feet from deep water, there is little traffic.

The original depth over the bar was 3 feet at mean low water, which had been increased to 7 feet by dredging done by the State of New York in 1885–86.

The original project, which contemplated securing a permanent channel 7 feet deep at mean low water and 100 feet wide, at an estimated cost of $52,000, was adopted in 1884, modified in 1887, and completed in 1892, with an expenditure of $42,000. To June 30, 1902, $15,000 had been expended for maintenance.

The existing project, which contemplates a channel 12 feet deep at mean low water and 200 feet wide from the channel of the Hudson River to the steamboat landing, at an estimated cost of $44,685, with an annual expenditure of $2,500 for maintenance, was adopted June 13, 1902.

The river and harbor act of March 3, 1905, authorizes the Chief of Engineers, upon application, to permit the extension of the channel from the point at which the present project terminates up to a point 600 feet below the dam in Esopus Creek, provided the plan of improvement is first submitted to and approved by him, and that no part of the appropriation made by said act shall be expended therefor.

The amount expended under the existing project up to June 30, 1905, was $23,216.32, of which $17,884.47 was applied to maintenance.

This expenditure has resulted in the removal of a portion of a dangerous reef of rock, a continuation of Barclays Point, to the depth of 12 feet, and the partial restoration of the channel above the reef to a depth of 9 feet, where, owing to the breaking of the dam a short distance above the head of navigation in the summer of 1902, and the consequent release of a large quantity of mud and silt retained by it, the channel had been reduced in width and depth so as to be practically closed to the navigation of large boats, and the relief of navigation along the wharves on the north side of the channel, where extensive shoaling has taken place, apparently as the result of the

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removal of the rock off Barclays Point. The head of navigation is at a point about 600 feet below the dam. The total length of navigable channel is about 1¼ miles.

The maximum draft at mean low water that could be carried June 30, 1905, was 8 feet for a minimum width of 60 feet. The mean rise and fall of tides is about 4 feet.

The additional work proposed is for the purpose of extension of the benefits already derived from the improvement.

The commerce consists mainly of bluestone, coal, building material, and general merchandise, and amounted to 67,473 tons in 1901, 66,500 tons in 1902, 112,677 tons in 1903; and 113,200 tons, valued at $18,832,195, in 1904.

The effect of the improvement, according to the best information available, is to reduce freight rates during the season of navigation.

Details in reference to this work appear in Reports of the Chief of Engineers for 1895, page 910, and 1900, pages 1518–1520. A sketch is printed in Report of the Chief of Engineers for 1904, page 1046.

July 1, 1904, balance unexpended	$4,421.81
Amount appropriated by river and harbor act approved March 3, 1905	5,000.00
	9,421.81
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	4,638.13
July 1, 1905, balance unexpended	4,783.68
July 1, 1905, outstanding liabilities	18.43
July 1, 1905, balance available	4,765.25
Amount (estimated) required for completion of existing project	19,685.00

(See Appendix E 13.)

14. Harbors at Rondout and Peekskill, N. Y.—(a) Rondout Harbor.—This harbor is at the mouth of Rondout Creek, which empties into the Hudson River, on its west shore, 90 miles above New York City. The creek, which is navigable to Eddyville, 3 miles from its mouth, was the most easterly section of the Delaware and Hudson Canal until that waterway was abandoned several years ago.

The original depth before the improvement was begun, which was the result of work of private parties, was 7 feet at mean low water.

The original project, which contemplated securing a channel 14 feet deep at mean low water and 100 feet wide, at an estimated cost of $172,500, was adopted June 10, 1872, and was completed in 1880 at a total cost of $90,000.

The amount expended on the work up to the close of the fiscal year ending June 30, 1905, was $125,300, of which $35,300 was for maintenance.

The result of the above expenditure is a channel 11.5 feet deep at mean low water and not less than 100 feet wide from deep water in the Hudson River to the westerly end of the dikes.

Owing to a bad breaking up of the ice this past spring, or some unknown cause, there has been a very serious shoaling between the south and north dikes, quite a deep hole having been scoured at the outer end of the south dike, which has weakened that structure for about 50 feet. The shoal east of the outer end of the south dike, which was removed by the dredging in 1904, has started to form

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again, but at present is not a serious obstruction, though it may be before another year.

The head of navigation is at Eddyville. The total length of navigable channel is 3 miles.

The maximum draft that could be carried through the dikes June 30, 1905, was 11.5 feet at mean low water, with a width of channel of 100 feet. The mean rise and fall of tides is 4 feet.

The commerce, which is mainly fuel, bluestone, cements, and general merchandise, amounted to $1,460,000 tons; estimated value, $41,065,000 in 1904.

The effect of the improvement is to keep freight rates down during the season of navigation.

(*b*) *Peekskill Harbor.*—This harbor is an indentation on the eastern shore of the Hudson River, about 46 miles above New York City, and was a flat about 3,500 feet wide, extending from the shore to the deep-water channel of the Hudson River, with a depth of water over it of about 5 feet at mean low water, except near the shore, where it was about 6 feet deep.

The original project for improvement, which provided for a dredged channel 10 feet deep at mean low water and 100 feet wide from deep water in the Hudson River north of the village to deep water south of it, following generally the contour of the shore, at an estimated cost of $50,000, was adopted June 3, 1896, and was completed in 1899 at a cost of $19,400.

The amount expended at the close of the fiscal year ending June 30, 1905, was $23,000, of which $3,500 was applied to maintenance.

No work was done during the past fiscal year, as the channel previously dredged has maintained its depth and, approximately, its width, so that on June 30, 1905, a maximum draft of 10 feet can be carried through, with a minimum width of channel of 70 feet.

The result of a survey made in June, 1905, was to show that though the dredged channel has filled up somewhat along the dock front of Peekskill it is in good condition and in no immediate need of dredging.

The total length of navigable channel is about 1⅛ miles. Mean rise and fall of tide is about 3 feet.

The commerce, which is mainly general merchandise, building material, and fuel, amounted to 81,265 tons; estimated value, $3,751,985.61, in 1904.

The effect of the improvement during the season of navigation is to lower freight rates.

July 1, 1904, balance unexpended	$4,605.23
Amount appropriated by river and harbor act approved March 3, 1905	17,500.00
	22,105.23
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	4,605.23
July 1, 1905, balance unexpended	17,500.00
July 1, 1905, outstanding liabilities	115.29
July 1, 1905, balance available	17,384.71

(See Appendix E 14.)

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15. Wappinger Creek, New York.—Wappinger Creek is a small stream which empties into the Hudson River from the east, about one-half mile below the village of New Hamburg, N. Y., is navigable from its mouth for a distance of about 2 miles, to the works of the Dutchess Company, which is located just below the falls and at the head of navigation. The entrance to the creek is through a drawbridge, over which passes the New York Central and Hudson River Railroad, with one opening of 26 feet clearance and about 4 feet clear head room at mean low water, under fixed spans. The original depth in the channel did not exceed 6 feet, and the width varied from 25 to 75 feet.

The original project for improvement, which contemplated a channel 8 feet deep at mean low water and 80 feet wide, at an estimated cost of $13,000, was adopted September 19, 1890, and was completed April 30, 1892.

The amount expended to June 30, 1905, was $14,500, of which $1,500 was applied to maintenance. The result of the expenditure during the past fiscal year was to restore the channel to the depth of 8 feet for a width of 30 feet for about three-fourths of a mile from the head of navigation.

The greatest draft that can be carried at mean low water from deep water in the Hudson River to the head of navigation is 6.5 feet, with a minimum width of channel of 20 feet.

The mean rise and fall of tides at the mouth of the creek is about 3.3 feet.

The commerce, consisting principally of cotton goods, clothing, building material, and fuel, etc., amounted to 56,927 tons in 1904, the estimated value being $7,955,975.

The traffic in the creek is mainly for the benefit of the print works at the head of navigation. Its effect is to reduce the freight rates.

Details in reference to this work appear in the Report of the Chief of Engineers for 1893, pages 1024–1025. A sketch is printed in the Report of the Chief of Engineers for 1904, page 1051.

July 1, 1904, balance unexpended	$1,342.07
Amount appropriated by river and harbor act approved March 3, 1905	3,000.00
	4,342.07
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	1,342.07
July 1, 1905, balance unexpended	3,000.00
July 1, 1905, outstanding liabilities	57.90
July 1, 1905, balance available	2,942.10

(See Appendix E 15.)

16. Tarrytown Harbor, New York.—This is a new work. The plan for improvement adopted by the river and harbor act of March 3, 1905, provides for dredging a channel along the wharf front of the harbor and connecting it north and south with deep water in Hudson River, the said channel to have a depth of 12 feet with a width of 150 feet along the wharf front and a width of 100 feet in the northerly and southerly connections with the Hudson River. The estimated cost of this work is $26,000, and $1,000 or $2,000 biennially for maintenance.

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The project is printed in the Annual Report of the Chief of Engineers for 1900, page 1520.

Amount appropriated by river and harbor act approved March 3, 1905.. $10,000.00
July 1, 1905, balance unexpended..... 10,000.00

17. Removing sunken vessels or craft obstructing or endangering navigation.—(*a*) *Wreck of coal barge Percie and Bertha in the Hudson River at New York, N. Y.*—This boat was sunk in the Hudson River at the foot of West Fifty-ninth street. It was reported to the Department August 29, 1904, an allotment of $530 for its removal made September 1, 1904, and it was completely removed for that sum on October 6, 1904.

(*b*) *Wrecks of unknown canal boat and an unknown schooner in Harlem River at New York, N. Y.*—These wrecks were sunk in Harlem River near One hundred and forty-seventh street and above Washington Bridge near One hundred and eighty-fifth street, respectively. They were reported to the Department September 21, 1904, and an allotment of $778 for their removal made October 3, 1904. The wrecks were completely removed November 5, 1904, at a total cost of $778.

(*c*) *Wreck of an unknown schooner in Great South Bay, New York.*—This wreck was sunk in Great South Bay opposite Browns Point, New York. It was reported to the Department April 13, 1905. The wreck was broken up with dynamite so as to be no longer a menace to navigation on June 24, 1905.

(See Appendix E 16.)

EXAMINATION AND SURVEY OF FLUSHING BAY, NEW YORK, MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED JUNE 13, 1902.

Reports dated January 31, 1903, and June 21, 1904, were submitted by Col. S. M. Mansfield, Corps of Engineers (now brigadier-general, United States Army, retired), and Col. Amos Stickney, Corps of Engineers, on preliminary examination and survey, respectively, of *Flushing Bay, New York, with a view to repairing, completing, or removing the dike in said bay and extending the channel to Ireland (Irland) Mills*, required by the river and harbor act approved June 13, 1902, and were reviewed by the Board of Engineers for Rivers and Harbors pursuant to law. A plan for improvement, at an estimated cost of $23,857.90, is presented. The reports were transmitted to Congress and printed in House Document No. 98, Fifty-eighth Congress, third session. (See also Appendix E 17.)

IMPROVEMENT OF NEW YORK HARBOR, OF BAY RIDGE, RED HOOK, AND BUTTERMILK CHANNELS, NEW YORK; ENLARGEMENT OF GOVERNORS ISLAND, NEW YORK.

This district was in the charge of Lieut. Col. W. L. Marshall, Corps of Engineers. Division engineer, Col. Amos Stickney, Corps of Engineers.

1. New York Harbor, New York.—Before the improvement of the main entrance into New York Harbor was undertaken by the United States the least depth in mid-channel on the outer bar was 23.7 feet at mean low water and about the same across three other shoals between the bar and deep water in the harbor. A large proportion of

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the commerce of the port, carried in vessels of great draft, could cross these shoals only at or near high water.

The project for the improvement of Gedney channel was approved by the Secretary of War December, 1884, and extended to cover the whole of the main entrance to the harbor December, 1886. It provided for dredging a channel 1,000 feet wide and 30 feet deep at mean low water from deep water below the Narrows, through Main Ship and Gedney channels, to deep water outside the bar. The estimated cost was $1,490,000 for dredging 4,300,000 cubic yards. The actual amount dredged to October, 1891, when the work was approximately completed, was 4,875,079 cubic yards.

The existing project for maintenance of channels was approved November 15, 1892. The cost of this work varies in different years; it is estimated at $50,000 annually.

Under these projects the amount expended up to July 1, 1905, is $1,998,206.75.

As a result of these expenditures, channels to the sea have been obtained with a depth of 30 feet at mean low water, and width of 1,000 feet or over, and have been maintained for the full depth with, as nearly as possible, the full width.

During the fiscal year ending June 30, 1905, the U. S. dredge *Gedney* excavated 315,418 cubic yards of sand and mud from Main Ship channel, Gedney channel, and Bayside channel, removing shoals and restoring the depth of 30 feet; further work is required in Main Ship channel to make the deep water full 1,000 feet wide.

The length of that part of New York Harbor included in the limits of the project for improvement (from Atlantic Ocean to the Battery, New York City) is 22½ miles by way of Sandy Hook, and (June 30, 1905) the channel has a depth of 30 feet or over throughout its entire length. For a length of about 8 miles this depth was made and is maintained under the project. The mean rise of tide is 4½ feet.

Future appropriations will be applied to the maintenance of these channels.

By the terms of the river and harbor act of 1899 a project was adopted for making an entrance to New York Harbor by way of Ambrose channel (formerly known as East channel), to be 2,000 feet wide and 40 feet deep at mean low water. The work was authorized to be done under a continuing contract at a cost not exceeding $4,000,000. It involves excavation of a channel about 7 miles in length.

The original depth through this channel was 16 feet at mean low water, the shoalest part being the outer bar. The channel was used only by towboats, scows, and other light-draft vessels.

Under the existing project, up to July 1, 1905, $1,908,206.26 has been expended in construction of two dredges and in excavating for about 2 miles in length on the outer bar, a small amount of work being done farther up the channel; 15,546,909 cubic yards of sand, etc., has been removed and the channel has been excavated to 40 feet depth or more with varying widths for a length of 8,400 feet, and to less depth for 21,600 feet farther.

During the fiscal year ending June 30, 1905, under the continuing contract, 2,914,440 cubic yards was excavated, extending the channel westward and widening it northward. The two Government dredges built under the appropriation of March 3, 1903, were completed, de-

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livered, and placed upon the work—one in November, 1904, and one in April, 1905. Details of the work of construction are given in Appendix H 7, herewith. These dredges have removed during the year 499,375 cubic yards of material, deepening the north half of the channel on the inner slope of the bar. The available depth of the channel, June 30, 1905, is 22 feet at mean low water, the excavation having passed beyond the crest of the bar which had but 16 feet depth.

Future appropriations will be applied to extending the channel westward and northwestward, the plan of operations being to first make a channel throughout the improvement of at least 35 feet depth and of navigable width, to provide passage for ships which can not use the present channels at full draft.

By the river and harbor act of 1905, the removal of a rock in North River, near pier 1, was authorized, and funds were provided by withdrawal of $20,000 from the Ambrose channel appropriation in addition to the $25,000 similarly diverted by the sundry civil act of 1903. A contract has been entered into for removal of the rock.

Under an allotment from the appropriation of April 28, 1904, for emergencies of rivers and harbors, work has just been begun for restoring Coney Island channel to the depth excavated in 1900, 14 feet at mean low water.

The foreign exports and imports for the port of New York during the fiscal year ending June 30, 1904, amounted approximately to 9,961,400 tons, valued at $1,212,377,112, being an increase over the valuations in 1886, before improvement was begun, of $372,100,420. The entire cost of the improvement of New York Harbor up to date is about 1 per cent of the increase in value of foreign commerce only for the port since the improvement began and less than one-third of 1 per cent of the present annual value of foreign commerce.

No statistics are kept of local and coastwise domestic commerce.

It is impossible to estimate the effect of the project upon freight rates. During 1904, 114 different ships, drawing 27 feet or more, made 589 trips in and out of the harbor. Prior to the improvement none of these ships could have crossed the bar or have come up the channel except at full high tide or after lightening.

Further details of the harbor and improvements are printed in the Annual Report of the Chief of Engineers for 1897, page 1031.

A report on the survey of Ambrose (East) channel, with map, is printed in House Document No. 243, Fifty-fourth Congress, second session. (See Annual Report of the Chief of Engineers for 1897, page 1053.)

GENERAL IMPROVEMENT.

July 1, 1904, balance unexpended	$22,412.70
Amount appropriated by river and harbor act approved March 3, 1905	75,000.00
Amount allotted from appropriation for maintenance of river and harbor improvements, act of April 28, 1904	15,000.00
	112,412.70
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	31,094.93
July 1, 1905, balance unexpended	81,317.77
July 1, 1905, outstanding liabilities	1,480.86
July 1, 1905, balance available	79,836.81

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AMBROSE CHANNEL.

July 1, 1904, balance unexpended		$815,775.48
Amount appropriated by sundry civil act approved March 3, 1905		715,510.00
Amount received on account of damage by New York, New Haven and Hartford Railroad car float		549.95
		1,531,835.43
June 30, 1905, amount expended during fiscal year:		
For works of improvement	[a]$684,707.74	
Allotted to removal of obstruction in North River	20,000.00	
		[a]704,707.74
July 1, 1905, balance unexpended		827,127.69
July 1, 1905, outstanding liabilities		[b]149,424.40
July 1, 1905, balance available		677,703.29
July 1, 1905, amount covered by uncompleted contracts		2,678,767.38
Amount (estimated) required for completion of existing project		1,221,490.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905. Submitted in compliance with requirements of sundry civil act of June 4, 1897.		265,000.00

OBSTRUCTION IN NORTH RIVER.

July 1, 1904, balance unexpended	$24,450.25
Amount allotted by river and harbor act approved March 3, 1905	20,000.00
	44,450.25
June 30, 1905, amount expended during fiscal year, for works of improvement	43.20
July 1, 1905, balance unexpended	44,407.05
July 1, 1905, amount covered by uncompleted contracts	40,000.00

CONEY ISLAND CHANNEL.

Amount allotted from appropriation for maintenance of river and harbor improvements, act of April 28, 1904	$8,000.00
June 30, 1905, amount expended during fiscal year, for works of improvement	15.20
July 1, 1905, balance unexpended	7,984.80
July 1, 1905, amount covered by uncompleted contracts	7,984.80

(See Appendix F 1.)

2. Channel in Gowanus Bay—Bay Ridge and Red Hook channels, New York Harbor.—These channels lie along the east shore of the upper bay, New York Harbor, and with Buttermilk channel form an easterly channel between the Narrows and East River, separated from the main channel by a broad shoal off Governors Island and Gowanus Bay.

Bay Ridge and Red Hook channels had a natural low-water depth of 7 to 12 feet, and were available only for a limited harbor commerce.

The original project, adopted in 1881, provided for making these

[a] Includes $400,407.04 on account of construction of dredges.
[b] Includes $999.50 on account of construction of dredges.

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channels 18 feet deep and 200 feet wide, subsequently modified to make the depth 26 feet, with width of 800 feet in Bay Ridge channel and 400 feet in Red Hook channel. This was completed in 1899 at a cost of about $1,090,000.

The existing project was adopted by the terms of the river and harbor act of 1899, which provided for making Bay Ridge and Red Hook channels 40 feet deep at mean low water and 1,200 feet wide. The work was authorized to be done under a continuing contract at a cost not exceeding $2,500,000.

Under this project, up to July 1, 1905, $821,096.19 has been expended. About 60 per cent of the entire area to be dredged has been excavated to depths ranging from 25 to 40 feet; 8,917,643 cubic yards has been removed, being about 37 per cent of the excavation required. In its present state of progress Bay Ridge channel is available for ships drawing 30 feet of water for nearly its full length and for about 800 feet width (two-thirds of its projected width), except over the shoal at the south end it has depths of nearly 40 feet. Red Hook channel has been widened to about 600 feet, but the available depth of 26 feet has not been increased continuously through the channel.

The total length of channel covered by this improvement is about 4½ miles; the mean rise of tide is 4½ feet.

During the year ending June 30, 1905, 2,038,227 cubic yards of material has been excavated, mainly in widening the channels and removing shoals.

The commerce of this part of New York Harbor consists of coal, lumber, iron, cotton, sugar, and miscellaneous freights, amounting in the calendar year 1904 to about 2,000,000 tons, valued at $72,000,000.

Future appropriations will be applied to increasing the depth and width of these channels, as provided for by the project.

Further details concerning these channels are contained in the Annual Report of the Chief of Engineers for 1899, page 1266.

House Document No. 337, Fifty-fourth Congress, second session, contains a report upon a survey of these channels, with map showing locations and depths as existing in 1897. (See Annual Report of the Chief of Engineers for 1897, p. 1177.)

July 1, 1904, balance unexpended	$435,091.60
Amount appropriated by sundry civil act approved March 3, 1905	200,000.00
	635,091.60
June 30, 1905, amount expended during fiscal year, for works of improvement	207,187.79
July 1, 1905, balance unexpended	427,903.81
July 1, 1905, outstanding liabilities	94,450.40
July 1, 1905, balance available	333,453.41
July 1, 1905, amount covered by uncompleted contracts	1,370,628.70
Amount (estimated) required for completion of existing project	1,251,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	250,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix F 2.)

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3. Buttermilk channel, New York Harbor.—This channel, lying between Governors Island and the Brooklyn shore, forms an easterly channel from East River to the main channel and to Red Hook channel.

Prior to improvement it had a natural depth of 26 feet in a channel so narrow and crooked as to be hardly navigable. Its available depth for navigation was about 20 feet.

The first project for improvement, adopted in 1880, provided for the removal of part of one shoal, to widen the channel. This was subsequently extended to removal of both shoals to 26 feet depth, making the channel about 1,000 feet wide. The work was completed in 1899, at a cost of about $650,000.

The project adopted by the river and harbor act of 1902 provided for deepening the channel to 30 feet, with such width as the appropriation of $90,000 would suffice for.

The amount expended under this project to June 30, 1905, is $88,776.01.

Work upon the project was begun in October, 1903, and the project was completed April 4, 1905, the channel of 30 feet depth being made 800 feet wide.

During the fiscal year 207,946 cubic yards of sand was excavated, increasing the width of the north half of the channel by 450 feet and making the south half 800 feet wide. The total amount dredged under the contract and the project is 310,000 cubic yards.

June 30, 1905, the available depth through this channel was 30 feet; the mean rise of tide is 4½ feet.

No satisfactory figures for commerce of Buttermilk channel were obtained; it is believed to be nearly the same as in 1899, when 16,587,000 tons was reported.

A survey of Buttermilk channel was made in 1900. The report containing further details is printed, with map, in House Document No. 122, Fifty-sixth Congress, second session. (See Annual Report of the Chief of Engineers for 1901, p. 1299.)

July 1, 1904, balance unexpended	$63,723.99
June 30, 1905, amount expended during fiscal year, for works of improvement	62,500.00
July 1, 1905, balance unexpended	1,223.99

(See Appendix F 3.)

4. Enlargement of Governors Island, New York Harbor.—The project for this entire work, adopted under the terms of the sundry civil act of 1901, which made appropriations for beginning operations, included an addition of about 82 acres to the area of the island by inclosing with a bulkhead part of the shoal southwest of the island and filling the inclosure, the building of a wharf on the north shore and dredging to a depth of 26 feet in front of the wharf, and the erection of buildings. The work of enlargement, including construction of a wharf and dredging, all estimated to cost $1,100,000, was assigned to the Engineer Department. By a modification of the project adopted in April, 1902, the enlargement was to be extended southwest over the shoal to reclaim an additional area of about 19 acres, making the total area of the enlargement about 101 acres.

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Work was begun in August, 1901, and up to June 30, 1905, $365,515.24 had been expended.

During the past fiscal year 45,943 tons of riprap was delivered in the bulkhead, extending it 559 feet, and completing it except a gap left for scows bringing embankment material; 105,692 cubic yards of sand was delivered at the embankment; about 12 acres of embankment were built up above low-water and about 3 acres above high-water level; 2,188 linear feet of masonry sea wall has been built upon the east bulkhead.

The entire work done to July 1, 1905, consists in building a wharf with T head, 370 feet long, dredging the approaches to 26 feet depth, laying intercepting sewers, building 6,765 linear feet of riprap bulkhead and 2,188 feet of masonry sea wall, and building about 30 acres of embankment above low water.

The available funds will be applied to continuing the embankment and the sea wall.

Future appropriations will be applied to continuing and completing the project.

July 1, 1904, balance unexpended	$482,060.50
Amount appropriated by sundry civil act approved March 3, 1905	100,000.00
	582,060.50
June 30, 1905, amount expended during fiscal year, for works of improvement	97,575.74
July 1, 1905, balance unexpended	484,484.76
July 1, 1905, outstanding liabilities	89,639.48
July 1, 1905, balance available	394,745.28
July 1, 1905, amount covered by uncompleted contracts	71,739.48
Amount (estimated) required for completion of existing project	175,000.00

(See Appendix F 4.)

5. Removing sunken vessels or craft obstructing or endangering navigation.—(*a*) An abandoned canal boat was found adrift in the Hudson River off pier 3 toward evening, August 18, 1904. She was removed without delay and finally disposed of by grounding at Rikers Island. The name had been carefully scraped off, and no marks of identification could be found.

(*b*) Schooner *Hattie V. Kelsey*, a coal-laden three-masted schooner, was badly damaged by collision September 14, 1904, and sunk on the edge of South channel. Her masts soon fell out, and she became a dangerous obstruction. She was removed and deposited in deep water at a cost of $5,200.

(*c*) Fishing schooner *Eva R.* sunk during a squall and dragged into Ambrose channel, where she became a source of danger to the dredges excavating the channel. She was promptly removed at a cost of $225 and disposed of by grounding at high tide at Staten Island.

(*d*) A raft of large timbers, worthless and abandoned, was found adrift in Buttermilk channel. It was towed away by the U. S. steamer *Manisees* and grounded at Staten Island, where it was subsequently cut up, all without expense to the United States.

(See Appendix F 5.)

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IMPROVEMENT OF RIVERS AND HARBORS IN NORTHEASTERN NEW JERSEY.

This district was in the charge of Col. W. R. Livermore, Corps of Engineers. Division engineer, Col. Amos Stickney, Corps of Engineers.

1. Passaic River, New Jersey.—This river is a stream of considerable size, rising among the highlands in the northern part of New Jersey and flowing in a generally easterly and southerly course into Newark Bay. It is navigable from its mouth to Passaic, a distance of about 16 miles, where navigation is cut off by the Dundee Water Power and Land Company's dam. In its natural condition the navigable depth to Newark was about 7 feet at mean low water; from Newark to Passaic it was about 3 feet.

The first project for improvement, adopted by the river and harbor act of June 10, 1872, was for providing a channel from Newark to Passaic from 6 to 7½ feet deep and from 50 to 200 feet wide, the first cost being estimated at $123,924. This was subsequently increased to $193,822.

A subsequent project for improving the river below Newark was authorized by the river and harbor act of June 14, 1880, at an estimated cost of $353,875. It proposed a channel 200 feet wide and 10 feet deep at mean low water up to Center Street Bridge, Newark.

The two projects were consolidated by the river and harbor act of July 13, 1892, the estimated cost of the improvement being $547,697.

The amount expended under this consolidated project up to the close of the fiscal year ending June 30, 1905, was $478,327.09, of which $389,610 was used in carrying out the projects and $88,717.09 for maintenance.

By the passage of the river and harbor act approved June 13, 1902, a new project was adopted for improving the lower part of the river, "in accordance with the report submitted in House Document No. 401, Fifty-sixth Congress, first session, from Staten Island Sound through Newark Bay and the said river to the Montclair and Greenwood Lake Railroad bridge, with a channel 12 feet deep to the Nairn Linoleum Works, and 10 feet deep from that point to the said railroad bridge." Estimated cost, $296,000, and the yearly cost of maintenance is estimated at $5,000. Work under this project is authorized to be done under continuing contracts. The amount expended on this project up to the close of the fiscal year ending June 30, 1905, was $53,352.85. The old project for improving the river below Newark is merged into this new project and therefore may be considered completed.

The adoption of this new project for the lower part of the river leaves in force the part of the old project above Newark which is included between the Montclair and Greenwood Lake Railroad bridge and the city of Passaic. Up to June 30, 1905, $188,500.55, including maintenance, had been expended on this part of the project, of which $150,734 was expended for the project and $27,766.55 for maintenance work, leaving approximately $43,000 as the estimated cost of completion. The annual cost of maintenance is estimated at $5,000.

During the past fiscal year dredging has been carried on under three contracts, one of which was an emergency contract for restoration of channels dredged by the United States under previous projects and the other two were for the completion of the work contemplated

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and adopted under the new project adopted by the act of Congress approved June 13, 1902. The restoration work was done under an allotment of $10,000 from the appropriation for emergency work, act of June 6, 1900, and consisted in the removal of 2,896 cubic yards of material and 1.17 cubic yards of bowlders from Lime Kiln bar, just below the Montclair and Greenwood Lake Railroad bridge. Work was completed July 13, 1904.

Under the contracts for the work required under the new project 222,100 cubic yards has been dredged by Kirk, Driscoll & Co. from six localities, namely: (1) Between Bridge Street and Center Street bridges, Newark; (2) east of Jackson Street Bridge, Newark; (3) near Lister's dock, Newark; (4) south of Plank Road Bridge, Newark; (5) south of Newark and New York Railroad bridge, Newark; (6) Newark Bay, and 9,247 cubic yards by P. Sanford Ross (Incorporated), from Newark Bay and near Lister's dock, Newark.

Under date of January 26, 1904, the Department allotted $10,000 for additional emergency work. Nothing has yet been done under this allotment.

The maximum drafts that could be carried June 30, 1905, were as follows: Nine feet to the Center Street Bridge, Newark; 7 feet to the Erie Railroad bridge, Newark, and 5 feet to Passaic. Mean range of tides: At mouth of river, 4.7 feet; at Passaic, 2.5 feet.

It is proposed to apply the amount estimated as a profitable expenditure to the continuation of the improvement in accordance with the adopted project.

The commerce of this river is mainly in building material, iron ore, fertilizers, coal, and general merchandise, and amounted to 1,962,462 tons in 1899, to 2,037,363 tons in 1900, to 2,009,356 tons in 1901, to 2,494,312 tons in 1902, to 2,356,511 tons in 1903; and to 2,567,942 tons in 1904, valued at $134,850,964.

This improvement is necessary to the great industrial interests and has reduced freight rates a dollar a ton on coal and building materials, and its continuance is necessary to the successful carrying on of the business of this locality.

Details as to this improvement may be found in the Annual Reports of the Chief of Engineers for 1896, pages 770–774, and for 1900, pages 177, 1530–1550.

Maps showing mouth of river and Newark Bay are printed in the Annual Reports of the Chief of Engineers for 1882, page 686, and 1887, page 766, and maps of the river in the vicinity of and above Newark are printed in House Document No. 401, Fifty-sixth Congress, first session.

July 1, 1904, balance unexpended		$177,827.94
Amount appropriated by sundry civil act approved March 3, 1905		75,000.00
Amount appropriated by river and harbor act approved March 3, 1905		40,000.00
		292,827.94
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$43,414.66	
For maintenance of improvement	2,743.22	
		46,157.88
July 1, 1905, balance unexpended		246,670.06
July 1, 1905, outstanding liabilities		7,552.55
July 1, 1905, balance available		239,117.51

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July 1, 1905, amount covered by uncompleted contracts	$163,375.34
Amount (estimated) required for completion of existing project	76,274.60
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	46,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix G 1.)

2. Arthur Kill, or Staten Island Sound, and channel between Staten Island and New Jersey.—(*a*) *Arthur Kill, or Staten Island Sound, New York and New Jersey.*—This is a waterway about 12 miles long, which, together with the lower end of Newark Bay, 2 miles long, and the Kill van Kull, 3 miles long, forms the inland waterway between upper New York Harbor and Raritan Bay. The section now contemplated under this improvement consists of the 14 miles of channel between Kill van Kull and Raritan Bay. The original depth through the Arthur Kill, or Staten Island Sound, at mean low water was 15 feet and upward, in a channel 100 to 1,000 feet in width. Through the lower end of Newark Bay the navigable channel depth is about 14 feet at mean low water, the result of an improvement commenced in 1874 and continued up to the present time. It is proposed in the present project to cut a new channel through the flats to the southward, where the depth is about 1 foot at mean low water.

Prior to the adoption of the present project sections of this waterway have been under improvement by the United States, under the title of "Channel between Staten Island and New Jersey," adopted in 1880, superseding the project of 1874, and "Arthur Kill," adopted in 1888. The former provided for a depth of 14 feet and width of 400 feet through the lower part of Newark Bay, and the latter for the removal of Steep Point, in order to straighten the channel to the southwestward of the Baltimore and Ohio Railroad bridge.

Details as to these projects are printed in the Annual Report of the Chief of Engineers for 1895, pages 969–972, and in current report (see p. 144) under the head of "Channel between Staten Island and New Jersey," which project is still in force.

The existing project for this improvement, adopted by the river and harbor act approved June 13, 1902, provides for making and maintaining a channel from Kill van Kull to Raritan Bay, New York and New Jersey, by means of dredging and diking, 300 feet wide and 21 feet deep at mean low water, at an estimated cost of $696,000, and $5,000 for annual cost of maintenance. Work under this project is authorized to be done under continuing contracts. This project, with estimates, is printed in the Annual Report of the Chief of Engineers for 1900, pages 1525–1530.

The amount expended to June 30, 1905, was $93,538.30.

Operations during the past fiscal year consisted in dredging under a continuing contract, approved by the Department on October 27, 1903, upon which work was commenced on December 2, 1903. Six hundred and fifty-nine thousand four hundred and seventeen cubic yards of material had been removed under this contract at the close of the fiscal year ending June 30, 1905, from the channel south of Shooters Island.

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The maximum draft that could be carried through the waterway on June 30, 1905, was about 14 feet at mean low water. Mean range of tides, 5 feet.

It is proposed to apply the amount estimated as a profitable expenditure to dredging for the continuation of the improvement in accordance with the adopted project.

The freight carried through this waterway consists of oil, coal, ores, clay products, chemicals, fertilizers, grain, machinery, manufactures, and general merchandise, and amounted in 1899 to 11,311,991 tons, in 1900 to 11,047,633 tons, in 1901 to 11,651,300 tons, in 1902 to 14,517,079 tons; and in 1903 to 11,512,420 tons, valued at $267,046,086.

It appears from inquiry that no estimate can be made of the exact effect of the project on freight rates, except to the local commerce. The rates on this have been reduced by this improvement and will be further reduced when the improvement has advanced to the extent of providing a practicable navigable channel of 21 feet.

Maps of this work are printed in House Document No. 393, Fifty-sixth Congress, first session.

(*b*) *Channel between Staten Island and New Jersey.*—This channel is an inland waterway, about 17 miles long, connecting New York Harbor with Raritan Bay. It consists of the Kill van Kull, connecting the upper bay with Newark Bay, and the Arthur Kill, connecting Newark Bay with Raritan Bay.

The natural depth through the channel was 15 feet or more, except for a distance of about 1¾ miles in Newark Bay, where there was a shoal with a crooked channel 9½ feet deep, bordered by flats with depth of about 2 feet of water. The improvement of the "Channel between Staten Island and New Jersey" consists in the deepening of the channel across this shoal.

The first project, adopted by the river and harbor act of June 23, 1874, was for making this channel from 14 to 16 feet deep, at an estimated cost of $443,211. The only work done under it was the building of 2,237 linear feet of diking, at a cost of $50,000.

The second and existing project was adopted in 1880, which, with subsequent modifications, proposed to dredge through the shoal a channel 400 feet wide and 14 feet deep at mean low water, the cost being estimated at $210,000.

A supplemental project was adopted by the river and harbor act of August 11, 1888, which had for its object the removal of the point of land known as "Steep Point," for the straightening of the channel to the westward of the Baltimore and Ohio Railroad bridge. This work was carried on under the title of "Improvement of Arthur Kill, New York and New Jersey," 1888–1895. The cost was estimated at $26,500, and the work was completed in 1895, at a cost of $25,401.30. This modification of the project brought the total cost of the improvement up to $286,500.

The river and harbor act of June 3, 1896, and of June 13, 1902, extended the project to include the dredging of a channel in Lemon Creek, on Staten Island, at a cost of $5,000 and $5.000, respectively. This extension increased the total estimated cost of the improvement from the beginning to $296,500. Annual maintenance is estimated at $10,000.

The total amount expended to June 30, 1905, on the project, with

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its additions and modifications, was $293,212.53, which was applied to diking, to dredging a channel 14 feet deep and 400 feet wide through the shoal in Newark Bay, to removing Steep Point, and to dredging a channel in Lemon Creek 8 feet deep at high water and from 35 to 50 feet wide; $206,635.08 has been expended in carrying out the project and $86,577.45 for maintenance.

No work has been done during the past year.

The maximum draft that could be carried June 30, 1905, through the channel between Staten Island and New Jersey was about 13 feet at mean low water, and in Lemon Creek 8 feet at high water, to the head of navigation, a distance of about one-half mile from the mouth. Mean range of tides, 5 feet.

The freight carried through this channel consists of oil, coal, ores, clay products, chemicals, fertilizers, grain, machinery, manufactures, and general merchandise, and amounted in 1899 to 11,311,991 tons, in 1900 to 11,047,633 tons, in 1901 to 11,651,300 tons, in 1902 to 16,266,574 tons; and in 1903 to 14,129,678 tons, valued at $327,477,738.

This is a connecting channel, and no estimate can be made of the exact effect on the rates of freight, but it is known that the present commerce could not be carried on without this improvement, from which it is inferred that rates would be advanced if this improvement had not been made.

Further details as to this improvement may be found in the Annual Reports of the Chief of Engineers for 1895, pages 969–970, and for 1896, page 775. Maps of this improvement are printed in the Annual Reports of the Chief of Engineers for 1881, page 696; 1889, pages 820–822; and 1890, page 844, and in House Document No. 393, Fifty-sixth Congress, first session. No map of Lemon Creek has been printed.

July 1, 1904, balance unexpended		$253,024.59
Amount appropriated by river and harbor act approved March 3, 1905		10,000.00
Amount appropriated by sundry civil act approved March 3, 1905		70,000.00
		333,024.59
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$88,274.97	
For maintenance of improvement	.45	
		88,275.42
July 1, 1905, balance unexpended		244,749.17
July 1, 1905, outstanding liabilities		16,890.25
July 1, 1905, balance available		227,858.92
July 1, 1905, amount covered by uncompleted contracts		425,586.30
Amount (estimated) required for completion of existing project		376,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905		100,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix G 2.)

3. Woodbridge Creek, New Jersey.—This creek is a small, crooked tidal stream, about 5 miles long, running through flat marshes for

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most of its length and emptying into the west side of Arthur Kill, or Staten Island Sound, 2 miles north of Perth Amboy, N. J.

It is navigable for 2⅜ miles above the mouth to a point where it is crossed by a highway bridge without a draw. The width of the creek below this bridge is about 100 feet. In its original condition this stream was obstructed at its mouth by a bar having a least depth of 9.8 feet at high water, and by two shoals just inside the mouth. From these shoals a good 12-foot channel existed to above Anderson's Brick Works, seven-eighths of a mile from the mouth, above which point, however, many shoals occurred, although a narrow 8-foot channel existed as far as Salamander dock, 1⅞ miles from the mouth.

First project: A survey of the navigable part of this creek was made in 1878, reference to which is made on page 139 of the Annual Report of the Chief of Engineers for 1904, and a project for its improvement was adopted by the river and harbor act of March 3, 1879. This project provided for forming a channel 12 feet deep at mean high water and 80 feet wide from the mouth of the creek to the Salamander dock, at an estimated cost of $13,800, which amount was increased in 1884 to $29,000. Work on this improvement was carried on under appropriations made from 1879 to 1882, amounting to $19,000, which was expended without completing the project, and was suspended in 1883.

The existing project, adopted by the river and harbor act of June 13, 1902, contemplates obtaining a channel 8 feet deep at mean low water, with a bottom width of 50 feet, by dredging, from Arthur Kill to Salamander dock, at an estimated cost of $35,000 for the improvement, and $3,000 annually for maintenance. A description of this project is contained in the Annual Report of the Chief of Engineers for 1900, page 1552.

The amount expended on the work of existing project up to the close of the fiscal year ending June 30, 1905, was $13,498.57, of which $10,000 was used in carrying out the project, and $3,498.57 for maintenance. During the past fiscal year, under appropriation for maintenance, 21,799 cubic yards of material was removed from the channel under a contract for restoration of previously dredged channel. The maximum draft that could be carried June 30, 1905, over the shoalest part of the channel was 6 feet at mean low water. The mean range of tides is 5 feet.

The commerce of this creek, mainly in clay, brick, tile, coal, and building materials, amounted in 1887 to 126,000 tons, in 1898 to 176,000 tons, in 1902 to 134,377 tons, in 1903 to 155,751 tons; and in 1904 to 165,313 tons, valued at $1,143,658.

It appears from inquiry that freight rates have been reduced as a result of this improvement and will be further reduced when the improvement is carried on throughout the entire length of the creek.

Detailed description of this work may be found in the Annual Report of the Chief of Engineers for 1900, pages 1552–1555. Map is printed in House Document No. 282, Fifty-sixth Congress, first session.

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Amount appropriated by river and harbor act approved March 3, 1905	$6,000.00
Amounts allotted from appropriation for maintenance of river and harbor improvements, act of April 28, 1904	7,750.00
	13,750.00
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	3,498.57
July 1, 1905, balance unexpended	10,251.43
July 1, 1905, outstanding liabilities	2,109.46
July 1, 1905, balance available	8,141.97
July 1, 1905, amount covered by uncompleted contracts	1,694.22
Amount (estimated) required for completion of existing project	19,000.00

(See Appendix G 3.)

4. *Raritan Bay, New Jersey.*—This bay is a large body of water lying between the southern end of Staten Island and the New Jersey shore. Its greatest width north and south is about 5 miles and its greatest length east and west is about 7 miles. The Raritan River empties into it at its west end between Perth Amboy and South Amboy, and the Arthur Kill, or Staten Island Sound, extends northward, connecting it with Newark Bay.

This bay had naturally a fairly straight channel, 11 feet deep, to South Amboy. The line of the deepest water, however, followed the Staten Island shore from Perth Amboy to Seguine Point, where it was separated from deep water in the eastern part of the bay by a shoal 1.5 miles broad with a minimum depth of 14.5 feet.

The original and existing project, approved March 3, 1881, and extended September 19, 1890, and June 3, 1896, provides for dredging channels, 300 feet wide and 21 feet deep, from Seguine Point to deep water in the bay, a distance of about 1.5 miles; through two shoals opposite Wards Point, 0.4 and 0.6 mile long, respectively, and from South Amboy to deep water near Great Beds light, a distance of about 1.5 miles. The estimated cost of the work is $507,875. Reference to reports on surveys, with estimates, is noted in the Annual Report of the Chief of Engineers for 1904, page 140.

The amount expended on the work up to the close of the fiscal year ending June 30, 1905, was $487,500, of which $297,314.45 was used in carrying out the project and $190,185.55 for maintenance. The project has been completed, and the only work now contemplated is maintenance of the improvement.

During the fiscal year no work has been done on this improvement.

The maximum draft that could be carried June 30, 1905, through the Wards Point channels was 21 feet, and through the Seguine Point and South Amboy channels about 20 feet, all at mean low water. Mean range of tides, 5 feet.

The commerce of the bay is mainly in coal, brick, manufactures, and general merchandise, and amounted in 1899 to 6,507,402 tons, in 1900 to 6,537,977 tons, in 1901 to 4,722,048 tons, in 1902 to 5,453,122 tons; and in 1903 to 4,484,152 tons, valued at $101,842,455.

It appears from statements of the shipping interests of the great railroad terminals that the improvements have resulted in a great reduction of towing rates, and a proportionate reduction of freight rates owing to the greater quantity of coal that can be carried and

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towed through these channels over that which was carried before the improvement was made. It is stated that the further improvement of the channels in question will work beneficially to the consumers and carriers in the same direction or proportion as heretofore.

Further details of this improvement are printed in Annual Report of the Chief of Engineers for 1896, pages 787–789.

Amount appropriated by river and harbor act approved March 3, 1905 . $50,000.00
July 1, 1905, balance unexpended . 50,000.00

(See Appendix G 4.)

5. Keyport Harbor, Matawan Creek, Raritan, South, and Elizabeth rivers, Shoal Harbor and Compton Creek, and Cheesequake Creek, New Jersey.—(*a*) *Keyport Harbor.*—This harbor is situated at the mouth of Matawan Creek, on the south side of Raritan Bay, 5 miles east of the mouth of Raritan River, and it consists of a bay about 1 mile broad.

There was no distinct natural channel in the harbor, the available depth to the wharves being less than 4 feet at mean low water. A 6-foot channel had been dredged at private expense before the United States assumed charge of the improvement, but it had shoaled again to 3 feet.

The original and existing project, approved August 2, 1882, contemplates dredging an 8-foot channel 200 feet wide from Raritan Bay to the steamboat dock at Keyport, at an estimated cost of $40,475. Report on survey, with estimate, is printed in the Annual Report of the Chief of Engineers for 1873, page 941.

The amount expended to June 30, 1905, was $55,475, of which sum $30,500 was used in carrying out the project and $24,975 in maintenance.

During the past fiscal year, under an allotment of $5,000, dated May 31, 1904, from the emergency river and harbor appropriation of June 13, 1902, 23,968 cubic yards of material was dredged from the channel.

The maximum draft that could be carried June 30, 1905, to the Keyport wharves was about 8 feet at mean low water. Mean range of tides, 4.9 feet.

The commerce of this harbor is mainly in farm products, fertilizers, coal, lumber, fish, shellfish, and miscellaneous freight, and amounted to 67,500 tons in 1899, to 45,000 tons in 1901, to 62,000 tons in 1902, to 62,000 tons in 1903; and to 70,000 tons in 1904, valued at $1,948,000.

The effect of this improvement has been to greatly reduce freight rates, especially in the marketing season.

Further details as to this work are printed in the Annual Report of the Chief of Engineers for 1897, page 1147.

(*b*) *Matawan Creek.*—This creek is a small tidal stream in the eastern part of New Jersey, which discharges into Raritan Bay at Keyport Harbor. It is navigable up to the bridge of the New York and Long Branch Railroad, about 2 miles above its mouth.

In its natural condition the mouth was obstructed by a mud flat, through which a narrow and crooked 3-foot channel existed. Above this flat there was a 4-foot channel for a mile, and beyond a narrow 3-foot channel extending nearly up to the head of navigation at Matawan.

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The original and existing project for improving this stream, by dredging a 4-foot channel 100 feet wide from the mouth to Winkson Creek, about 1 mile, and thence 75 feet wide to the railroad bridge at Matawan, was approved March 3, 1881. The cost was estimated at $33,120. Report on survey, with estimate, is printed in the Annual Report of the Chief of Engineers for 1881, page 720.

The amount expended to June 30, 1905, was $47,804.39, of which $21,000 was used in carrying out the project and $26.804.39 for maintenance.

During the past fiscal year, under an allotment of $3,000, dated May 31, 1904, from the emergency river and harbor appropriation of June 13, 1902, 9,050 cubic yards of material was dredged from the creek between the docks of the Pennsylvania Clay Company and the steamboat company.

The maximum draft that could be carried June 30, 1905, was 4 feet at mean low water. Mean range of tides, 4.9 feet.

The commerce of this creek is in brick, fertilizer, farm produce, and general merchandise, and amounted to 51,000 tons in 1899, to 60,000 tons in 1901, to 61,500 tons in 1902, to 61,500 tons in 1903: and to 29,600 tons in 1904, valued at $74,000.

The effect of this improvement has been to greatly reduce rates of freight, especially in the marketing season.

Further details as to this improvement may be found in the Annual Report of the Chief of Engineers for 1897, page 1145.

(*c*) *Raritan River.*—This river is a moderate-sized stream flowing through the central part of the State of New Jersey and emptying into Raritan Bay at Perth Amboy. It is navigable to New Brunswick, N. J., a distance of 12 miles, where it is the eastern terminus of the Delaware and Raritan Canal.

In its natural state the channel to New Brunswick was obstructed by several extensive shoals, on which the depth was from 6½ to 8½ feet at mean low water.

The original and existing project for improvement, approved June 18, 1878, provided for a channel 200 feet wide and 10 feet deep from the mouth to the Delaware and Raritan Canal terminus at New Brunswick, to be obtained by dredging, diking, and rock excavation, the cost being estimated at that time at $2,093,662. Recent and improved methods for doing such work have made it probable that this estimate will not exceed $1,035,000.

The amount expended up to the close of the fiscal year ending June 30, 1905, was $689,015.58, of which $659,192.32 was used in carrying on the work and $29,823.26 for maintaining that already done.

During the fiscal year 720 cubic yards of material was dredged from the channel at Bishop's dock and the contract for the restoration of previously dredged channel was completed.

On June 30, 1905, the maximum draft that could be carried to the head of navigation was 8½ feet at mean low water. Mean range of tides: At mouth of river, 5.1 feet; at New Brunswick, 5.56 feet.

The commerce of this river is principally in coal, ores, lumber, building materials, and general merchandise, and amounted in 1899 to 1,523,391 tons, in 1900 to 1,476,645 tons, in 1901 to 1,266,950 tons, in 1902 to 1,228,791 tons; and in 1903 to 1,020,420 tons, valued at $19,351,776.

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It appears from numerous letters received that this improvement has most certainly resulted in a very material reduction of freight rates.

Details as to this improvement may be found in the Annual Report of the Chief of Engineers for 1897, page 1136, and further information is contained in the report for 1900, page 1505.

Maps of the river are printed in the Annual Report of the Chief of Engineers for 1885, page 760.

(*d*) *South River.*—This is a small stream in the central part of New Jersey which discharges into the Raritan River about 8 miles above its mouth. Before improvement by the United States a private canal about three-fourths of a mile long had been dredged from near Washington, on the South River, to Sayreville, on the Raritan River, which shortened the sailing course about 2 miles.

The depth in the canal was about 3.5 feet, and in the river about 2.5 feet as far as Oldbridge, at the head of navigation, 6.3 miles above the canal.

The first project for this improvement was adopted March 3, 1871, and provided for dredging a channel 6 feet deep at mean low water up to the Washington wharves at an estimated cost of $13,653. This was completed in 1874 at a cost of $20,000.

The existing project, approved June 14, 1880, provides for correcting the canal outlet and for obtaining, by dredging and diking, a channel 100 feet wide and 8 feet deep to Washington, 1.5 miles above the mouth; thence 6 feet deep to Bissetts, 3.7 miles above the mouth; thence 4 feet deep to Oldbridge, 6.3 miles above the mouth, at the head of navigation. The cost was estimated at $194,695, but was reduced in 1892 to $176,695. Report upon survey, with estimate, for this project is printed in the Annual Report of the Chief of Engineers for 1880, page 519.

The amount expended on the present project up to the close of the fiscal year ending June 30, 1905, was $98,000, of which $78,000 was used for carrying on the work and $20,000 for maintenance.

During the past fiscal year no work has been done on this improvement.

The maximum draft that could be carried to South River on June 30, 1905, was about 8 feet, and to the railroad bridge above about 6 feet at mean low water. Mean range of tides: At canal, 5.34 feet; at Oldbridge, 4.57 feet.

Large brick yards established along the banks of the river give it a commercial importance out of proportion to its size.

The commerce is principally in brick, sand, clay, coal, fertilizer, and general merchandise, and amounted in 1899 to 343,202 tons, in 1900 to 414,288 tons, in 1901 to 328,186 tons, in 1902 to 387,246 tons, in 1903 to 333,890 tons; and in 1904 to 392,626 tons, valued at $1,027,371.

The improvement has caused a great reduction in freight rates, and it appears probable that the rates will be further reduced when the improvement reaches the upper reaches of the river. From reliable information received it appears that as a result of this improvement a reduction in freight rates on fire brick by rail to Boston of from $3.25 to $2 per ton has been made. The freight rate by rail to New York is $1.60 per ton; by water it is 75 cents per ton.

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Details as to this improvement may be found in the Annual Report of the Chief of Engineers for 1896, pages 784–785.

Sketches of South River are printed in the Annual Reports of the Chief of Engineers for 1882, page 678, and 1885, page 764.

(*e*) *Elizabeth River.*—This is a small stream in the eastern part of New Jersey which discharges into the Arthur Kill at Elizabethport. Before improvement by the United States its width varied from 50 to 90 feet, and it had a high-water depth of 4 feet at the head of navigation at Broad street, Elizabeth, about 2¾ miles above its mouth.

The original and existing project, approved March 3, 1879, consists in dredging a channel 60 feet wide and 7 feet deep at mean high water at an estimated cost, revised in 1881, of $43,160. Report upon survey, with estimate, is printed in the Annual Report of the Chief of Engineers for 1879, page 481.

The amount expended on this work to June 30, 1905, was $45,160, of which $27,000 was used for carrying out the project and $18,160 for maintenance.

During the past fiscal year no work has been done on this improvement.

The maximum draft that could be carried to Bridge street, Elizabeth, about one-fourth mile from the head of navigation at Broad street, on June 30, 1905, was about 5 feet at mean high water. Mean range of tides: At mouth, 4.7 feet; at Bridge street, Elizabeth, 3.4 feet.

The commerce of this river is in coal, building materials, and miscellaneous freights. It amounted to 21,650 tons in 1895, to 36,066 tons in 1896, to 28,865 tons in 1897, to 29,495 tons in 1901, to 40,250 tons in 1902, to 37,136 tons in 1903; and to 36,336 tons in 1904, valued at $193,894.

It appears from statements received from shippers that there has been a reduction in freight rates, probably due to this improvement.

Details in reference to this improvement may be found in the Annual Reports of the Chief of Engineers for 1896, page 778, and 1897, pages 1134 and 1185.

(*f*) *Shoal Harbor and Compton Creek.*—This harbor is on the south shore of Raritan Bay, 5 miles from Sandy Hook. Compton Creek is a narrow stream emptying into it. The natural harbor is inside the mouth of the creek, where the depth is from 3 to 6 feet at mean low tide. The creek is navigable for about 1 mile above its mouth, where it is crossed by a railroad bridge without a draw. One-fourth of a mile above its mouth it is crossed by a highway drawbridge.

The entrance to this harbor was originally obstructed by a broad, flat shoal on which there was a depth of less than 1 foot at mean low tide, the distance between the deep water in the creek and the 4-foot depth in the bay being about one-half mile.

The original and existing project, adopted September 19, 1890, proposes a channel 4 feet deep connecting Compton Creek with Raritan Bay, the width to be 150 feet in the bay and 75 feet in and near the mouth of the creek, the channel through Shoal Harbor to be protected by a dike if necessary, at an estimated cost of $64,130.

The amount expended to June 30, 1905, was $32,000, of which sum $17,000 was applied to carrying out the project and $15,000 for maintenance.

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During the past fiscal year no work in furtherance of this improvement was done.

The maximum draft that could be carried June 30, 1905, in the improved channel through Shoal Harbor and Compton Creek to the drawbridge was 3½ feet at mean low water. Mean range of tides, 4.5 feet.

The commerce of this locality in farm and fish products, fertilizers, and general merchandise amounted to 179,500 tons in 1900, to 180,000 tons in 1901, to 48,790 tons in 1902, to 65,175 tons in 1903; and to 28,570 tons in 1904, valued at $906,350.

It appears from statements received from shippers that there has been a reduction on coal freights of 40 per cent, on manure from 40 to 50 per cent, and on fish 20 per cent as a result of this improvement, and if the improvement is not continued the rates will be very much advanced.

Further details as to this improvement may be found in the Annual Report of the Chief of Engineers for 1897, page 1150.

(*g*) *Cheesequake Creek.*—This is a small stream in the eastern part of New Jersey which discharges into Raritan Bay, about 2 miles east of South Amboy. Before improvement by the United States the available navigable depth in the creek was 1½ feet at mean low water over the shoals, the distance from the entrance to the upper limit of navigation being 3½ miles.

The existing project was adopted June 14, 1880, and provided for a new outlet, 5 feet deep, from the creek into Raritan Bay, at right angles to the shore line, through a beach which put across the mouth of the creek from the right bank, and which had forced the outlet nearly one-half mile to the westward. This was to be obtained by dredging and constructing parallel jetties of stone, 200 feet apart, each side of the dredged channel; the old outlet was to be closed by a pile dike, and a channel, 4 feet deep and from 50 to 100 feet wide, was to be dredged from the mouth to the head of navigation, 3½ miles up the creek. In this distance two dikes were to be built, and a new channel to be made through the marsh was to cut off a bend in the creek. Stump Creek, a tributary stream emptying into the creek near its mouth, was to be improved by dredging a channel 50 feet wide and 3 feet deep.

The cost was estimated at $75,279, which was revised in 1885 to $90,000.

Report upon survey, with estimate, is printed in the Annual Report of the Chief of Engineers for 1880, page 525.

The amount expended on the present project up to the close of the fiscal year ending June 30, 1905, was $40,000, all of which was used in carrying out the project.

During the past fiscal year no work has been done.

The maximum draft that could be carried through the mouth of the creek on June 30, 1905, was about 3½ feet for narrow widths. Mean range of tides, 5.1 feet.

The commerce of the creek is principally in bricks, clay, and farm produce, and amounted in 1886 to about 50,000 tons, valued at about $216,000.

Details as to this improvement may be found in the Annual Report of the Chief of Engineers for 1886, page 763.

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Sketch of Cheesequake Creek is printed in Annual Report of Chief of Engineers for 1882, page 680.

July 1, 1904, balance unexpended		$15,910.44
Amount appropriated by river and harbor act approved March 3, 1905		50,000.00
Received from sale of condemned property		1.15
		65,911.59
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	$13,360.41	
Deposited to credit of Treasurer United States	315.61	
		13,676.02
July 1, 1905, balance unexpended		52,235.57
Amount (estimated) required for completion of existing project		557,752.68

(See Appendix G 5.)

6. Shrewsbury River, New Jersey.—This river is a large tidal basin in the eastern part of New Jersey, and consists of two bays, each having an area of about 3 square miles, and known, respectively, as the North Branch (or Navesink River) and the South Branch, and a channel called the main stem, which unites the two branches at their eastern ends and extends northwardly to the outlet at southeast end of Sandy Hook Bay. The river is navigable on the North Branch to Redbank, 8 miles from the mouth, where it is crossed by three bridges without draws, and on the South Branch to Branchport, 9 miles from the mouth; also to Little Silver, Oceanport, Parkers Creek, North Long Branch, and Monmouth Beach, on the several arms of the South Branch.

The part of the river which has been under improvement by the United States consists of the main stem, the North Branch to Oceanic, 5 miles from the mouth, and the South Branch to the vicinity of Seabright, about 5¼ miles from the mouth. The bays above Oceanic and Seabright had sufficient water to accommodate navigation.

Before any improvement was begun by the United States the available depth to Oceanic, on the North Branch, was 3½ feet, and to Seabright, on the South Branch, it was 2½ feet; the depth in the main stem was 4 feet. For details see Annual Report of the Chief of Engineers for 1886, page 756.

By act of Congress of August 30, 1852, $1,500 was appropriated for and expended upon a survey to ascertain the extent of a break through the beach between the Shrewsbury River and the ocean, but no work of improvement was begun.

First project: By act of Congress of July 11, 1870, a survey of the river was ordered. The report on this survey, printed in Annual Report of the Chief of Engineers for 1871, page 702, described a bar across the river nearly opposite the Navesink lights and four smaller bars above, and recommended deepening them by dredging, at an estimated cost of $14,000. The work was completed under appropriations amounting to $19,000, made in 1871 and 1873, and a new shoal near Lower Rocky Point was also dredged. The dredged channels did not long maintain the improved depth (6 feet at low tide).

Existing project, with modifications: The river and harbor act of 1875 provided for a survey of the "North and South branches of the Shrewsbury River, New Jersey." The report on this survey, printed

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in the Annual Report of the Chief of Engineers of 1876, page 278, proposed dredging at Upper and Lower Rocky Point and a training dike at the entrance to the North Branch at a total estimated cost of $18,000. This sum was appropriated by the river and harbor act of 1878, but before beginning the work it was decided to make a new and more detailed survey of the river. This survey was made in 1878, and the report, printed in the Annual Report of the Chief of Engineers for 1879, page 405, presented a plan for improving both branches of the river and main stem to obtain a channel of 6 feet depth at mean low water, with a width of 300 feet in the main stem and of 150 feet in each of the branches, by dredging and constructing pile dikes or training walls. At this time the available depth in the main stem was found to be 5.4 feet at mean low water, in the North Branch 3.5 feet, and in the South Branch, at the entrance, 2.6 feet—practically suspending all navigation in the latter channel. The plan was referred to a Board of Engineers, and with slight modifications was approved by it February 12, 1879. It provided for the construction of seven pile dikes and for dredging at seven different shoal points, at a total estimated cost of $142,086. This project was adopted March 3, 1879, when an appropriation of $10,000 was made for beginning work. No essential modification of this project has since been made. Nine dikes have been built and the shoals have been dredged and redredged frequently in order to maintain the proposed depth of 6 feet. Owing to the change in diking and to the cost of dredging being generally greater than originally estimated, it was found necessary in 1881, 1883, and 1887 to add to the estimate for the completion of the whole work. The existing project for improvement, therefore, is the project of 1879, with the modifications indicated above, and proposes to secure a channel of 6 feet depth at mean low water, with width of 300 feet up to the junction of the North and South branches and with a width of 150 feet in those branches, by means of dredging and diking at an estimated cost (including appropriation of 1878 applied to this project) of $234,062.

Report on preliminary examination and survey, with estimate, under act of June 13, 1902, is printed in Annual Report of the Chief of Engineers for 1904, page 1162.

The sum expended under the existing project to the close of the fiscal year ending June 30, 1905, was $320,227.81, of which $195,393.95 was for carrying out the project, $119,833.86 for maintenance, and $5,000 for the survey made in 1903.

During the past fiscal year dredging for improvement and maintenance was in progress under two contracts; 103,413 cubic yards of material was removed from the main stem below the Highlands bridge, the contract being completed May 17, 1905, and 61,476 cubic yards from three bars in the North Branch and six bars in the South Branch. The latter contract is still in force, but practically completed.

The maximum draft that could be carried June 30, 1905, throughout the limits of the improvement was 6 feet at mean low water in channels not less than 50 feet in width. Mean range of tides: Outer bar, 5 feet; Highlands bridge, 3 feet; Seabright bridge, 1.3 feet.

The commerce of this river, mainly in coal, farm products, fertilizer, and general merchandise, amounted in 1889 to 906,000 tons; in

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1900, to 804,000 tons; in 1901, to 488,000 tons; in 1902, to 657,000 tons; in 1903, to 761,000 tons; and in 1904 to 780,290 tons, valued at $7,051,826. The passenger traffic is important, the number of people carried by the Patten Line, South Branch, in 1902 being 264,635; in 1903, 277,257, and in 1904, 266,157.

Further details in reference to this work may be found in the Annual Reports of the Chief of Engineers for 1896, page 797, and 1900, page 185.

Sketches of Shrewsbury River are printed in the Annual Reports of the Chief of Engineers for 1879, 1881, 1882, 1887, 1890, 1891, 1892, and 1893, and a map of the whole river is printed in House Document No. 123, Fifty-eighth Congress, second session.

July 1, 1904, balance unexpended		$46,469.72
Amount appropriated by river and harbor act approved March 3, 1905		20,000.00
		66,469.72
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$26,893.95	
For maintenance of improvement	10,803.58	
		37,697.53
July 1, 1905, balance unexpended		28,772.19
July 1, 1905, outstanding liabilities		4,292.39
July 1, 1905, balance available		24,479.80
July 1, 1905, amount covered by uncompleted contracts		404.80
Amount (estimated) required for completion of existing project		19,581.51

(See Appendix G 6.)

7. Manasquan River, New Jersey.—This is a small stream in the eastern part of New Jersey which empties into the Atlantic Ocean about 26 miles south of Sandy Hook, and in its natural condition the low-water depth for several miles above the mouth varied from 4 to 6 feet. The outlet, however, was obstructed by a shifting sand bar, on which the depth did not exceed 1½ feet. After severe storms this outlet was sometimes entirely closed, remaining so until sufficient fresh water had accumulated in the river above to force an outlet into the ocean.

A project for its improvement, adopted by the river and harbor act of March 3, 1879, contemplated obtaining a permanent outlet for the river nearly at right angles to the shore, with a depth of 6 feet at mean low water; also dredging a channel in the lower river to the same depth. The estimated cost was $52,120. Work was suspended in 1883 after three appropriations, amounting to $39,000, had been expended on the improvement.

The existing project, approved March 3, 1899, with subsequent modifications, which is a modification of the original project, contemplates obtaining an outlet 6 feet deep for the river, and also in deepening the channel just above the mouth to the same depth, at an additional cost of $18,300 over the amount expended and on hand, making the total estimated cost of the improvement $59,300, to which should be added $1,075 expended for maintenance.

The amount expended to June 30, 1905, was $40,229.27, of which $39,000 was used for carrying out the project and $1,229.27 for maintenance.

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Reference to survey of the inlet is noted in the Annual Report of the Chief of Engineers for 1904, page 147.

The maximum draft that could be carried June 30, 1905, was about 2 feet at mean low water. Mean range of tides, 2.4 feet.

The commerce amounts practically to nothing. The river is used principally by small fishing craft; also by pleasure boats during the summer season.

The improvement has not advanced to the condition which would affect the rates of freight. It is stated that there will be a reduction when the entrance is made navigable.

Detailed description of this improvement, with map, is printed in the Annual Report of the Chief of Engineers for 1898, page 1070.

Histories of the work and maps are printed in the Annual Reports of the Chief of Engineers for 1880, Part 1, pages 547–556, and 1882, Part 1, page 701.

July 1, 1904, balance unexpended	$5,797.57
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	26.84
July 1, 1905, balance unexpended	5,770.73
Amount (estimated) required for completion of existing project	14,375.00

(See Appendix G 7.)

IMPROVEMENT OF DELAWARE RIVER, NEW JERSEY AND PENNSYLVANIA, AND OF CERTAIN WORKS IN DELAWARE BAY, DELAWARE.

This district was in the charge of Maj. J. C. Sanford, Corps of Engineers. Division engineer, Col. Amos Stickney, Corps of Engineers.

1. Delaware River, New Jersey and Pennsylvania.—Trenton, the head of natural and actual navigation of the Delaware River, is about 30 miles above the upper end of the port of Philadelphia. In its original condition this stretch of river was obstructed by several shoals. Between Bordentown and Trenton, a distance of about 5 miles, a narrow and circuitous channel existed, which carried only from 3 to 6 feet at mean low water. At Kinkora bar, about 9 miles below Trenton, there was a shoal carrying 7½ feet, and at Fivemile bar, opposite the upper part of Philadelphia, a shoal crossed the Pennsylvania channel carrying only 3 to 4 feet at mean low water; there was, however, a depth of 13 feet past Fivemile bar in the New Jersey channel south of Petty Island.

Below Philadelphia the river in its original condition presented obstructions at Mifflin bar, which reduced the depth at mean low water to 17 feet, at Schooner ledge and Cherry Island flats to 18 feet, at Bulkhead shoal and Baker shoal to about 20 feet, and at Duck Creek flats to about 20 feet. The lower end of Duck Creek flats is 56 miles below Philadelphia.

In that part of the Delaware River between Trenton, N. J., and Bridesburg, Pa., efforts in the past have been directed toward relieving commerce from the obstructions which exist in the upper 9 miles of the river and toward deepening the channels across Perriwig and Kinkora bars.

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Previous to 1885 the efforts to improve the river between Philadelphia and the bay were confined to dredging, except at Schooner ledge, where solid rock was removed. The work was done under appropriations for special localities, and also under general appropriations for the Delaware River below Bridesburg.

A Board of Engineers, convened by direction of the Secretary of War for the purpose of considering the subject of the permanent improvement of Delaware River and Bay, recommended, under date of January 23, 1885, the formation of a ship channel from a point opposite Philadelphia and about midway between the American Ship Building Company's yard and the Gas Trust wharf to deep water in Delaware Bay, having a least width of 600 feet and a depth of 26 feet at mean low water. The formation of such a channel was to be obtained, except at Schooner ledge, where rock would have to be removed, by regulating the tidal flow by means of dikes, with recourse to dredging where necessary, as an aid to such contracting and regulating works.

The estimated cost of obtaining a channel of the above dimensions was about $2,425,000, which covered the estimated cost of the permanent improvement of the Delaware River between the upper part of Philadelphia and deep water in the bay. The annual cost of maintenance was estimated at 10 per cent of the original cost for dredging and 1 per cent of the original cost for dikes. This estimate of cost did not include the improvement of Philadelphia Harbor, which was a separate project.

In the river and harbor act approved March 3, 1899, Congress adopted a new project for the improvement of the river, providing for the formation of a channel 600 feet wide and 30 feet deep from Christian street, Philadelphia, to deep water in Delaware Bay, at an estimated cost of $5,810,000. This project superseded the project of 1885, which provided for a depth of 26 feet at mean low water. At the time of adoption of the new project the 26-foot channel, with widths varying from 200 to 600 feet, had been formed from the upper part of Philadelphia Harbor to the bay, except at the following-named localities: Tinicum Island shoal, depth from 23.6 feet to 26 feet over a distance of about 4,200 feet; above Schooner ledge, depth from 24 feet to 26 feet over a distance of about 4,800 feet; from below Marcushook to Bellevue, depth from 23 to 26 feet over a distance of about 13,500 feet. These distances are measured on the range lines. The distances measured between the 26-foot curves on the lines of deepest water were much shorter.

At the same time there was between Trenton and Philadelphia a channel 6 feet deep at mean low water through Perriwig bar, a depth of 7 feet in the eastern channel at Bordentown, a channel 8½ feet deep through Kinkora bar, and a channel 26 feet deep over the whole width through Fivemile bar.

The entire amount expended on the improvement of the Delaware River from 1836 to June 30, 1905, under appropriations for special localities and the general river improvement, not including Philadelphia Harbor, was $6,279,278.97, of which $124,500 was expended on the part of the river between Trenton and Philadelphia.

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The total amount expended on the 26-foot project since its adoption in 1885 was $1,532,688.81, of which about $200,000 is estimated to have been applied to maintenance. In addition to this expenditure the following sums were expended since the adoption of the 26-foot channel in 1885 on special localities on the river under appropriations made for the purpose:

Channel across Smiths Island bar, between Philadelphia, Pa., and Camden, N. J	$30,000.00
Between the upper part of Philadelphia, Pa., and Trenton, N. J	37,500.00
Rebuilding and enlarging dike at junction of Schuylkill and Delaware rivers	3,000.00
Removing rock ledge opposite Petty Island	69,463.26
Expenses of Board of Engineer officers on project for channel 30 feet deep and 600 feet wide	7,000.00
Total	146,963.26

Work under the existing project was commenced under an appropriation of $300,000 contained in the river and harbor act of March 3, 1899. Under the provisions of this act $69,463.26 was applied to the improvement of the river between Trenton and Christian street, $7,000 to the expenses of the Board of Engineer officers on project for a 30-foot channel, and the balance, $223,536.74, under the existing project. The sundry civil act of June 6, 1900, appropriated the sum of $270,500 for continuing the improvement under the existing project, and sundry civil act of March 3, 1901, appropriated a further sum of $61,500 for the work.

The river and harbor act approved June 13, 1902, appropriated the sum of $600,000 for continuing this improvement under the existing general project. The same act authorized the letting of a contract or contracts to the extent of $2,400,000 additional for such materials and work as might be necessary for the prosecution of the project, to be paid for as appropriations may from time to time be made by law. The work completed during the past fiscal year, under the contracts entered into and by the operation of the plant belonging to the United States, was done under this authority. The entire amount authorized by the act to be contracted for has been appropriated.

The river and harbor act approved March 3, 1905, appropriated the sum of $500,000 for continuing this improvement under the existing general project. The same act authorized the letting of a contract or contracts to the extent of $1,000,000 additional for such materials and work as might be necessary to prosecute said improvement, to be paid for as appropriations may from time to time be made by law.

Up to the close of the fiscal year ending June 30, 1905, the sum of $3,247,626.90 was expended on the work of the existing project in surveys, in operations at Baker shoal, Duck Creek flats, Salem Cove flats shoal, Cherry Island flats, Deep Water Point, Schooner ledge, and Tinicum Island flats, and in the construction of bulkheads for the reception of dredged material. A suction dredge is under construction, and details of the work are given in Appendix H 7, herewith. None of this amount is considered as applied to maintenance, as the original project estimate includes maintenance until completion of the work.

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The changes during the past fiscal year are summarized as follows:

At Baker shoal the work of bulkhead construction has resulted in the completion of 30,627 linear feet of structure. At Cherry Island flats the work of bulkhead construction has resulted in the completion of 4,535 linear feet of structure. The work of dredging under the 30-foot project has resulted in the formation of a channel 30 feet deep at mean low water about 20,500 feet long and with an average width of 600 feet through the upper part of Baker shoal, a channel of the same depth with length of 43,000 feet and 600 feet in width through Duck Creek flats shoal, and a channel of the same depth and 600 feet in width for a distance of 12,500 feet through Salem Cove flats shoal. The channel through Cherry Island flats, Deep Water Point range, and Tinicum Island flats has been deepened and improved by suction dredges.

The greatest draft of water that could be carried at mean low water on June 30, 1905, over the shoalest part of the river below Philadelphia was about 22 feet at a short shoal near lower end of Schooner ledge range.

For 1890 the total foreign freight movement of the Delaware River was estimated at 2,923,994 tons and the total domestic freight movement at 8,433,276 tons; total, 11,356,270 tons. For 1904 the total foreign freight movement was estimated at 3,609,413 tons and the total domestic freight movement at 19,762,623 tons; total, 23,372,036 tons.

The additional work proposed in the approved project, and for a part of which funds were provided by the river and harbor act of June 13, 1902, by sundry civil acts of March 3, 1903, and April 28, 1904, and by the river and harbor act of March 3, 1905, is necessary to make the improvement available and will largely benefit commerce.

COMMERCIAL STATISTICS.

The following statement concerning the foreign commerce of the Delaware River for the years ending December 31, 1903 and 1904, is compiled from the reports of the Board of Trade, the Commercial Exchange, and the Maritime Exchange of the city of Philadelphia:

Articles.	1903.	1904.
IMPORTS.	*Tons.*	*Tons.*
Clay	66,297	60,623
Drugs and chemicals	112,159	120,300
Hemp, jute, flax, and their fabrics	29,101	30,839
Iron, manufactured	123,177	11,204
Sugar	239,975	259,601
Miscellaneous	990,540	574,781
Total	1,561,249	1,057,348
EXPORTS.		
Coal	540,030	622,611
Grain and flour	370,298	281,292
Petroleum and products	1,114,005	1,185,918
Miscellaneous	353,976	462,244
Total	2,378,307	2,552,065

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The following statement concerning the domestic and coastwise commerce of the Delaware River for the years ending December 31, 1903 and 1904, has been compiled from returns made by shippers, consignees, and carriers:

Articles.	1903.		1904.	
	Tons.	Value.	Tons.	Value.
ARRIVALS.				
Chemicals	148,462	$3,312,754	133,120	$3,509,392
Coal	399,696	1,438,000	434,259	1,574,474
Lumber	948,491	18,417,757	1,055,076	10,224,542
Sand	1,423,859	762,892	1,325,756	679,337
Miscellaneous	4,250,629	625,303,725	4,492,806	786,917,522
Total	7,171,139	649,235,128	7,441,017	802,905,267
DEPARTURES.				
Chemicals	108,902	2,444,798	132,846	3,275,241
Coal	7,452,125	30,303,465	7,656,356	29,968,722
Fertilizers	101,047	1,725,749	112,083	1,788,020
Iron, manufactured	71,414	3,984,717	94,816	3,491,730
Miscellaneous	3,982,743	473,620,790	4,325,505	617,239,823
Total	11,716,231	512,029,514	12,321,606	655,763,536

July 1, 1904, balance unexpended		$1,334,936.90
Amount appropriated by river and harbor act approved March 3, 1905		500,000.00
Amount received from sales of condemned property		485.00
		1,835,421.90
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$1,010,214.52	
By Treasury settlements 1898–99	1.35	
		1,010,215.87
July 1, 1905, balance unexpended		825,206.03
July 1, 1905, outstanding liabilities		269,263.05
July 1, 1905, balance available		555,942,98
July 1, 1905, amount covered by uncompleted contracts		146,136.00
Amount (estimated) required for completion of existing project		1,754,463.26
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905		1,000,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix H 1.)

2. Ice harbor at Marcushook, Pa.—In 1785 the Commonwealth of Pennsylvania built two wharves upon crib piers at Marcushook for the convenience of commerce. In 1829 an appropriation was made by Congress for repairing the piers and improving the harbor.

In 1866 a project was adopted for a harbor in the Delaware River to protect vessels against moving ice. The old work at Marcushook was utilized as far as possible. The amount expended from 1866 to June 30, 1905, was $213,962.46. Since 1889 all expenditures have been for repairs and maintenance. The last amount appropriated for the work was $5,000, by act of September 19, 1890.

The harbor covers an area of 12 acres, of which about one-half has a depth of 12 to 18 feet and the other half 18 to 25 feet at mean low water. The protection consists of the old landing piers and seven

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detached piers, having foundations of wooden cribs filled with stone, the superstructures being faced with cut stone. The detached piers appear to be in good condition.

During the past fiscal year 73 cents was expended for incidental expenses.

Rules for the use of the landing piers were approved by the Acting Secretary of War under date of April 29, 1904.

July 1, 1904, balance unexpended	$38.27
June 30, 1905, amount expended during fiscal year	.73
July 1, 1905, balance unexpended	37.54

(See Appendix H 2.)

3. Iron pier in Delaware Bay, near Lewes, Del.—The original project for this work proposed the construction of a landing pier about 1,700 feet in length, extending from the shore south of the breakwater into Delaware Bay to a depth of 22 feet at mean low water, the pier to consist of a substructure of wrought-iron screw piles, surmounted by a timber superstructure. The work was commenced in 1871 and completed, except as to superstructure, in 1880.

The work done to June 30, 1890, resulted in the construction of 1,155 linear feet of pier 21 feet in width and 546 linear feet 42 feet in width, or a total length of 1,701 feet. The depth of water at the outer end of the pierhead was about 21 feet at mean low water. Since construction the pier has been repaired and cared for by the United States.

The total expenditures to June 30, 1905, were $385,339.40. Of this amount $27,000 was applied to the maintenance of the improvement.

The right to use the pier for railway purposes, granted in the act of July 15, 1870, has never been exercised and doubtless never will be, as the pier has not sufficient strength to support the weight of modern frieght engines. It is therefore impossible to obtain any assistance from the railroad company in maintaining and repairing the structure.

During the past fiscal year no work has been in progress.

The pier is of great use for the purposes of the Government engineer, light-house, and quarantine services. It is of very great value to vessels frequenting the breakwater harbor in winter, when the harbor is packed with floating ice, rendering the anchorage dangerous. At such times vessels eagerly seek its shelter and protection.

It is proposed to hold the available balance of $820.60 for maintenance and repairs as needed.

The mean range of tide at the pier is 4.5 feet.

July 1, 1904, balance unexpended	$820.60
July 1, 1905, balance unexpended	820.60

(See Appendix H 3.)

4. Delaware Breakwater, Delaware.—The final report of the local officer upon this work was submitted June 19, 1899, and is printed in the Annual Report of the Chief of Engineers for 1899, page 1346.

The depths in the protected anchorage vary from 11½ to 18 feet at mean low water, and the harbor is available for vessels drawing up to about 16 feet.

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The amount expended on this work up to June 30, 1905, was $2,807,479.06. No portion of this amount has been applied to maintenance.

During the fiscal year ending June 30, 1903, a survey of the breakwater harbor was completed as a part of a survey of the national harbor of refuge.

The mean range of tide is 4.5 feet.

It is proposed to reserve the available balance of $875.64 for repairs to the breakwater and for surveys and examinations of the work.

July 1, 1904, balance unexpended	$875.64
July 1, 1905, balance unexpended	875.64

(See Appendix H 4.)

5. Harbor of refuge, Delaware Bay, Delaware.—The project for the construction of this harbor, which was adopted and provided for under the continuous-contract system in the river and harbor act of June 3, 1896, includes the construction of a breakwater on the line of least depth along the eastern branch of the shoal known as the "Shears," and the construction of a row of ice piers across the upper end of the harbor to protect it from ice descending the bay, at a total cost not to exceed $4,665,000.

No expenditures were made on this improvement previous to June 30, 1896.

Up to the close of the fiscal year ending June 30, 1905, $2,238,205.34 had been expended in the construction of the breakwater and ice piers.

No part of this amount was applied to the maintenance of the work.

During the fiscal year ending June 30, 1904, the sum of $338.43 was expended on a survey made of the harbor.

The breakwater was completed on December 11, 1901. The superstructure of the breakwater has a length of 7,950 feet and the substructure a length of 8,040 feet, measured on the low-water line.

A project for the construction of 10 ice piers was submitted on April 5 and approved April 23, 1900. This work was commenced during the fiscal year ending June 30, 1901, and completed November 22, 1902. Seventy-one thousand three hundred tons of stone was deposited in the work.

A project for the construction of additional ice piers was submitted under date of June 7 and approved June 30, 1902. Work under this project was begun August 4, 1902, and completed June 19, 1903. Thirty-seven thousand six hundred and seventy-three tons of stone was deposited, completing 5 ice piers.

A report was submitted under date of November 19, 1902, containing project and estimates for further protection of the harbor. A further report on this subject, containing a detailed project and estimate of cost of the proposed extension of the breakwater at this harbor, was submitted under date of November 14, 1903. Both reports and the recommendations of the Board of Engineers for Rivers and Harbors are published in House Document No. 548, Fifty-eighth Congress, second session, and also contained in the Annual Report of the Chief of Engineers for 1904, pages 1215–1225.

It is proposed to reserve the available balance of $1,128.66 for repairs and surveys and examinations of the work.

The great value of this harbor to commerce is due to its location. It is about equidistant from New York, Philadelphia, and the capes

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of Chesapeake Bay (the ocean entrance for the ports of Baltimore, Norfolk, and Newport News), and is therefore an especially convenient port of call for the entire commerce of the North Atlantic coast. It is now largely used by vessels awaiting orders to ports for discharge or loading. During the year ending December 31, 1904, 1,171 vessels (not including small craft) called at this harbor.

By the construction of the breakwater the usefulness of this anchorage has been greatly increased not only as a port of call, but also as a harbor of refuge. Vessels bound from northern to southern or from southern to northern ports are able to go to sea in doubtful weather with the assurance of finding ample protection at the Delaware capes if overtaken by storm.

Details as to this improvement may be found in the Annual Report of the Chief of Engineers for 1897, page 1216. A map is printed in House Executive Document No. 112, Fifty-second Congress, first session.

The mean range of tide is 4.5 feet.

July 1, 1904, balance unexpended		$1,132.91
Treasury settlement, June 9, 1898	$0.46	
June 30, 1905, amount expended during fiscal year	3.79	
		4.25
July 1, 1905, balance unexpended		1,128.66

(See Appendix H 5.)

6. Removing sunken vessels or craft obstructing or endangering navigation.—(*a*) *Wreck of canal boat in Schuylkill River.*—This wreck, lying in the western draw passage of the Grays Ferry highway bridge, was considered an obstruction to navigation. Its removal was authorized on December 14, 1903. Work under the existing contract for the removal of this wreck has not yet been commenced.

(*b*) *Wreck of barge Alice in Delaware River near Tinicum Island.*—This wreck was considered an obstruction to navigation; its removal was authorized on June 30, 1904. The wreck has not yet been removed.

(*c*) *Wreck of barge Santiago in national harbor of refuge, Delaware Bay.*—This wreck was considered a dangerous obstruction to navigation; its removal was authorized on January 17, 1905. The work of removal is in progress. The contractor paid the United States $3,160 for the wreck and agreed to do the work of removal.

(*d*) *Wreck of Philadelphia City ice boat No. 3 in national harbor of refuge, Delaware Bay.*—This wreck was considered a menace to navigation; its removal was authorized February 25, 1905. The work of removal is in progress.

(*e*) The removal of the wreck of the schooner *Lottie K. Friend* from Delaware Bay, about 1¼ miles west of Ship John light, under a contract dated February 18, 1897, with Thomas Poynter and Elijah D. Register, of Lewes, Del., in progress during the fiscal year ending June 30, 1897, was not completed, and the annulment of the contract was recommended June 16, 1898, and approved June 18, 1898. This wreck has not yet been removed.

The amount expended during the past fiscal year upon removal of wrecks was $1,039.63.

(See Appendix H 6.)

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IMPROVEMENT OF RIVERS AND HARBORS IN SOUTHERN NEW JERSEY, OF CERTAIN RIVERS AND HARBORS IN DELAWARE, AND OF INLAND WATERWAY FROM CHINCOTEAGUE BAY TO DELAWARE BAY, VIRGINIA, MARYLAND, AND DELAWARE.

This district was in the charge of Capt. C. A. F. Flagler, Corps of Engineers. Division engineer, Col. Amos Stickney, Corps of Engineers.

1. Rancocas River, New Jersey.—The Rancocas River is a tributary of the Delaware River, its mouth being about 11 miles above the Pennsylvania Railroad terminal and ferry at Camden, N. J.

In the original condition the minimum depth was 4½ feet at mean low water from the junction of the forks near Centerton to its mouth, a distance of 7½ miles. Above Centerton the depth on the Mount Holly Branch, a distance of 5½ miles, was generally about 2½ feet. From the forks to Moores Landing, the head of navigation on the Lumberton Branch, a distance of 3.6 miles, the low-water depth over shoal places was 3 feet. The mean range of tides at Centerton is about 5 feet.

The original project of 1881 proposed the formation, by a dike at Coates bar and dredging elsewhere, of a channel from 150 to 200 feet wide and 6 feet deep at mean low water from the mouth to Centerton and thence to Mount Holly a channel 5 feet deep. Operations under this project were carried on from 1881 to 1895, and were directed to the formation of a low-water channel 100 feet wide and 6 feet deep from the mouth to Centerton and 50 feet wide and 5 feet deep for a distance of about 1¾ miles above Centerton. The unexpended balance, $399.70, has been returned to the surplus fund of the Treasury.

An appropriation of $2,000 for this river, made in the act of June 3, 1896, was required by the act to be expended in the improvement of the Lumberton Branch and was applied in the fiscal year 1898 to dredging through the shoals at Pattersons Landing, below Paxsons Landing, and partly through the shoal above Paxsons Landing, the channel having a width of 30 feet and a mean low-water depth of 6 feet, and an appropriation of $2,000, made in the river and harbor act of March 3, 1899, was likewise required to be expended in the Lumberton Branch and was applied to dredging a channel with a depth of from 6 to 7 feet at mean low water and a width of 30 feet through the shoal below Moores Landing.

The river and harbor act of June 13, 1902, appropriated $3,000 for continuing the improvement of the Lumberton Branch, and for its expenditure a project was approved providing for the construction of contraction works, consisting of low wing dams, to be located at places where the channel had been dredged and had refilled. The work was completed on July 24, 1903. In all, 18 wing dams were built. Of these, 11 were placed on the north side and 7 on the south side, covering the stretch from the forks up to the highway bridge at Hainesport, a distance of about 2½ miles.

The expenditure during the year was for contingent expenses.

The amount expended on this improvement to June 30, 1905, is $44,479.45, of which $6,979.24 was on the Lumberton Branch.

The maximum draft that could be carried June 30, 1905, at mean low water, over the shoalest part of the river between the mouth and the forks and Centerton was 7 feet, and above, to Moores, about 6 feet.

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It has been impracticable to ascertain what direct effect the improvement of the channel has had upon freight rates, or the extent of the commerce during the past year. For 1903 the commerce reported was 462,971 tons, valued at $9,634,550.

No work was done on the improvement during the past fiscal year.

July 1, 1904, balance unexpended		[a] $433.21
June 30, 1905, amount expended during fiscal year:		
For maintenance of improvement	$12.75	
June 30, 1905, covered into surplus fund, United States Treasury	[a] 399.70	
		412.45
July 1, 1905, balance available		[b] 20.76

(See Appendix I 1.)

2. Cooper Creek, New Jersey.—This creeks enters the Delaware River in the city of Camden, just above Cooper Point. It was navigable at mean high water for a distance of 9 miles from its mouth for vessels drawing 5 feet, and for the first 5 miles for vessels of 11½ feet draft. The mean range of the tide at the mouth is about 6 feet. For a distance of 1½ miles from the mouth the width of the stream averaged about 80 feet at low water and about 120 feet between the banks, and the channel in its original condition had a depth at mean high water of from 12 to 15 feet, except at one place, where the depth was 9½ feet.

The project for this improvement was adopted in the river and harbor act of June 3, 1896, and is printed in the Annual Report of the Chief of Engineers for 1895, page 1102. It provides for the formation, by dredging, of a channel 70 feet wide at bottom and 18 feet deep at mean high water from the mouth of the creek to Browning's Chemical Works, and a channel of the same dimensions through the bar just outside the mouth—in all, a distance of about 9,000 feet. The estimated cost, including contingencies, is $35,000.

The river and harbor act of June 3, 1896, appropriated $37,000 for completing this improvement, of which $2,500, or as much thereof as might be necessary, was to be expended in rebuilding the dike on the Government reservation in the Delaware River at Woodbury Creek.

During the fiscal year ending June 30, 1897, the sum of $2,500 was expended in rebuilding the dike on the Government reservation at Woodbury Creek, and in 1898–99 the channel in Cooper Creek was dredged. The dredging resulted in the formation of a channel extending from the mouth to the Camden Iron Works, 7,500 feet long, 50 to 70 feet wide, except at the bridges, where the widths are 30 feet, and 18 feet deep at mean high water, except on the water pipe belonging to the city of Camden at State street, where the high-water depths are 14 to 15 feet.

No work was done on the improvement during the past fiscal year. The disbursement was for contingent expenses.

The amount expended to June 30, 1905, is $25,882.55, exclusive of the $2,500 expended in rebuilding the dike at Woodbury Creek. Of this amount $206.45 was for maintenance.

It is proposed to complete the improvement with funds now available as soon as the city of Camden removes or lowers the water pipe

[a] $399.70 pertains to Mount Holly Branch.
[b] Pertains to Lumberton Branch.

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at State street, which, it was understood, it contemplated doing last year.

The maximum draft that could be carried on June 30, 1905, at mean low water over the shoalest part of the channel was 7 feet to the Camden Iron Works and 5 feet to Browning's Chemical Works.

No statement of the commerce of the creek for the last calendar year could be obtained. That reported for 1903 was 414,838 tons, valued at $3,820,974.

The effect of the improvement made in this stream on freight rates is that it has reduced the rates by permitting larger vessels to be secured for long voyages, which was formerly impossible. The railroad rates to points in the United States east of Cape Cod are 25 per cent higher than by water.

July 1, 1904, balance unexpended	$8, 618. 81
June 30, 1905, amount expended during fiscal year	1. 36
July 1, 1905, balance unexpended	8, 617. 45

(See Appendix I 2.)

3. Mantua Creek, New Jersey.—Mantua Creek is a stream flowing into the Delaware River at a point about 10 miles below the terminal and ferry of the Pennsylvania Railroad at Camden, N. J.

In its original condition it was navigable at high water for a distance of one-half mile above its mouth to the phosphate works of the I. P. Thomas & Sons Company for vessels of 13 feet draft; thence 3¼ miles farther, to Paulsboro, for vessels drawing 9 feet; thence 3¼ miles to Parkers Landing for tugs and barges drawing 6 feet, this being the head of steam navigation; thence 4.1 miles to Mantua, 11¼ miles above the mouth, small boats and barges of 3 to 4 feet draft passed up on the tide. The navigable portion is generally bordered by low ground, protected from overflow by earthen banks. The general course of the stream is tortuous, and its navigation is much obstructed by bars, sharp bends, and the upper portion by stumps and overhanging trees. The stream, on account of its flat watershed, is subject to only moderate freshets, which seldom exceed 2 to 3 feet above tide water. The range of tide is 6 feet at the mouth, 4.5 feet at Paulsboro, 3.4 feet at Berkley, and 2 feet at Mantua, which is the head of navigation. The low-water width near the mouth averaged 160 feet, decreasing to about 100 feet at Paulsboro. Above Paulsboro the width decreased to 88 feet at Parkers Landing, and near Mantua to 50 feet.

The approved project for the improvement, which was adopted by Congress in river and harbor act of March 3, 1899, contemplates the dredging of a channel 100 feet wide on the bottom and 12 feet deep from the 12-foot contour in the Delaware River, through the marsh to the phosphate works, a distance of 2,200 feet; thence 80 feet wide on the bottom and 8 feet deep to Paulsboro, 6,300 feet, making a channel nearly direct by cutting off three bends; thence to Parkers Landing, near Berkley, 3 miles, with one cut-off 60 feet wide and 7 feet deep; and the dredging of a cut-off 350 feet long, 50 feet wide, and 3 feet deep, 9,000 feet above Berkley; also the removal of overhanging trees above Berkley and the construction of jetties on both sides at the mouth of the creek. The estimated cost of this improvement is $145,030. Such land and rights as were considered necessary for the

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cut-offs were purchased in September, 1900, at a cost of $8,000, and during the fiscal year ending June 30, 1901, the channel between the phosphate works and Paulsboro was dredged to the project dimensions and the three cut-offs made as planned.

The river and harbor act of June 13, 1902, appropriated $35,000 for continuing the improvement and contract was made for dredging the channel from the Delaware River to the phosphate works. Work under this contract was begun in November, 1903, and after many interruptions was completed in January, 1905. A channel was dredged between the points named to a depth of 12 feet at mean low water. The width made was 110 feet across the flats and 100 feet at the upper and lower ends. Plans, etc., for the jetties necessary for the protection of the channel at the mouth as far as available funds will permit are now in preparation.

The amount expended on this improvement to June 30, 1905, no part of which was for maintenance, was $47,430.31, of which $44,430.31 is on the present project.

The maximum draft that could be carried on June 30, 1905, at mean low water over the shoalest part of the creek under improvement was 10 feet to the phosphate works, 5½ feet thence to Paulsboro, and 2½ feet thence to Parkers Landing.

It has been impracticable to obtain commercial statistics for 1904. Those reported for 1903 were 136,105 tons, valued at $1,638,790.

The improvement of Mantua Creek is reported to have reduced freight rates on car floats by fully 25 per cent, and has greatly facilitated shipments.

July 1, 1904, balance unexpended	$32,521.86
June 30, 1905, amount expended during fiscal year, for works of improvement	16,952.17
July 1, 1905, balance unexpended	15,569.69
Amount (estimated) required for completion of existing project	85,030.00

(See Appendix I 3.)

4. Alloway Creek, New Jersey.—This is a tidal tributary of the Delaware River, flowing westerly in the southwestern part of New Jersey, its mouth being about 50 miles below Camden, N. J. In its original condition the creek was obstructed between its mouth and Quinton, a distance of about 10 miles, by shoal areas in the upper half of the stream, which reduced the low-water depths to from 1.3 to 4 feet. The mean range of tide is 6 feet at the mouth and 4 feet at Quinton, the head of navigation.

The original project of 1889 proposed the formation by dredging of a channel 6 feet deep at mean low water and 60 feet wide from Quinton to a point about 1,000 feet above upper Hancock Bridge; thence a channel of the same depth and 75 feet wide to a locality known as "The Square," where the work was to be supplemented by a dike. At a locality known as the "Canal," in addition to a channel of the last-named dimensions, the width of the stream was to be increased to about 150 feet between its low-water lines. The project was modified on December 10, 1896, so as to provide for a dike formed by a single row of piles above upper Hancock Bridge. This modification does not increase the original estimated cost of the work, which is $25,000.

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At the close of the fiscal year ending June 30, 1900, $18,000 had been expended in dredging below The Square, at The Square, at Smith Reeves, at and near the Canal, just below upper Hancock Bridge, from upper Hancock Bridge to a point about 1,400 feet above it, above and below Robinsons Landing, upper and lower Fowsers, upper and lower Lamberts, and Quinton, and in dike construction at The Square and above upper Hancock Bridge. Channels from 40 to 75 feet wide and 6 feet deep at mean low water had been dredged at the above-mentioned localities, and dikes 300 and 404 feet in length, respectively, had been constructed at The Square and above upper Hancock Bridge. Of this amount about $1,200 had been expended for the maintenance of dredged channels.

In 1903, with the $3,000 appropriated by the river and harbor act of June 13, 1902, the channel was dredged at various points between the upper end of a shoal just above Hancock Bridge and a point about 3 miles below, forming a continuous channel 6 feet deep at mean low water and 60 feet wide between the points named.

No work was done on the improvement during the past fiscal year.

The river and harbor act of March 3, 1905, appropriated $3,000 for continuing the improvement and for maintenance. A project for the expenditure of this appropriation in removing shoals between The Square and a point about 1,000 feet above upper Hancock Bridge and for dredging thence toward Quinton was duly approved and proposals invited for the work, to be opened June 21, 1905, but none was received. The advisability of doing the work either by readvertising for proposals or by day labor was under consideration at the close of the fiscal year.

The amount expended on this improvement to June 30, 1905, is $20,995.44, of which $4,506.42 was for maintenance. The expenditures during the year were for outstanding liabilities and examinations.

The maximum draft that could be carried on June 30, 1905, at mean low water over the shoalest part of the locality under improvement to Quinton was 5½ feet.

The commerce of the creek consists of miscellaneous articles, such as coal, sand, lumber, agricultural products, etc. The tonnage for the year 1904 was 60,350, valued at $1,093,200.

The freight rates are reported to have been lowered by reason of the improvement of the creek, but to what extent is not stated. Larger boats are enabled to enter and depart, and shipments have been facilitated very much by avoiding delays in waiting for tides.

Local interests in the navigation of this stream are desirous of having a cut-off made at a bend known as "Fosters Bottle." The proposed cut-off is to be about 1,200 feet long, 75 feet wide, and 6 feet deep at mean low water. Its lower end is about 7,000 feet above the mouth of the creek and the bend 7,000 feet long. It will shorten the distance to the mouth by over a mile and will remove two difficult turns and be an improvement to the stream. The estimate for the entire work will not be increased if the proposed cut-off be made, and it is understood that the necessary land—a strip 250 feet wide—will be deeded to the United States free of expense.

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July 1, 1904, balance unexpended	$297.30
Amount appropriated by river and harbor act approved March 3, 1905	3,000.00
	3,297.30
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	292.74
July 1, 1905, balance unexpended	3,004.56
Amount (estimated) required for completion of existing project	5,200.00

(See Appendix I 4.)

5. Goshen Creek, New Jersey.—This creek rises in the central part of Cape May County, N. J., and discharges into Delaware Bay about 15 miles north of Cape May.

In its original condition Goshen Creek carried a low-water depth of from 2 to 4 feet, with a least low-water width of 20 feet and a high-water width of 36 feet from Goshen to a point about 4,000 feet below; and thence to the mouth, a distance of about 2,500 feet, a low-water depth of from 3 to 5 feet, with a least width of 30 feet. The range of tide is about 5 feet.

The project for its improvement, adopted in 1891, proposed the deepening and widening by dredging of the 4,000 feet of the creek below Goshen Landing, which may be said to be the head of navigation, to a low-water depth of 3 feet and a width of 30 feet, the formation of a dredged channel 3 feet deep and about 50 feet wide through the bar at the mouth to the limit of the same beyond the low-water line, and the protection of the channel by a sheet-pile jetty.

The improvement was commenced during the fiscal year ending June 30, 1893, and to the close of the year the sum of $2,270.16 had been expended in widening and deepening the channel to the proposed dimensions over a distance of about 3,975 feet below Goshen Landing. By this work about one-fourth of the projected improvement had been completed and the navigable conditions had been proportionately improved.

During the fiscal year ending June 30, 1897, the pile dike was constructed to its projected length of 600 feet, and 8,002 cubic yards of material was removed from the channel in the vicinity of the dike.

The original cost of the project, made in 1891, was estimated at $12,000, this estimate being based on a single appropriation of that amount, by which the improvement could be made in a single season. On account of the small appropriations the execution of the work was carried through an interval of several years, and it was not executed with sufficient rapidity to prevent injurious changes, which considerably increased the cost of the improvement.

During the fiscal year ending June 30, 1898, an estimate for the completion of the project, based on a careful survey of existing conditions, was made. In order to maintain the dredged channel it was found necessary to extend the dike somewhat farther inshore and dredge through the bar at the mouth of the creek, which increased the cost of the project from $12,000, as originally estimated, to $17,000.

The river and harbor act of March 3, 1899, appropriated $8,000 for the completion of this improvement. During the fiscal year ending June 30, 1899, a project for the expenditure of this sum and of a balance remaining from a previous appropriation was submitted and approved. The project provides for dredging a channel with a low-

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water depth of 3 feet entirely through the mouth of the creek and for repairing and extending the existing dike and constructing a short dike on the upper side of the mouth of the creek. Work under this project was commenced during the fiscal year ending June 30, 1899.

During the fiscal year ending June 30, 1900, under this project the existing dike was repaired and strengthened with brush and stone; two parallel brush and stone dikes, on opposite sides of the creek entrance, with a total length of 680 feet, were constructed; 10,436 cubic yards of material, dipper measurement, was removed from the bar at the mouth of the creek, and one of the brush and stone dikes repaired. By the work done the improvement was completed.

The total amount expended to the close of the fiscal year ending June 30, 1905, was $16,228.77, of which amount it is estimated that about $870 was expended for maintenance.

No work was done on the improvement during the past fiscal year and no further work is contemplated. The unexpended balance has been covered into the surplus fund of the Treasury. No further reports will be submitted.

No commercial statistics have been received for the past year. The commerce reported in 1903 was only $3,300. That reported in 1900 was $438,900, and the depreciation is stated to be due to excessive shoaling at the bar. The maximum draft that could be carried at mean low water in the creek when last reported, June 30, 1904, was 2 feet.

July 1, 1904, balance unexpended	$771.23
June 30, 1905, covered into surplus fund United States Treasury	771.23

(See Appendix I 5.)

6. Tuckerton Creek, New Jersey.—This is a tidal stream flowing into Little Egg Harbor, on the Atlantic coast, northeast of Atlantic City. A preliminary examination and survey of the creek were made, and a report recommending its improvement was transmitted to Congress and is printed in House Document No. 274, Fifty-sixth Congress, first session; also in Annual Report of the Chief of Engineers for 1900, pages 1612–1615.

The original low-water depth at Tuckerton, the head of navigation, was 15 inches, which increased gradually to 4 feet at the mouth of the creek, a distance of 2 miles. From the mouth of the creek across the flats to Gaunts Point, three-fourths of a mile, the low-water depths were 2 to 2½ feet. The mean tidal range is 2½ feet. The project, adopted by the river and harbor act of June 13, 1902, contemplates the dredging of a channel 6 feet deep at mean low water and 80 feet wide from Gaunts Point, seven-eighths of a mile to the mouth of the creek; thence a channel of the same depth and 75 feet wide, 1 mile to Parkers Landing; thence a channel of the same depth and 60 feet wide, five-eighths of a mile farther, to West Tuckerton Landing; thence a channel 5 feet deep at mean low water and 60 feet wide for three-eighths of a mile to just above Scow Landing; and thence a channel 3 feet deep at mean low water and 40 feet wide for one-eighth of a mile to the milldam at Tuckerton, together with the widening of the channel at sharp bends, the channel across the cove between the mouth of the creek and Oyster Bed Point to be supplemented, if necessary, by a revetment wall along its northern side. The estimated cost of the work, including contingencies, is $61,380.

The plan was adopted by Congress in the river and harbor act of

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June 13, 1902, which appropriated $12,000 thereon, and with this appropriation the channel was dredged, between May, 1903, and February, 1904, from a point five-eighths of a mile above the mouth to the milldam at Tuckerton, the width made being 75 feet to Parkers Landing; thence 60 feet to just above Scow Landing, and thence 40 feet to the milldam. The depth made was 4 feet at mean low water between the milldam and a point about 300 feet below Daddy Tuckers Creek, and 6 feet thence for a distance of 1,500 feet below.

The river and harbor act of March 3, 1905, appropriated $12,000 for continuing improvement and for maintenance, and provided that the Secretary of War might, in his discretion, direct that the plan heretofore adopted for this improvement may be modified, provided the cost of completion shall not exceed the estimate heretofore made for the work. In accordance therewith, and to meet the wishes of those directly interested in the improvement, the Secretary of War, under date of April 11, 1905, approved the modification of the project by extending the channel from the mouth of the creek in a south-southeast direction to deep water at the head of Marchelder channel in lieu of dredging to Gaunts Point. The change will give a straighter and shorter course to the inlet and will not be more expensive than under the original project. For the expenditure of the available funds a project was approved which provides for dredging from the point where work was last suspended, abreast of Flax Island, downriver to the mouth, and thence by the new route toward Marchelder channel, to the 6-foot depth in Little Egg Harbor, the width and depth to be made approximately 50 feet and 6 feet at mean low water, respectively.

Proposals for this dredging were opened June 19, 1905, and contract awarded under which the work therein provided for is expected to be completed about the end of this year.

The amount expended on this improvement to June 30, 1905, is $12,178.36, no part of which was for maintenance.

The maximum draft that could be carried on June 30, 1905, at mean low water, over the shoalest part of the improvement was 2½ feet from the mouth to Tuckerton and 3 feet across the flats from the mouth.

The improvement of Tuckerton Creek is not yet sufficiently advanced to show any material decrease in freight rates. Shipments from distant points have, however, been increased and facilitated, and lumber-laden vessels now come and await tides to make landings.

The commerce reported for the calendar year 1904 is reported to have been 17,330 tons, valued at $564,880.

July 1, 1904, balance unexpended	$129.42
Amount appropriated by river and harbor act approved March 3, 1905	12,000.00
	12,129.42
June 30, 1905, amount expended during fiscal year, for works of improvement	307.78
July 1, 1905, balance unexpended	11,821.64
July 1, 1905, outstanding liabilities	50.00
July 1, 1905, balance available	11,771.64
Amount (estimated) required for completion of existing project	37,380.00

(See Appendix I 6.)

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7. Raccoon Creek, New Jersey.—This creek rises in Gloucester County, flows in a northwesterly direction, and empties into the Delaware River at a point nearly opposite Marcushook, Pa. A preliminary examination and survey of Raccoon Creek was made in 1899, and a report, with estimated cost of improvement, was submitted to the Secretary of War, under date of December 18, 1899, and printed in House Document No. 231, Fifty-sixth Congress, first session; also on pages 1590 to 1598, Annual Report of the Chief of Engineers for 1900.

It was navigable at high water for a distance of three-fourths mile above its mouth to Bridgeport for vessels of 9 feet draft; thence 3¼ miles farther to Springer's wharf for vessels drawing 7 feet, and thence 4¾ miles to Swedesboro, the head of steam navigation, for boats and barges having a draft of 4 feet. Above Swedesboro the stream was narrow, shoal, and very crooked. The navigable portion, when it left fast land, wound through meadows lying 2 or 3 feet above low water, which, except for the 2 miles immediately below Swedesboro, were generally protected from overflow by revetted earthen banks. Navigation was much obstructed by bars and a few sharp bends.

The range of tide at the confluence with the Delaware River is 6 feet; at Bridgeport, 1¾ miles above the mouth, it is also 6 feet; at Kirbys Landing, 3 miles above the mouth, 5.8 feet; at Davenport's wharf, 4½ miles from the mouth, 5.6 feet; at Leap's wharf, 5¾ miles from the mouth, 5.6 feet; at Adolph Black's wharf, 7¾ miles above the mouth, 5.3 feet; while at Swedesboro it is 4.9 feet, though at the latter place it is considerably influenced by winds and freshets.

The approved project, adopted by river and harbor act of June 13, 1902, proposes the formation of a dredged channel 7 feet deep and 75 feet in width at mean low water, from the mouth for a distance of 1¾ miles to Bridgeport; thence a channel of the same depth and 60 feet wide to Springer's wharf, and thence a channel 5 feet deep at mean low water and 40 feet in width to the head of navigation at Swedesboro, 9¾ miles from its mouth, together with the widening of the channel around sharp bends, at an estimated cost of $102,135. That act appropriated $15,000, and between August, 1903, and March, 1904, a continuous channel not less than 7 feet deep at mean low water and a width of not less than 75 feet was dredged from the mouth of the creek to the highway bridge at Bridgeport, and thence across Springer's bar to a width of 60 feet, the depth made being 7 feet at mean low water. The length improved is about 5 miles.

The amount expended on this improvement to June 30, 1905, is $14,944.70, no part of which was for maintenance, exclusive of $757.23 expended for an examination under act of August 2, 1882.

The maximum draft that could be carried June 30, 1905, at mean low water, over the shoalest part of the creek to Bridgeport is 4 feet.

The improvement of this stream has so far had no marked effect upon freight rates, as the improvement made extends only about half the way up the creek. Bulky freight by water, however, costs only about half that by rail.

The commerce of the creek during the calendar year 1904 is reported to have been 252,389 tons, valued at $3,300,000.

The river and harbor act of March 3, 1905, appropriated $15,000 for continuing the improvement, and a project for the expenditure of

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the available funds was approved on April 11, 1905. This provides for dredging to a depth of 7 feet between the mouth and Springer's wharf, the width to be 75 feet to Bridgeport and 60 feet thence to Springer's wharf, and above that point to a depth of 5 feet and width of 40 feet. Proposals for this work were opened June 20, 1905. At the close of the fiscal year award of contract was under consideration.

A cut-off at Molonox shoal, about 5½ miles above Bridgeport, is much desired by the local interests and will be a valuable improvement to the stream. It will shorten the run from Swedesboro 2,950 feet and will eliminate eight bad bends. It can be executed for about $1,000 more than would be required to dredge the channel in the bends cut off. If authorized, the present estimated cost of the improvement will not be increased thereby, and the necessary land, with right of way 200 feet wide, will, it is stated, be deeded, without expense, to the United States.

July 1, 1904, balance unexpended	$3,659.69
Amount appropriated by river and harbor act approved March 3, 1905	15,000.00
	18,659.69
June 30, 1905, amount expended during fiscal year, for works of improvement	1,361.62
July 1, 1905, balance unexpended	17,298.07
Amount (estimated) required for completion of existing project	72,135.00

(See Appendix I 7.)

8. Wilmington Harbor, Delaware.—The harbor of Wilmington, Del., is in the Christiana River and includes a length of about 4 miles above its mouth at the Delaware River. It also includes the navigable portion of the Brandywine River, which flows into the Christiana River at a point about 1¾ miles above its mouth.

Previous to 1836, when the first appropriation for the improvement of the Christiana River was made, the low-water depth at the entrance to this stream was about 8½ feet. The minimum depth in the channel in the portion of the river below Third Street Bridge, Wilmington, was 8 feet. This depth was increased in 1836 by dredging to 10 feet below low water.

The present project is based upon a survey made in 1895 (see the Annual Report of the Chief of Engineers for 1896, pp. 974 to 998) and provides for the formation, by dredging, rock removal, and construction of dikes, of a channel in the Christiana River 21 feet deep at mean low water from that depth in the Delaware River to the pulp works, a distance of about 4 miles, and thence diminishing to a depth of 10 feet at mean low water to the draw pier of the Philadelphia, Baltimore and Washington Railroad cut-off bridge No. 4, the width at bottom varying between 250 feet at the mouth and 200 feet at bridge No. 4. The project further provides for the removal of shoals from bridge No. 4 to Newport to a depth of 7 feet at mean low water. The width made under the present project is 200 feet from the pulp works to the mouth of the Brandywine, and thence to the 21-foot contour in the Delaware River, 250 feet, except a stretch of about 1,750 feet extending up from a point opposite the light-house at the mouth, where the width was made only

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200 feet. The depth made was 21 feet, and over the rock ledges above and below Third Street Bridge about 21½ feet.

A history of the improvement and the work done under this and previous projects will be found in the Annual Report of the Chief of Engineers for 1901, pages 246 to 249.

During the fiscal year 1903 a survey was made of the river extending from the 21-foot contour in the Delaware River to the draw pier of the Philadelphia, Baltimore and Washington Railroad cut-off bridge No. 4, and report thereon with maps was submitted under date of March 26, 1903.

The river and harbor act of June 13, 1902, appropriated $50,000 for continuing the improvement and for maintenance, with a proviso that not more than $25,000 thereof shall be expended until arrangements have been made by the city of Wilmington, and approved by the Secretary of War, to dispose of the sewage from the city in such manner as to prevent the filling of the channel. For the expenditure of $25,000 of this appropriation a project was approved August 15, 1903, and under this a shoal, extending a length of about 3,400 feet between the Third Street Bridge and the Market Street Bridge, was dredged to a depth of 18 feet at mean low water for a width of between 100 and 150 feet, resulting in a channel 18 feet deep at mean low water and a width of 200 feet from the Third Street Bridge to the lower end of the Pusey & Jones yards, thence 100 feet wide to the foot of French Street, and thence an average width of 200 feet to Market Street Bridge. A shoal between the mouth of the Brandywine and the Pennsylvania Railroad cut-off bridge No. 3 was dredged to a width of 200 feet to the bridge and of 100 feet through the south draw, the depth made being 20 feet at mean low water, and a shoal extending a length of about 2,500 feet between the Baltimore and Ohio Railroad bridge and the pulp works was dredged to a width of 100 feet and depth of 16 feet at mean low water.

Under date of December 8, 1904, a Board of officers was convened by authority of the Secretary of War to consider the establishment of harbor lines at the harbor of Wilmington, Del. The Board met, held a public hearing regarding the matter, and concluded to have a detailed survey made, in so far as may be necessary, to express accurately on a map the positions of the harbor lines to be recommended by the Board in its report. This survey is now in progress and will be completed shortly.

The river and harbor act of March 3, 1905, provides as follows:

> Improving harbor at Wilmington, Delaware: Continuing improvement and for maintenance, up to Third Street Bridge, twenty-five thousand dollars, in addition to the amounts heretofore appropriated, which are hereby made available and the restrictions upon the expenditure of which are hereby removed.

Under date of April 27, 1905, the Chief of Engineers approved a project for the expenditure of about $40,000 of the $50,000 made available by the act above quoted, the remaining $10,000 to be held for dredging on such places as may need immediate relief in 1906, and to defray the expenses of the survey for the harbor lines, estimated at about $1,800. This project provides for dredging a channel 18 feet deep, 200 feet wide from the Third Street Bridge to the mouth of the Brandywine, and thence 250 feet wide to the Delaware River, and for repairing the north jetty at the mouth of the Christiana River and that at the mouth of the Brandywine. The jetty work is

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now in progress and will soon be completed, and proposals for the required dredging were opened on June 26, 1905. It is expected that this dredging will be completed by June 30, 1906.

The maximum draft that could be carried on June 30, 1905, at mean low water, over the shoalest part of the river between the mouth and the Third Street Bridge is 15 feet, and thence to the pulp works 14 feet.

The amount expended on this improvement from 1836 to June 30, 1905, is $870,323.79. Of this amount $468,203.58 was expended on the present project, and of which $24,550.95 was for maintenance.

The tonnage and value of the leading articles shipped to and from the port of Wilmington in 1904, as reported by the board of trade, in addition to the foreign shipments, was 680,263 tons, valued at $31,343,099. The shipbuilding industry on this river is quite extensive.

The harbor improvements do not directly affect freight rates on light-draft boats. Shipments thereon made by water range about 25 per cent lower in rate than by rail, and still more in deep-draft vessels, of which there are many, covering shipments to and from the manufacturers and shipbuilding plants.

July 1, 1904, balance unexpended	$57,477.94
Amount appropriated by river and harbor act approved March 3, 1905	25,000.00
	82,477.94
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	24,550.95
July 1, 1905, balance unexpended	57,926.99
July 1, 1905, outstanding liabilities	8,480.00
July 1, 1905, balance available	49,446.99
July 1, 1905, amount covered by uncompleted contracts	835.00

(See Appendix I 8.)

9. Appoquinimink, Murderkill, and Mispillion rivers, Delaware.—(*a*) *Appoquinimink River.*—At the time of the adoption of the present project there was a mean low-water depth of 2 feet at the entrance into Delaware Bay, and the shoalest depth inside the river was 4½ feet. The most serious obstructions to the navigation of the river were the many bends in the lower and middle sections.

The approved project is based upon a survey made in 1889, and provides for a channel 8 feet deep at mean low water, having a width of 80 feet from the bridge at Odessa, the head of navigation, to near Townsend's wharf, a distance of 3¼ miles, and a width of 100 feet from this wharf to the mouth of the river, a distance of 5 miles. The estimated cost of the improvement was $39,963.

In 1891 the channel was dredged to the full width of 80 feet and depth of 8 feet at mean low water for a distance of 1,975 feet in a down-river direction, beginning at the lower end of Watkins wharf, at Odessa, and early in 1893 a farther distance of 4,487 feet was dredged. Of the latter 595 feet was dredged to the approved width, but on account of the settlement and sliding in of the very soft marsh bank upon which the excavated mud and sand were deposited, the full approved width of 80 feet could not be made along the remaining 3,892 feet, and it was therefore made only 50 feet until the banks

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should become firmer. The entire length dredged was 6,462 feet, of which 2,570 feet is 80 feet wide and 3,892 feet is 50 feet wide. The channel was thereby materially improved so far as the work had progressed, giving great relief to the shipping and increased harbor room at Odessa.

During the fiscal year 1898–99 the channel was dredged and shoals removed to a width of 50 feet and a depth of 8 feet at mean low water, as follows: At the upper point of and through Quarter-Mile reach; from just below Polk's wharf to above the lower corner of the steamboat wharf at Odessa; in Windmill reach and Toms Bay reach; below Windmill reach and in the reach just above the one leading to New bridge; the cut-off at No Mans Friend reach was widened to from 60 to 70 feet through the straight portion of it, and still more at the ends, which were made fan shape; a cut-off 625 feet in length was made through the marsh at Thomas Landing, and another, 960 feet long, including approaches, through the marsh just below. An average width of 45 feet and a low-water depth of 6.8 feet in the upper and 6.5 feet in the lower cut-off were obtained, with a low-water depth of 8 feet over a width of about 30 feet extending through both cut-offs. The aggregate length of dredging done in these operations was about 8,000 feet. At the mouth of the river a cut 30 feet wide and 5 feet deep at mean low water was made for a length of 1,100 feet through the marsh from the 5-foot curve of depth in the slough outside, through which deep water in the Delaware River is reached just below Blackbird Creek.

In the early part of 1900 the two cut-offs at Thomas Landing were dredged to a width and depth of not less than 80 feet and 8 feet at mean low water, respectively; at the mouth of the river the cut across the marsh was widened to 100 feet, the depth made being not less than 5 feet at mean low water, and at Toms Bay a cut 380 feet long was made through a sharp turn in the river, the width and depth made being not less than 35 feet and 6 feet at mean low water, respectively; and with $3,000 allotted from the appropriation made by the river and harbor act of June 13, 1902, for maintenance of the Appoquinimink, Murderkill, and Mispillion rivers, a number of points in the river were dredged, resulting in a channel varying from 7 to 8 feet deep at mean low water, and from 50 to 100 feet wide between Odessa and Fennimore's bridge, except at a place near Townsends Point, in a bend proposed to be cut off, where the depth was 6 feet at mean low water; and the cut-off at Toms Bay was widened and deepened to 50 feet and 8 feet at mean low water, respectively.

To provide for the restoration and maintenance of the channel, the Secretary of War, under date of June 23, 1904, allotted the sum of $4,000 from the appropriation of $200,000 made by the act of June 13, 1902, for emergencies in river and harbor work, and with this allotment numerous shoals, aggregating 8,509 feet in length and an average width of 23 feet, were dredged, resulting in a navigable channel 6 feet deep at mean low water from Odessa to the Delaware River.

The maximum draft that could be carried on June 30, 1905, at mean low water, over the shoalest part in the river was 6 feet and across the bar at the mouth 2 feet.

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The amount expended on the improvement to June 30, 1905, is $32,108.34, of which $7,108.34 was for maintenance.

The freight rates, it has been reported, remain about the same, but the passenger business has increased in consequence of the improvements in the river.

The commerce of the river for the calendar year 1904 is reported to have been 30,705 tons, valued at $2,055,600.

Under date of April 19, 1905, the Secretary of War approved an allotment of $5,500 for the river, from the appropriation of $20,000 made by the river and harbor act of March 3, 1905, for continuing improvement and maintenance of the Appoquinimink, Murderkill, and Mispillion rivers, and under date of June 12, 1905, the Chief of Engineers approved a project for the expenditure of the available funds in making a cut-off at New, or Fennimore's, bridge, and in dredging the channel where required to a width of 50 feet and a depth of 7 feet at mean low water, as far as the funds will permit. Specifications for the work were approved June 30, 1905, and proposals will be advertised for and it is expected that contract will be made shortly.

(*b*) *Murderkill River.*—This river is a tidal stream and a tributary of Delaware Bay and flows through Kent County, Del. Its navigable portion is about 9 miles long. The condition of the river was fair for the greater part of its length, the average width and depth being 90 and 6 feet, respectively. Outside the junction with Delaware Bay, however, there was a serious obstruction—the flats, which are nearly bare at low tide and extend for nearly a mile from the shore. The average rise and fall of the tide at the mouth is 4.6 feet.

In 1881 an examination of this river was made and a project submitted for its improvement. No appropriation was made by Congress, however, as the river was at that time in the hands of an improvement and navigation company chartered by the State. This company had expended about $10,000 in rectifying the many bends of the river by cutting straight canals and in dredging a narrow cut across the flats at the mouth. The latter slowly filled up again.

The project for improvement adopted in 1892 is for a 7-foot low-water channel 80 feet wide from the town of Frederica, at the head of navigation, to the mouth of the river, and 150 feet wide from the mouth across the flats outside to the 7-foot curve of depth in Delaware Bay, the cut at the mouth to be protected by forming an embankment of the dredged material on each side, the estimated cost being $47,550.

In 1893 a channel was dug to a depth of 5 feet below mean low water across the flats from a short distance inside the river to the 5-foot curve of depth in Delaware Bay, and in 1895 a cut-off 975 feet long was made at Lower Landing, about 4 miles from the mouth, and shoals were dredged at a short turn in the river below Frederica, at the head of Long Canal, at Coles shoal, and just inside the mouth of the river. The width of the cut in every case was 40 feet and the depth 7 feet at mean low water.

In the winter of 1896–97 a channel was dredged 60 feet wide and 6 feet deep at low water from the 6-foot curve in Delaware Bay to the steamboat wharf inside the river, a distance of 4,700 feet, and shoals

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just above the steamboat wharf at Broad reach and Webbs Landing, aggregating 2,484 feet in length, were dredged to a width of 40 feet and a depth of 6 feet, resulting in an unobstructed low-water channel 6 feet deep from that depth in Delaware Bay to Lindells shoal, a distance of 16,000 feet; and in 1899 shoals at the steamboat wharf at Frederica and 500 feet below, at Long reach, Bradleys Canal, Goodwins, and Lower Landing, aggregating about 4,000 feet in length, were dredged to a width of 40 feet and a depth of 6 feet at mean low water, and at the mouth the channel was dredged to a width of 60 feet and a depth of 6 feet at mean low water to that depth in Delaware Bay, resulting in a channel 6 feet deep at mean low water, and from 40 to 60 feet wide from the head of navigation at Frederica to Delaware Bay.

In 1902 with an allotment of $2,000, shoals at West Canal, near Frederica; at Goodwins, Coles, above and below Webbs Landing, and at Sand Point, were dredged to a width of from 30 to 40 feet and depth of 7 feet at mean low water; and with an allotment of $5,500 from the appropriation of $3,000,000, contained in the river and harbor act of April 28, 1904, the mouth of the river was dredged in August, 1904, from Sand Point to the 6½-foot depth in Delaware Bay, the width and depth made being 50 feet and 7 feet at mean low water, respectively.

The amount expended on this improvement to June 30, 1905, is $30,967.75, of which $7,606.97 was for maintenance. The sum of $1,500 of the appropriation of August 18, 1894, was expended in accordance with the terms of the appropriation in removing a shoal at the mouth of the Saint Jones River.

The maximum draft that could be carried on June 30, 1905, at mean low water, over the shoalest part of the river is 4 feet and 3½ feet across the bar at the mouth.

The river and harbor act of March 3, 1905, appropriated $20,000 for improving the Appoquinimink, Murderkill, and Mispillion rivers. From this, $5,500 has been allotted for the Murderkill River, and contract made for dredging therewith, the work to be completed about August 8, 1905.

The commerce of the river, which is quite varied, is reported for the past calendar year as 22,480 tons, valued at $985,780.

As to the effect of the improvement of this stream upon freight rates, it is reported that shipments by water are 25 to 50 per cent lower than by rail, and that in winter when the boats can not run the railroad increases its rates.

(*c*) *Mispillion River.*—This river is a tidal stream which enters Delaware Bay about 17 miles northwest of Cape Henlopen. It is navigable for about 12 miles. The mouth of the river is greatly obstructed by a flat foreshore without a channel. Vessels could enter and depart only at high water, the tidal range being about 4 feet.

The river from Milford, the head of navigation, to the mouth was improved by the General Government between the years 1879 and 1889, and $17,000 was expended in making a channel 40 feet wide and 6 feet deep at mean low water.

The project for the improvement of the mouth of the river, proposed in a report on a survey made in 1891, provides for a cut across the flats in a southeasterly direction, having a width of 150 feet and a depth of 6 feet at mean low water, beginning opposite the light-house

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and ending in deep water in the bay, the cut to be protected on the upper or north side by a bank made of the excavated material. The estimated cost was $24,000.

In 1893 operations were begun under the project, and at the close of work in that season a pile dike 500 feet long had been built on the north side of the mouth along the line of the channel, and a channel 80 feet wide and 5 feet deep at mean low water had been dredged for a length of 570 feet, extending from the 5-foot curve of depth in the Mispillion River to a point opposite and 50 feet west from the outer end of the dike; and in 1895 and 1896 a channel was dredged 75 feet wide and 6 feet deep at mean low water from inside the river just above Sandy Point to opposite the mouth of Cedar Creek, and a crib dike 350 feet in length flanking the new channel on the west side was built. The dikes were found necessary during the progress of the dredging, owing to the character of the material dredged, which was mainly treacherous sand.

In 1897 a brush and stone extension to the pile dike was built for a length of 200 feet, and a cut 50 feet wide and 6 feet deep at mean low water was dredged over a length of 450 feet near the end of the crib dike, but was soon obliterated during severe storms. A channel 4 feet deep at mean low water and 40 feet wide was then dredged across the Bulkhead shoal about 400 feet beyond the mouth, resulting in a continuous channel 4 feet deep from inside the river across the Bulkhead shoal, and in 1899 a single pile jetty was built for a length of 141 feet, extending from the inner end of the old pile and brush jetty northward to the high-water line of the Mispillion River, and a similar jetty was constructed from Green Point due east for a length of 206 feet. The latter, which was designed to direct the waters of Cedar Creek into the Mispillion currents, was to extend much farther out, but it was found necessary to reduce its proposed length temporarily by about one-half in order to keep the old channel down the bay shore open to navigation, as a cut made by private parties in 1898, under authority of the War Department, along the route of the original project to deep water in Delaware Bay had been completely closed by shoaling.

In 1901 the crib dike built in 1895, having been undermined and become unserviceable, was removed. In the same year a survey of the river was made under the provisions of the emergency river and harbor act of June 6, 1900. The report on this survey is printed in House Document No. 102, Fifty-sixth Congress, second session, and also in Appendix H 24 of the Annual Report of the Chief of Engineers for 1901. The improvement therein recommended is the formation of a channel 6 feet deep at mean low water and 60 feet wide, widening to 75 feet at sharp turns from Milford to the mouth, and thence a channel 4 feet deep at mean low water and 150 feet wide across the flats at the mouth to the 4-foot curve in Delaware Bay, the channel at the mouth to be protected by a jetty on the south side 5,000 feet long, the total cost being estimated at $87,065.

The river and harbor act of June 13, 1902, appropriated $15,000 for the Appoquinimink, Murderkill, and Mispillion rivers for maintenance. Of this amount $10,000 was allotted to this improvement, the project approved for its expenditure providing for dredging at the mouth of the river and the construction of a jetty on the northeasterly side of the channel across the bar. The channel across the

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flats was dredged in October and November, 1902, from a point 1,100 feet out from the outer end of the Green Point jetty along the former cut in a southeasterly course from the light-house for a length of 4,450 feet, the width and depth made being 40 and 5 feet at mean low water, respectively. Work upon the jetty was begun on May 21, 1903, and completed May 26, 1904. This consists of a double row of piles 12 feet apart filled in with brush and stone. It extends from the end of the old stone dike for a length of 805 feet.

Under date of June 23, 1904, the Secretary of War allotted from the appropriation of $200,000 made by act of June 13, 1902, for emergencies in river and harbor works, the sum of $5,300, and on August 29, 1904, the further sum of $1,800 from the appropriation of $3,000,000 contained in river and harbor act of April 28, 1904, for maintenance of the improvement. With these funds the gap between the pile jetty at Sand Point and the inner end of the new jetty on the north side of the channel was filled in with stone, and a cut 40 feet wide was dredged to a depth of 6 feet at mean low water from the 6-foot depth in the Mispillion River to the 6-foot curve in Delaware Bay.

The river and harbor act of March 3, 1905, appropriated $20,000 for improving Appoquinimink, Murderkill, and Mispillion Rivers, Delaware, and of this appropriation $9,000 has been allotted for maintenance of this improvement, and proposals for the work to be done therewith have been advertised for, to be opened July 6, 1905.

The amount expended on the improvement to June 30, 1905, is $59,510.43. Of this amount $17,000 was on a former project and $42,510.43 on the present one, including $18,517.19 expended for maintenance.

The commerce of the river for the past fiscal year is reported to have been 187,065 tons, valued at $4,537,300. The commerce reported in 1891, just before the present improvement was begun, was 67,396 tons, valued at $1,051,405.

The effect of the improvement on freight rates is stated to be quite marked, a reduction of an average of 25 per cent being reported, in addition to affording better and increased transportation facilities.

The maximum draft that could be carried on June 30, 1905, at mean low water over the shoalest part of the river was 3½ feet and over the bar at the mouth 2 feet.

July 1, 1904, balance unexpended		$19,373.10
Amount appropriated by river and harbor act approved March 3, 1905		20,000.00
Amount allotted from appropriation for maintenance of river and harbor improvements, act of April 28, 1904		1,800.00
		41,173.10
June 30, 1905:		
Amount expended during fiscal year, for maintenance of improvement	$21,137.30	
Returned to Treasury	203.67	
		21,340.97
July 1, 1905, balance unexpended		19,832.13
July 1, 1905, amount covered by uncompleted contracts		4,950.00
Amount (estimated) required for completion of existing project		33,727.00

(See Appendix I 9.)

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10. St. Jones River, Delaware.—Before the channel was improved the least practicable low-water depth of water to Lebanon, 12 miles above the mouth, was 4 feet, and thence to Dover, 9 miles farther up the river, only 2½ feet.

The original project, made in 1880, was for a 3-foot low-water channel, 100 feet wide across the bar at the mouth, protected by a jetty, at an estimated cost of $35,000. The project was modified in 1884 so as to include the removal of shoals in the river to a depth of 6 feet at mean low water. Improvements were not begun until 1885. The proposed channel within the river was reported as nearly completed at the close of the fiscal year ending June 30, 1888, $25,000 having been expended. A modification of the project for the improvement of the entrance was submitted and approved in March, 1889.

This modified project provided for a cut across the bar at the mouth from the 6-foot depth inside the river to the corresponding depth outside the bar, the width of the cut to be 100 feet, of which 50 feet in the center was to be dredged to a depth of 6 feet, the remainder to a depth of 3 feet, below mean low water. The material was to be deposited on either side of the cut to form training dikes, the outer ends of the dikes to be strengthened with pile revetments. It also provided for a new cut-off across a very sinuous bend in the upper river about 1 mile below Lebanon and near Wharton's fishery. During the fiscal year 1890 $14,097.64 was expended on the improvement at the mouth, and there then existed, as reported, a clear and unobstructed 6-foot low-water channel, 40 feet wide within the river and nearly 100 feet wide over the bar at the mouth, from Dover to deep water in Delaware Bay.

In compliance with the river and harbor act of August 18, 1894, which provided that of the $6,500 appropriated for the Murderkill River $1,500 should be applied to the removal of a shoal at the mouth of the St. Jones River, a cut 60 feet wide and 6 feet deep at mean low water was dredged in July, 1895, resulting in the removal of about 10,000 cubic yards of material. Upon the completion of this dredging the steamer plying regularly on the St. Jones River could enter and depart at any stage of the tide.

A preliminary examination and survey of the river "from its mouth to the highest point of feasible navigation" were provided for in the river and harbor act of March 3, 1899, and made in that year. The report thereon, which contains a project for further improvement, is printed in the Annual Report of the Chief of Engineers for 1900, pages 1662–1665.

This project provides for the formation, by dredging, of a channel 7 feet deep from the curve of 7-foot depth in Delaware Bay to Lebanon, the channel at the mouth to have a width of 100 feet and inside the mouth of 60 feet, widening at the bends and in existing cut-offs. The estimated cost of the work is $47,074.50. No appropriation has been made for this project.

In 1900, with $2,946.73 allotted from the emergency river and harbor act of June 6, 1900, a cut 60 feet wide and from 6 to 7½ feet deep at mean low water was dredged from the 6-foot curve in the Delaware Bay to the 6-foot depth inside the river.

Under date of June 23, 1904, the Secretary of War allotted the sum of $4,500 from the appropriation made by the act of June 13, 1902,

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for emergencies in river and harbor works, to the restoration and maintenance of the channel, and with this allotment shoals at and just below Lebanon, below Horseshoe Cut-off, and at White Stone reach and Barkers Landing, an aggregate length of 5,135 feet, were removed, and at the mouth the channel was dredged from inside the river across the flats to the 6-foot contour in Delaware Bay, a length of 3,650 feet, the width and depth made in these operations being 40 and 6 feet at mean low water, respectively.

The amount expended on this improvement to June 30, 1905, is $48,941.74, of which $7,441.74 was for maintenance.

The maximum draft that can be carried on June 30, 1905, at mean low water over the shoalest part of the river is 5 feet to Lebanon, 1½ feet to Dover, and 3 feet across the bar at the mouth.

The commerce of the river is reported for the past year to have been 81,610 tons, valued at $4,658,444. That reported in 1900 was 69,241 tons, valued at $3,569,829. It is reported that the improvements made have reduced freight rates by one-fourth to one-half, besides increasing shipments, especially fruits, which now reach the markets in less time and fresher condition.

July 1, 1904, balance unexpended		$4,500.00
June 30, 1905:		
Amount expended during fiscal year, for maintenance of improvement	$4,495.01	
Returned to Treasury	4.99	
		4,500.00

(See Appendix I 10.)

11. Smyrna River, Delaware.—This river was formerly known as Duck Creek. It is a tidal stream, flowing easterly into the Delaware River at a point about 26 miles south of Wilmington, Del. The navigable portion of the river was originally about 9 miles long; the minimum mean low-water depth over shoal places was 2½ feet in the river and 4 feet at the bar where it enters the Delaware River. The mean range of the tide at the mouth is nearly 6 feet.

In 1878 a project was made for the improvement of the whole river, including the channel across the bar at the mouth. By direction of Congress the improvement of the bar was commenced first, and during the following four years three appropriations, aggregating $10,000, were expended in dredging a channel, 100 feet wide and 8 feet deep at mean low water, across the bar. The dredged channel soon filled up again.

A new project was adopted in 1887, with a view of obtaining a channel of 7-foot depth throughout, with a width of 60 feet in the river and 100 feet at the bar, the channel over the bar to be protected by a stone jetty. The estimated cost of the improvement was $90,698.40. The first appropriation for work on this project was in 1888, and was for dredging. The subsequent appropriations for continuing the improvement have also been applied to dredging.

The entire length of channel has been dredged in parts at various times between 1888 and 1900 to the approved dimensions, except at the mouth of the river.

Under the provisions of the emergency river and harbor act of June 6, 1900, a preliminary examination and survey were made, with a view to securing two crosscuts to shorten the distance between the head of navigation on this river and Delaware River. The report on the

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survey is printed in House Document No. 90, Fifty-sixth Congress, second session, and on pages 1363–1364, Annual Report of the Chief of Engineers for 1901. It recommended the construction of two cut-offs, 60 feet wide and 7 feet deep at mean low water, one 2,445 feet long, extending from the turn just below Limekiln wharf to the turn just above Mill Creek; the other 2,200 feet long, extending from below Rothwells Landing to the turn between Deep Hole and Brick Store Landing. The cost of work was estimated at $15,000, and that amount was appropriated for the purpose by the river and harbor act of June 13, 1902. Upon further examination, however, it was found that a modification of the plan by the substitution for the present lower cut of a cut from the mouth of Mill Creek to the bend above Brick Store Landing would be a material improvement, and action in the matter was therefore deferred to await further action by Congress in relation to that cut.

Under an allotment made by the Secretary of War for the restoration of the channel at the mouth under date of June 25, 1904, from the appropriation for emergencies in river and harbor works, act of June 13, 1902, the channel was dredged to a width of 50 feet and a depth of 6 feet at mean low water from the 6-foot curve just inside the mouth of Smyrna River across the flats to the 6-foot curve in Delaware Bay.

The river and harbor act of March 3, 1905, empowered the Secretary of War to authorize a modification of the plan of the cut-offs referred to above, provided such modification would not increase the total cost estimated for the completion of the improvement, and with the further proviso that no part of the appropriation should be expended until a satisfactory title to the land required should be obtained without expense to the Uinted States. The required title having been obtained, and as the estimated cost for completion will not be increased by the modification, it was authorized by the Secretary of War under date of April 11, 1905. Under contract for this work dredging was begun June 20, 1905, and to the end of the month 11,978 cubic yards of material had been removed. The work is to be completed by December 25, 1905.

The amount expended on the improvement to June 30, 1905, is $45,549.78. Of this amount $35,549.78 is on the present project, and of which $5,365 was for maintenance.

The maximum draft that could be carried on June 30, 1905, over the shoalest part of the river was 4 feet and across the bar at the mouth 4 feet.

The commerce of the river is reported for the past calendar year to have been 828,091 tons, valued at $6,163,450. Before the improvement of this river was begun the tonnage reported was 204,706, valued at $1,944,000.

The effect of the improvement of this river on freight rates has been to reduce them by about 25 per cent, and in addition it has resulted in the saving of time in shipments to Philadelphia and elsewhere. These conditions have stimulated certain industries, especially fruit culture, and largely increased the production in this section.

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July 1, 1904, balance unexpended		$21,016.07
Amount appropriated by river and harbor act approved March 3, 1905		5,365.00
		26,381.07
June 30, 1905:		
Amount expended during fiscal year, for maintenance of improvement	$2,565.85	
Returned to Treasury	3,571.58	
		6,137.43
July 1, 1905, balance unexpended		20,243.64
July 1, 1905, outstanding liabilities		1,200.00
July 1, 1905, balance available		19,043.64
July 1, 1905, amount covered by uncompleted contracts		17,100.00

(See Appendix I 11.)

12. Inland waterway from Chincoteague Bay, Virginia, to Delaware Bay at or near Lewes, Del.—The original project, based on a survey made in 1884, contemplated the construction of a continuous waterway 70 feet wide and 6 feet deep at mean low water from Chincoteague Inlet, at the southwesterly end of Chincoteague Bay, Virginia, to Delaware Bay at or near Lewes, Del. The entire length of the proposed channel is nearly 73 miles, of which about 57 miles is through several shallow interior bays separated from the Atlantic Ocean by narrow strips of sandy beach and soil. The remaining 16 miles consists mainly of canals to be formed by dredging.

The estimated cost was $350,000.

In 1892 the line of location was slightly modified and the proposed dimensions of the canal were reduced from a width of 70 feet to 20 feet on the bottom. The estimated cost from Rehoboth to Delaware Bay was reduced to $241,224. This, however, supposed that the work would be done in about two years in one large contract.

In 1891 a cut was made 4 miles long, 20 feet wide at bottom, and 4 feet deep below the mean level of Assawaman Bay across the neck of land lying between Little Assawaman Bay and Whites Creek, a tributary of Indian River Bay, and three temporary wooden bridges built over it; and between 1893 and 1896 a cut 20 feet wide and 6 feet deep below datum (mean low water at the Delaware Breakwater in Delaware Bay) was made from that depth in Rehoboth Bay to a point 1,250 feet south of the Delaware, Maryland and Virginia Railroad crossing at Rehoboth, a distance of 9,000 feet, and another cut, in continuation of this, extending to the railroad reservation, a distance of 1,125 feet, was made to a depth of 2 feet below mean low-water level; and north of the railroad crossing a cut was made to a point 1,000 feet north of the boundary of the railroad track. Of this latter distance the lower 800 feet was excavated to a depth of 9½ feet and the remaining 200 feet to an average depth of 15 feet above datum, the depth of cutting in the first averaging approximately 17½ feet and in the latter about 8 feet.

The amount expended on the project to June 30, 1902, was $168,421.88, no portion of this amount having been applied to maintenance, and the condition of the work between Ocean View and Rehoboth when last examined, in June, 1901, was as follows: The cut made between Whites Creek and the head of Little Assawaman Bay to a depth of 4 feet had shoaled in the middle portion, the depth there

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being about 2½ feet. These shoals are formed where the sandy side slopes, bare of all vegetation, fall in considerably during heavy rains. The depths in the cut through low or marsh ground had maintained themselves very well. The cut, made to a depth of 6 feet from Rehoboth Bay along Millers Creek toward the high ground back of Rehoboth during the working season of 1894, was in fair condition except for the closing of the entrance to the canal by the forming of a bar in line with the bay shore.

The river and harbor act of June 3, 1896, appropriated $25,000 for continuing this improvement, to be used between Delaware Bay and Indian River, but provided that no part of the appropriation should be expended until the right of way should be secured without cost to the United States. The right of way over or through any railroad or county bridge was, however, not subjected to the proviso, but might be secured by condemnation proceedings. Previous to the passage of this act deeds to the land covering the entire right of way had been vested in the United States, with the exception of that portion crossing the Delaware, Maryland and Virginia Railroad at Rehoboth.

In January, 1899, the commissioners of Rehoboth conveyed to the United States a quitclaim deed to whatever title that corporation had to the land at the railroad crossing. The railroad, however, held the right of way by a franchise from the State.

In May, 1899, the commissioners for condemnation of the right of way of the Delaware, Maryland and Virginia Railroad Company at Rehoboth awarded the sum of $37,343.58 to the railroad company as being in full for all damages to them and for the erection and maintenance of a bridge across the waterway. No funds have thus far been made available for the payment of this award. No action has, therefore, been taken toward the construction of the bridge by the railroad company.

The proviso restricting the expenditure of the appropriation of June 3, 1896, having been construed by the law officers of the Department to apply only to that portion of the right of way secured without cost to the United States, the unexpended funds were held to be available for work under the existing project, and on April 7, 1902, a contract was made for construction of two parallel jetties of stone and brush and for dredging, the work to be completed by October 31, 1902. This time was extended, the work under the contract not being begun until September 16, 1902. To the end of the fiscal year 1903 the jetties had been completed and the canal north of Rehoboth Bay had been dredged where required and some dredging done in Rehoboth Bay at the mouth of the canal. The dredging called for by the contract was finally completed on June 9, 1904. During this period the shoal at the entrance to the canal was removed. Dredging was also done in Rehoboth Bay where required, and a channel 40 feet wide and 6 feet deep was dredged through a shoal at Raccoon Point for a length of 2,700 feet into the 6-foot depth in Indian River Bay, making a continuous 6-foot channel from the railroad crossing at Rehoboth to Whites Creek.

The expenditures during the fiscal year were for examinations and contingent expenses.

The amount expended on the improvement to June 30, 1905, is $193,742.30, of which $25,330.42 was for maintenance.

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No statistics as to commerce have been obtained. A small steamer plies between the railroad crossing at Rehoboth and Bethany Beach.

By section 7 of the river and harbor act of March 3, 1905, the provisions of river and harbor acts heretofore passed providing for the prosecution of work on this project are repealed, and the amount remaining unexpended is required to be paid into the Treasury of the United States. Accordingly, the unexpended balance, $7.70, has been returned to the Treasury. By section 9 of the same act an examination is directed to be made of the artificial channels constructed in connection with this project, with a view to ascertaining whether any bridge or bridges should be constructed over such artificial channels. At the close of the fiscal year the examination was in progress.

July 1, 1904, balance unexpended		$156.40
June 30, 1905:		
Amount expended during the fiscal year, for maintenance of improvement	$148.70	
Covered into surplus fund of the Treasury	7.70	
		156.40

(See Appendix I 12.)

13. Removing sunken vessels or craft obstructing or endangering navigation.—During the past fiscal year wrecks were removed as follows:

Wreck of scow lying sunk in channel of Mispillion River, Delaware; wreck of sloop *Constitution*, sunk in Maurice River, New Jersey; steamer *Mary N. Githens*, sunk in St. Jones River, Delaware; coal barge *Carrie*, sunk at entrance to Little Egg Harbor Bay, New Jersey; schooner *Rebecca M. Smith*, sunk on outer shoal of Little Egg Harbor Inlet, New Jersey; schooner *A. L. Lee*, sunk in the south channel of the entrance to Absecon Inlet, New Jersey; schooner *Ann Virginia*, sunk in Cohansey River, New Jersey.

The following wrecks have been examined and found not to be obstructions to navigation:

Wrecks of steamer *Ranald* and schooner *Rival*, alleged to be obstructing navigation to the channel of Absecon Inlet, New Jersey.

The wreck of schooner *Mary*, sunk in St. Jones River, Delaware, has been examined and found to be an obstruction. Proposals for its removal are to be opened July 17, 1905.

The total amount expended in this district for the examination and removal of wrecks during the fiscal year was $4,824.09.

(See Appendix I 13.)

IMPROVEMENT OF PATAPSCO RIVER AND BALTIMORE HARBOR, MARYLAND; OF RIVERS AND HARBORS IN MARYLAND ON THE EASTERN SHORE OF CHESAPEAKE BAY; OF NANTICOKE RIVER, MARYLAND AND DELAWARE, AND OF BROAD CREEK RIVER, DELAWARE.

This district was in the charge of Lieut. Col. R. L. Hoxie, Corps of Engineers. Division engineer, Col. W. A. Jones, Corps of Engineers, to June 26, 1905, and Col. Amos Stickney, Corps of Engineers, since that date.

1. Patapsco River and channel to Baltimore, Md.—The original condition before operations were begun by the United States was a controlling depth of 17 feet with a mean range of tide of a little over

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1 foot. Vessels of over that draft were obliged to lighter portions of their cargoes from about 14 miles below to permit them to reach the wharves of the city. There were pockets where deeper water prevailed, but they were unconnected by any channel, natural or artificial. Under the original project, dated April 15, 1853, for a channel 22 feet deep at mean low water and 150 feet wide, Col. Henry Brewerton, Corps of Engineers, gave the first relief to commerce by dredging the Fort McHenry channel, extending from the limits of the city of Baltimore to a point just below Fort Carroll and continuing thence at an angle by the Brewerton channel to the deep water of the Chesapeake Bay off Swan Point. The cost of those operations was $390,000.

In 1871 the project was enlarged to a width of 400 feet at the lower end of the channel, graduated to 250 feet at its upper end, with a mean low-water depth of 24 feet. Meantime it had been found that the portion of the Brewerton channel which was swept across by the current of the Susquehanna River was continually obstructed by sedimentary deposit. This led to a search for a better location for a deep channel which could be made and maintained by dredging and the natural currents. This was found in the position of the resultant of the two great forces made by the currents of the Susquehanna and Patapsco rivers. The new channel had also the advantage of being shorter by several miles, and for this reason and the very much diminished sedimentary deposit the cost of maintenance was much lessened. In 1892 a project for 27 feet depth at mean low water, with a width of 600 feet in the straight sections and over 1,200 feet in the angles, was completed. At the same time the portion of the Brewerton channel between the upper end of the present cut-off and the point of intersection of the Brewerton and Craighill channels was abandoned because of the sedimentary deposit from the Susquehanna sweeping across it and to still further shorten the channel and lessen the cost of maintenance. The projects of dredging to depths of 24 and 27 feet and the two changes in the position of the channel were designed and executed by Col. W. P. Craighill, Corps of Engineers. The act of June 3, 1896, authorized the increase of the depth of the channel to 30 feet at mean low water, with a bottom width of 600 feet, widened at the angles and with side slopes of 3 base to 1 vertical. This was completed May 22, 1903, and has since been maintained. The amount expended on original and modified projects prior to operations under existing project is $4,721,269.48.

The existing project, adopted by Congress March 3, 1905, provides for a channel 35 feet deep at mean low water and 600 feet wide at bottom, with side slopes of 3 base to 1 vertical from Fort McHenry to deep water in Chesapeake Bay above Sandy Point light-house and through the shoals opposite York Spit, at an estimated cost of $3,465,000. An appropriation of $250,000 was made in the river and harbor act of March 3, 1905, and work was authorized under continuing contracts to an additional amount of $1,000,000.

Preliminary steps have been taken to enter into such contracts. With the funds now available and provided for under continuing contract it is proposed to deepen the existing channel above Sandy Point to 35 feet at mean low water, beginning on the east side and for such

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width as the existing and authorized appropriations admit, and to dredge a channel through the shoals off York Spit to corresponding dimensions.

The amount expended on the improvement to the close of the fiscal year ending June 30, 1905, is $4,721,269.48, of which $32,797.72 has been applied to maintenance.

The draft that can now be carried to Baltimore, the head of navigation, a distance of 11 miles from the mouth of the Patapsco River and 171 miles from the mouth of Chesapeake Bay, is 30 feet at mean low water. The length of dredged channel in Patapsco River and Chesapeake Bay above Sandy Point is about 19 miles.

The tonnage movement of the port has been as follows:

Fiscal year ending June 30—	Tons.	Fiscal year ending June 30—	Tons.
1889	3,243,017	1898	7,339,405
1890	4,237,361	1899	6,843,620
1891	4,495,469	1900	7,941,580
1892	5,224,042	1901	8,055,017
1893	4,607,176	1902	7,529,870
1894	4,752,946	1903	7,736,447
1895	4,794,964	1904	7,334,241
1896	5,363,894	1905	7,510,713
1897	6,868,120		

The statistics of the port for the past fiscal year are illustrated briefly by the following table:

Dutiable imports have decreased		$595,487.00
Free imports have increased		$1,447,927.00
Domestic exports have increased		$8,352,012.00
Tonnage (foreign) has decreased	tons	55,027
Duties collected have decreased		$31,136.45
Duties on merchandise in bond have decreased		$12,238.94
Duties on merchandise in bond, with and without appraisement, have decreased		$29,272.25

The effect of the present project upon freight rates can not be ascertained until work is completed, but as some of the vessels trading with the port are not now able to load to their full capacity the tendency should be toward cheapening rates when means are provided to enable them to carry full cargoes and to enable other vessels of greater capacity to trade with the port.

References to reports of examinations and surveys are to be found on page 180 of the Annual Report of the Chief of Engineers for 1904.

July 1, 1904, balance unexpended		$25,732.48
Amount appropriated by river and harbor act approved March 3, 1905		250,000.00
		275,732.48
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$732.48	
For maintenance of improvement	5,239.48	
		5,971.96
July 1, 1905, balance unexpended		269,760.52
July 1, 1905, outstanding liabilities		2,975.77
July 1, 1905, balance available		266,784.75

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Amount (estimated) required for completion of existing project	$3,215,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	500,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix J 1.)

2. Channel to Curtis Bay, in Patapsco River, Baltimore Harbor, Maryland.—With a mean range of tide of a little over 1 foot, there was a controlling depth of 20 feet at mean low water in 1893, when the first improvement was undertaken by the United States. The original project was dated July 15, 1892, and was for a channel 27 feet deep at mean low water and a bottom width of 150 feet, at an estimated cost of $85,000. Forty thousand dollars of the estimate was appropriated, and with this total expenditure the channel was first made 25 feet deep for the project width and then dredged to 27 feet depth for a width of 70 feet in the axis of the 150-foot channel. That project never was completed. It was superseded by a project in the river and harbor act approved June 13, 1902, for deepening the channel to 30 feet and widening it to 250 feet, and authority was granted to make continuing contracts to complete the work. The estimated cost was $196,000.

A continuing contract was approved, and under it dredging was commenced March 5, 1903, and the project completed November 30, 1903. The amount expended on existing project to June 30, 1905, was $192,450.32, no portion having been applied to maintenance. The balance available is held for maintenance.

Curtis Bay is the mouth of Curtis Creek, which is navigable in fact 5⅛ miles above the head of the channel contemplated by the existing project, but a maximum draft of 30 feet at mean low water can be carried June 30, 1905, over the shoalest part of the locality under improvement, which is a distance of 2¼ miles.

With the funds now available it is proposed to maintain the existing channel. It is stated that the improvement has lowered rates upon freight, but the amount of reduction has not been ascertained.

References to reports on examinations and surveys are to be found on page 180 of the Annual Report of the Chief of Engineers for 1904.

This bay is in the collection district of Baltimore and the statistics are attached to the report for that harbor.

July 1, 1904, balance unexpended	$6,215.98
June 30, 1905, amount expended during fiscal year, for works of improvement	2,666.30
July 1, 1905, balance unexpended	3,549.68

(See Appendix J 2.)

3. Harbor of southwest Baltimore (Spring Garden), Md.—No work was done by the United States before the existing project, but the city of Baltimore dredged a channel from the main ship channel to the foot of Eutaw street which had a controlling depth of 15 feet at mean low water. The average rise of the tide is a little over 1 foot. In response to a resolution of the House of Representatives, an estimate was furnished March 7, 1896 (printed in Annual Report for 1896, p. 1006), of the cost of deepening the channel to a depth of 27 feet. It was for a channel 100 feet wide on the bottom, with side

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slopes of 1 on 3, from the main ship channel near Fort McHenry to the foot of Eutaw street, with a turning basin 400 feet by 400 feet near the upper end, at an estimated cost of $314,000, which is the existing project. Five thousand dollars was appropriated June 3, 1896, but it was deemed inexpedient to start the work with that small sum. June 13, 1902, $88,000 was appropriated and authority granted to enter into contracts for the completion of the work. A continuing contract was made for the completion of the project, and it was completed April 4, 1905. The sum of $314,000 has been expended to June 30, 1905. The maximum draft that can be carried June 30, 1905, at mean low water over the shoalest part of the locality under improvement is 27 feet.

The stream is navigable in fact to Baltimore, Md., which is 14 miles from the mouth of Patapsco River and 174 miles from the mouth of Chesapeake Bay. The length of the channel dredged under the existing project is 4 miles. It is stated that the improvement has somewhat lowered freights, but the amount of reduction has not been ascertained.

The commercial statistics of the port of Baltimore include this harbor.

July 1, 1904, balance unexpended	$110,389.40
June 30, 1905, amount expended during fiscal year, for works of improvement	110,389.40

(See Appendix J 3.)

4. Elk River, Maryland.—Before improvements were commenced there was practically no navigation above Cedar Point. The original project, dated July 17, 1874, was for a channel 6 feet deep at low water, or 8 feet at high water, from Cedar Point to Elkton, the head of navigation, and in the Little Elk as far as Bennett's wharf. The mean range of the tide is 2 feet. Such a channel was estimated to cost $36,000 if 75 feet wide and about $25,000 if 50 feet wide, cheap dikes being required for regulating the banks and to provide a place behind which to deposit the material dredged from the shoals. The first work was done in 1874, when $5,000 was expended in building a dike and dredging to a width of 25 feet and a depth of 6 feet at mean low water in front of it and for about 300 feet below. Two years later the channel was made 40 feet wide from the bridge at Elkton to about one-half mile below. In 1884 a channel was completed 80 feet wide through the bar near the mouth of the Little Elk River and 70 feet wide thence to the bridge at Elkton, the depth being 7 feet at mean low water. In 1893 a channel 100 feet wide and 8 feet deep from deep water below Cedar Point to the bridge at Elkton was completed. The expenditure on the original and subsequent projects has amounted to $46,500.

The channel had shoaled, and in a report on a survey made in 1899 it was proposed to restore the channel to 8 feet deep at mean low water and 100 feet wide from deep water below Cedar Point to the bridge at Elkton, at an estimated cost of $16,665, with an annual cost of $2,500 for maintenance. The river and harbor act of June 13, 1902, adopted this project, which is the existing one, and appropriated $16,665 for the work. This appropriation was practically expended in dredging in the fiscal year ending June 30, 1903. The project width of 100

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feet could not be made, as the river was found to have shoaled very much since the survey in 1889, on which the appropriation was based. To complete the project will require the removal of about 40,000 cubic yards of material. The act of March 3, 1905, appropriated $2,000 for maintenance, and at the close of the fiscal year ending June 30, 1905, the work had been advertised. It is proposed to expend this sum in removing shoals that have formed in the channel, dredging to begin at the fertilizer works and continue downstream. The amount expended on this improvement to June 30, 1905, is $63,165, of which $46,500 was on previous projects. The maximum draft that could be carried June 30, 1905, at mean low water over the shoalest part of the river was 3½ feet. The stream is navigable in fact to Elkton, Md., which is about 16 miles from the mouth of the river. It is stated that the improvement has lowered freight rates, but the amount of reduction has not been ascertained.

Reference to a report on a survey is to be found on page 182 of the Annual Report of the Chief of Engineers for 1904.

A preliminary examination of the river is in progress at the close of the fiscal year 1905.

Partial commercial statistics for the fiscal year show a tonnage of 2,686, valued at $35,769.64, for this river.

July 1, 1904, balance unexpended	$1,567.87
Amount appropriated by river and harbor act approved March 3, 1905	2,000.00
	3,567.87
June 30, 1905, amount expended during fiscal year, for works of improvement	1,567.87
July 1, 1905, balance unexpended	2,000.00

(See Appendix J 4.)

5. Susquehanna River above and below Havre de Grace, Md.—The original governing depth was 5 feet at mean low water. The mean range of tide is 2½ feet. The channel above Havre de Grace was narrow and subject to ice gorges. The original project is dated February 22, 1853, and was for a channel 12 feet deep and 100 feet wide, at an estimated cost of $59,000. Improvements have been in progress since 1853, and up to August 22, 1882, when the existing project was adopted, $97,390 had been expended upon them. The existing project is to give a channel 15 feet deep at mean low water below Havre de Grace and to remove the shoal opposite Watson Island (which is above Havre de Grace) to a depth of 8 feet at the same stage of the tide, at an estimated cost of $168,000. The amount expended on that project to June 30, 1905, is $83,500, and resulted in dredging a portion of the channel below Havre de Grace to a depth of 15 feet at mean low water and partially removing the shoal opposite Watson Island.

With the funds now available it is proposed to remove the balance of the shoal opposite Watson Island and to continue dredging in the channel on the shoal about 4,000 feet below Havre de Grace. The work is under advertisement at the close of the fiscal year 1905.

The maximum draft that can be carried June 30, 1905, at mean low water over the shoalest part of the channel under improvement is 11 feet.

The stream is navigable in fact to Port Deposit, Md., which is about 5 miles above the mouth of the river. The improvement has made no appreciable difference in freight rates.

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The commerce of the river for the calendar year 1903 is reported to be 143,212 tons, not including much carried in vessels trading transiently, the statistics of which can not be obtained. No statistics could be gotten later.

July 1, 1904, balance unexpended	$17,241.49
Amount appropriated by river and harbor act approved March 3, 1905	10,000.00
	27,241.49
June 30, 1905, amount expended during fiscal year, for works of improvement	17,241.49
July 1, 1905, balance unexpended	10,000.00
Amount (estimated) required for completion of existing project	74,500.00

(See Appendix J 5.)

6. Harbors at Rockhall, Queenstown, Claiborne, and Cambridge, and Chester, Choptank, Warwick, Pocomoke, La Trappe, and Manokin rivers, and Tyaskin (Wetipquin) Creek, Maryland.—*(a) Rockhall Harbor and inner harbor at Rockhall.*—In 1894 the controlling depth at Rockhall Harbor was 5 feet, with an average range of tide of 1.1 feet. With $16,600 (the first for this work) appropriated June 3, 1896, a project was carried out in 1897–98 for dredging a cut 80 feet wide and 10 feet deep at mean low water from the 10-foot curve in Swan Creek Inlet to the 10-foot depth in Chesapeake Bay, and a channel 100 feet wide and 10 feet deep from that depth in Swan Creek Inlet to the old pier at Rockhall. A turning basin, embracing the old and new piers, was also dredged.

In accordance with the river and harbor act of March 3, 1899, an examination was made of Rockhall Harbor and the inner harbor at Rockhall, report on which is printed in the Annual Report for 1900, pp. 1670–1672. The project then proposed is the dredging of a channel 12 feet deep and 150 feet wide from Chesapeake Bay to Swan Creek Inlet, across Swan Point bar, and 12 feet deep and 150 feet wide from Swan Creek Inlet to the wharf at Rockhall, at an estimated cost, in 1899, of $43.065, and $9.208 every two years for maintenance.

The river and harbor act of June 13, 1902, adopted this project, which is the existing one, and appropriated $74,000 for dredging certain harbors and rivers on the eastern shore of Chesapeake Bay, including Rockhall Harbor. The sum of $12,000 was allotted for this improvement, the available sum to be applied to the dredging of a channel 12 feet deep and as wide as practicable within the project limits from Swan Creek Inlet to the wharf at Rockhall. Contract for dredging on this and the other improvements on the eastern shore of Chesapeake Bay was made, under which the entire work was to be completed by December 31, 1903. The contract was completed June 1, 1904. All the dredging was done in the inner harbor, with the result of establishing a 10-foot navigation there.

The river and harbor act of March 3, 1905, appropriated $44,000 for dredging certain harbors and rivers on the east shore of the Chesapeake Bay. The sum of $12,829.35 was allotted for this improvement, to be applied to the existing project. The work was under advertisement at the close of the fiscal year 1905.

The amount expended on this improvement to June 30, 1905, is

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$28,597.12, of which $16,597.12 was on a previous project. It is reported that freight rates have been reduced 50 per cent.

The maximum draft that could be carried on June 30, 1905, at mean low water over the shoalest part of the channel across Swan Point bar is about 4 feet and in the inner harbor 10 feet, to which point the improvement is navigable in fact. In 1903 from 50 to 60 vessels of from 5 to 50 tons made this harbor their headquarters, and steamers make a daily service from Baltimore, their course from Baltimore being down the bay and around the south end of Swan Point bar to the inner harbor at Rockhall. No later statistics could be obtained.

The harbor is a bay, making in from the Chesapeake Bay, and is navigable in fact to Rockhall pier, which is about one-fourth mile above the mouth of Rockhall Harbor.

(*b*) *Queenstown Harbor.*—Before 1871 the controlling depth in this harbor was 6 feet. Between that year and 1880 it was improved under a project dated January 2, 1871, and a channel 100 feet wide at bottom and 8 feet deep at mean low water was made. In 1897, with $5,000 appropriated for continuing the improvement, a channel was dredged to 8½ feet at mean low water and 100 feet wide from Chester River to the inner harbor, to which point the improvement is navigable in fact; and in 1900 a shoal extending from a point 138 feet above the lower light down for a distance of 950 feet was dredged to a depth of 8 feet and a width of 80 feet.

Of the $74,000 appropriated by the river and harbor act of June 13, 1902, for dredging certain harbors and rivers on the eastern shore of Chesapeake Bay, the sum of $12,000 was allotted to Queenstown Harbor. The act provides that the improvement shall be made in accordance with the report submitted and printed in the Annual Report of the Chief of Engineers for 1900, pages 1673–1676. The project therein submitted contemplates increasing the dimensions of the channel so as to make them 10 feet deep and 200 feet wide, at an estimated cost of $23,100. The range of tide is about 2 feet. With the allotment the entire length of channel was dredged under contract to a depth of 10 feet at mean low water and as wide as practicable within the project limits.

The river and harbor act of March 3, 1905, appropriated $44,000 for improvement of harbors and rivers on the east shore of the Chesapeake Bay, and $4,606.50 was allotted for this harbor, to be applied toward completing the project. Proposals for dredging were invited by advertisement at the close of the fiscal year 1905.

The amount expended on this improvement to June 30, 1905, is $31,000, of which $12,000 was on the existing project. The maximum draft that could be carried June 30, 1905, at mean low water over the shoalest part of the locality under improvement was 10 feet.

The tonnage of the harbor is reported to be as follows:

	Tons.
1900	12,373
1901	11,328
1902	18,769
1903 (only partial statistics could be obtained)	3,889
1904	19,144

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The harbor is a bay making in from the Chester River and is navigable in fact to Queenstown, which is about one-half mile above the mouth of the harbor. The improvement has made no perceptible difference in freight rates.

(*c*) *Claiborne Harbor.*—Claiborne is on the eastern shore of Eastern Bay, an estuary of the Chesapeake Bay, about 6 miles east from Bloody Point light-house. No improvement there had ever been made by the United States previous to the existing project. The controlling depth was 9 feet at mean low water, with a mean range of tide of 2 feet. The sum of $15,000 was allotted to this improvement from the $74,000 appropriated by the river and harbor act of June 13, 1902, for certain harbors and rivers on the eastern shore of Chesapeake Bay, Maryland. The act provides for dredging a channel 12 feet deep at mean low water and 300 feet wide from the 12-foot contour in Eastern Bay to the railroad pier in the harbor, a distance of about 1,900 feet, and thence shoreward along the south side of the pier to a width of 195 feet for a length of 500 feet, at an estimated cost of $17,490, and a further sum of $2,500 for an extension of the existing jetty, should it be found necessary. This is the existing project.

A 12-foot depth at mean low water was dredged with variable widths in the fiscal year ending June 30, 1904. Forty-four thousand dollars was appropriated by the river and harbor act of March 3, 1905, for harbors and rivers on the east shore of the Chesapeake Bay. The sum of $1,863.35 was allotted to this harbor, and proposals for dredging are advertised for at the close of the fiscal year 1905, to be applied to excavating under the existing project. The maximum draft that could be carried June 30, 1905, at mean low water over the shoalest part of the channel is 12 feet. The amount expended to June 30, 1905, is $15,000.

Claiborne is at the head of navigation in Claiborne Harbor and is the western terminus of the Baltimore, Chesapeake and Atlantic Railway. It is about one-half mile from the mouth of the harbor. Three steamers and 70 sailing vessels and barges are reported to ply in the harbor.

The tonnage of the harbor is reported to be as follows:

	Tons.
1903	89,549
1904	90,435

The improvement has made no appreciable difference in freight rates.

Reference to a survey is to be found on page 185 of the Annual Report of the Chief of Engineers for 1904.

(*d*) *Cambridge Harbor.*—This harbor is on the eastern side of the Choptank River, about 20 miles above its mouth, and Cambridge is the head of navigation, at the mouth of the harbor. In 1870, before operations were commenced, there was a controlling depth of 4 feet. The improvement of the harbor was commenced in 1871 with a project submitted in March of that year for an entrance way of 100 feet in width and to provide sufficient harbor accommodations of a depth of 10 feet at mean low water. The estimated cost was $36,000. The sum of $10,000 was appropriated March 3, 1871, and work begun. On this and succeeding projects $50,237 was expended to June 30,

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1896, resulting in a channel 150 feet wide and 12 feet deep at mean low water from that depth in the Choptank River to the railroad wharf, a distance of nearly a mile. The inner harbor below the bridge had been dredged over its whole irregular area to a depth of 10 feet, and the part of the harbor above the bridge, for a distance of 750 feet, had been dredged to a depth of 8 feet and a width of 215 feet. A survey was made in 1896 (printed in Annual Report for 1897, p. 1297), and the improvements then recommended were for a 12-foot low-water channel 150 feet wide from the 12-foot curve in the Choptank River to a point 500 feet outside the Baltimore, Chesapeake and Atlantic Railway Company's steamboat wharf, and from this point gradually widening to the harbor line at the wharf; from the steamboat wharf to Mill wharf to increase the width an average of 200 feet, with a depth of 8 feet, making an anchorage basin; increasing the width of the lower harbor 40 feet on the north side and widening the upper harbor an average of 360 feet along the channel already dredged to a depth of 8 feet. The estimated cost of the project is $8,120. It is the existing one.

Of the 74,000 appropriated by the river and harbor act of June 13, 1902, for certain harbors and rivers on the eastern shore of Chesapeake Bay $3,000 was allotted to the above project. A channel 130 feet wide, 450 feet long, and 8 feet deep at mean low water was dredged during the fiscal year ending June 30, 1904. The river and harbor act of March 3, 1905, appropriated $44,000 for harbors and rivers on the east shore of the Chesapeake Bay. The sum of $3,120.80 was allotted for this harbor, and dredging under it was advertised for at the close of the fiscal year 1905, the work to be applied toward completing the project. The amount expended on this improvement to June 30, 1905, is $53,237, of which $50,237 was on previous projects.

The maximum draft that could be carried June 30, 1905, at mean low water over the shoalest part of the channel below the bridge was 10 feet, and about 8 feet above as far as the channel has been dredged. The range of the tide is about 1.7 feet. Six steamers and 130 sailing vessels and barges are reported to ply in the harbor, the commerce being valued at $1,986,352.

The tonnage of the harbor is reported to be as follows:

	Tons.
1903	101,552
1904	102,568

The improvement has made no appreciable difference in freight rates.

(*e*) *Chester River, Maryland, from Crumpton to Jones Landing.*—Before operations were undertaken on this part of the river vessels at low tide drawing 6 feet of water could reach Crumpton, 33 miles above the mouth, and from that point to Jones Landing (to which point the stream is navigable in fact), 6¼ miles, the controlling depth was 3 feet, with a mean range of tide of 1.2 feet. The project for improvement, adopted October 21, 1890, is for a 6-foot low-water channel from Crumpton to Jones Landing, at an estimated cost of $12,750, increased in 1896 to $14,250, and still later to $19,562.50. There has been but one project for this section of the river. By June 30, 1900, the projected channel had been brought to within less than a half mile of Jones Landing by dredging. Of the $74,000

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appropriated by the river and harbor act of June 13, 1902, for certain harbors and rivers on the eastern shore of Chesapeake Bay, Maryland, $5,402 was allotted for Chester River for continuing the improvement, and this was applied mainly to dredging at the upper end of the river in the fiscal year 1903. The river and harbor act of March 3, 1905, appropriated $44,000 for rivers and harbors on the east shore of Chesapeake Bay, and $1,245 was allotted to this river. With the allotment it is proposed to complete the project at the upper end and dredge some shoals formed in the channel below. The work was advertised at the close of the fiscal year 1905. The amount expended on this improvement to June 30, 1905, is $19,602, of which about $2,500 was for maintenance.

The maximum draft that could be carried June 30, 1905, at mean low water over the shoalest part of the river was 5 feet.

The tonnage for the past calendar year, consisting mainly of agricultural products, is reported to be 48,463, valued at $1,896,485, and is carried on by 6 steamers and 175 sailing vessels and barges. The improvement has made no difference in freight rates.

(*f*) *Choptank River, Maryland.*—Before improvements were begun in 1879 the depth of water in the channel between Denton and Greensboro varied from 2 to 8 feet at low water, with a mean range of tide of about 2 feet. Navigation, carried on by small sailing vessels, extended to only 3 miles above Denton. Upon the remaining 5 miles to Greensboro, the head of navigation, all freight had to be transported upon scows. Greensboro is about 46 miles above the mouth of the river.

A project for improvement was made in 1880 for an 8-foot low-water channel 75 feet wide, at an estimated cost of $79,000. At the close of the fiscal year 1903 the project channel had been completed, except for a distance of about 1 mile at the upper end, but there has been some shoaling since. No dredging was done in the fiscal years 1904 or 1905. The river and harbor act of March 3, 1905, appropriated $44,000 for rivers and harbors on the east shore of Chesapeake Bay, and $7,885 was allotted for this river. It is proposed to apply these funds toward completing the project at its upper end and to removing some shoals which have formed below. The work is under advertisement at the close of the fiscal year 1905.

The maximum draft that could be carried on June 30, 1905, at mean low water over the shoalest part of the channel under improvement was 7 feet. The amount expended on this improvement to June 30, 1905, was $63,000, of which $2,437.39 was for maintenance.

Six steamers and 246 sailing vessels and barges are reported as plying in the river, the commerce being valued at $4,743,416. The tonnage of the river is reported to be as follows:

	Tons.
1903	208,367
1904	210,447

The improvement has made no appreciable difference in freight rates.

(*g*) *Warwick River, Maryland.*—This river, formerly named Secretary Creek, is in Dorchester County, eastern shore of Maryland, and

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flows into the Choptank River, one of the largest tributaries of Chesapeake Bay. It is a small tidal basin 2 miles long, with no fresh-water influx at the head, and was originally only 4 feet deep. The average rise of tide is 2 feet. The original project for the stream is dated January 20, 1880.

Before the adoption of the present project about $12,000 had been expended in the improvement of this river—$6,000 by the General Government and the remainder by private parties. The existing project for improvement based upon a survey in 1891 (printed in Annual Report for 1891, p. 1219), provides for a channel 100 feet wide and 10 feet deep at mean low water from the 10-foot depth in Choptank River to Secretary Landing at the head of the river, including a turning basin at the latter point, at an estimated cost of $18,600. Up to July, 1903, dredging had been done from time to time as funds became available, until the project was practically completed, but shoals formed rapidly. It is proposed to partially remove these with $1,909 alloted from the appropriation of $44,000 appropriated March 3, 1905, for rivers and harbors on the east shore of the Chesapeake Bay. The work is under advertisement at the close of the fiscal year 1905.

The amount expended on the present project to June 30, 1905, is $16,000. The maximum draft that could be carried June 30, 1905, at mean low water over the shoalest part of the channel under improvement was reported to be 9 feet.

Six steamers and 78 sailing vessels and barges are reported as plying in the river, the commerce being valued at $1,532,754.

The tonnage of the river is reported to be as follows:

	Tons.
1903	65,206
1904	65,858

The improvement has made no appreciable difference in freight rates.

(*h*) *Pocomoke River, Maryland.*—This river has been under improvement by the General Government since 1878, the original project being dated November 19, 1878. In 1879 and 1880 $12,500 was expended on work below Snowhill, chiefly in the rectification of the channel and in giving increased width, the depth being 7 feet at mean low water. In 1888, with an appropriation of $8,000, a cut-off was made through the low neck of land forming four abrupt bends just below Snowhill. At the close of these operations there was a channel not less than 80 feet wide and 7 feet deep between Snowhill and Shad Landing, a distance of about 4⅓ miles.

The existing project, adopted October 1, 1896, is based upon a survey made in 1894–95 (printed in Annual Report for 1895, p. 1167), and is for dredging the channel between Snowhill and Shad Landing to a depth of 9 feet at mean low water and a width of from 100 to 130 feet, at an estimated cost of 14,000. The mean range of tide is 2½ feet. Snowhill is the head of navigation on this stream, and is about 28 miles above the mouth. With funds provided from 1897 to 1904, the channel was dredged to the project dimensions, but in a few places there were shoals forming. The river and harbor act of March 3, 1905, appropriated $44,000 for the rivers and harbors on the

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east shore of the Chesapeake Bay, and $1,743 of it was allotted to this river. With this amount it is proposed to remove shoals that have formed in the channel. The work is advertised at the close of the fiscal year 1905.

The maximum draft that could be carried June 30, 1905, at mean low water over the shoalest part of the channel under improvement was 9 feet. To the end of the fiscal year $33,300 had been expended for the improvement of this river, of which $20,500 was on previous projects. Two steamers and 86 sailing vessels and barges are reported as plying in the river, the commerce being valued at $2,314,411.

The tonnage of the river is reported to be as follows:

	Tons.
1903	245,568
1904	246,223

The improvement has made no appreciable difference in freight rates.

(*i*) *La Trappe River, Maryland.*—This stream, formerly known as Dividing Creek, has a length of about 3 miles and is a tributary of the Choptank River. The head of navigation is at Trappe Landing. The controlling depth prior to 1893 was 4 feet, with a mean range of tide of 18 inches, but was afterwards increased to 8 feet by dredging, under private subscription. The original project is the existing one, adopted August 5, 1892, and is for a channel *150* feet wide and 11 feet deep at mean low water across the bar at the mouth, and for a width of 75 feet and a depth of 8 feet inside the bar as far as Trappe Landing, with a turning basin at the latter point, at an estimated cost of $7,250, subsequently increased to $9,750. The amount expended to June 30, 1905, is $7,250, and has resulted in completing the project except for a length of 1,200 feet over the bar, where the width is but 100 feet. The river and harbor act of March 3, 1905, contains an appropriation of $44,000 for rivers and harbors on the east shore of Chesapeake Bay, and $1,867.50 has been allotted for this river. It is expected to expend the funds in dredging in the channel across the bar and the restoration of it where it has shoaled. The work is under advertisement at the close of the fiscal year 1905.

The maximum draft that could be carried June 30, 1905, at mean low water over the shoalest part of the channel was 7 feet. Three steamers and 81 sailing vessels and barges are reported as plying in the river, the commerce being valued at $303,426.

The tonnage of the river is reported to be as follows:

	Tons.
1903	11,466
1904	13,601

The improvement has made no appreciable difference in freight rates.

(*j*) *Manokin River, Maryland.*—Before improvements were commenced, in 1891, the depth of water at the mouth of the river at the so-called "Mud flats" was between 1 and 2 feet at low tide. These flats are about 2½ miles wide, and make navigation impossible except at high water, thereby rendering the upper part of the river, which has a very fair depth and width, almost useless for extensive shipping purposes. The average rise of tide at the flats is 2.6 feet. Princess

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Anne is the head of navigation and is about 12 miles above the mouth of the river.

This project was adopted in 1890, and is based upon a survey made in August and September, 1889 (report printed in Annual Report for 1890, p. 961). It provides for a channel 6 feet deep at mean low water and 100 feet wide from Locust Point to Sharps Point, a distance of about 2½ miles, and embracing the section called the "Mud flats," at an estimated cost of $30,000. From 1891 to 1900 dredging on the whole project was done at various times as funds became available. At the close of these operations there was a channel 6 feet deep from Sharps Point to about a mile above Dashiells Creek, and a slightly less depth to the steamboat wharf above, and at the mouth soundings taken over the area formerly dredged showed a range of depth from 4.5 to 7.3 feet. No work has been done since, but the river and harbor act of March 3, 1905, contains an appropriation of $44,000 for the rivers and harbors on the east shore of the Chesapeake Bay. Four thousand seven hundred and seventy-two dollars and fifty cents of this appropriation has been allotted to this river, and proposals for dredging are under advertisement at the close of the fiscal year 1905. With the funds it is proposed to complete part of the project and restore the channel where it has shoaled.

The amount expended on the improvement to June 30, 1905, is $22,500, and $2,000 additional was expended on the upper river, which is not included in the existing project. The maximum draft that could be carried June 30, 1905, at mean low water over the shoalest part of the channel at the mouth was 4½ feet.

It was impracticable to obtain complete commercial statistics, but it is reported that the commerce has increased between 5 and 10 per cent over that reported for 1896, which was 32,076 tons, valued at $522,990. The improvement has made no appreciable difference in freight rates.

(*k*) *Tyaskin Creek.*—This stream is also known as Wetipquin Creek, or River. It is a small tributary of the Nanticoke River, having a length of about 5 miles. No work has heretofore been done on this creek. The controlling depth in the creek was 8 feet, but on the bar at the mouth it was but 3½ feet at mean low water, with an average rise and fall of the tide of 3 feet. A survey was made in 1899 (report printed in Annual Report for 1900, p. 1681). The existing project is for a channel 9 feet deep at mean low water, with a width of 120 feet, at an estimated cost of $13,200. Dredging was done in the fiscal year ending June 30, 1904, and resulted in making a 9-foot navigation at mean low water to the wharf at Tyaskin, the head of navigation, but the channel is only 60 feet wide. Two thousand one hundred and fifty-eight dollars was allotted for this creek from the appropriation of $44,000, March 3, 1905, for rivers and harbors on the east shore of the Chesapeake Bay. It is expected to widen the channel as far as permitted with these funds, and the work was under advertisement at the close of the fiscal year 1905.

The amount expended to June 30, 1905, is $8,000. The maximum draft that could be carried June 30, 1905, at mean low water over the shoalest part of the channel was 7½ feet. Three steamers and 35 sailing vessels and barges are reported as plying in the creek, the commerce being valued at $33,813.

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The tonnage of the creek is reported to be as follows:

	Tons.
1903	784
1904	796

The improvement has made no appreciable difference in freight rates.

A preliminary examination is in progress at the close of the fiscal year 1905.

July 1, 1904, balance unexpended	[a] $8,293.40
Amount appropriated by river and harbor act approved March 3, 1905	44,000.00
	52,293.40
June 30, 1905, amount expended during fiscal year, for works of improvement	8,290.52
July 1, 1905, balance unexpended	44,002.88
Amount (estimated) required for completion of existing project	43,818.00

(See Appendix J 6.)

7. Nanticoke River, Delaware and Maryland.—This river is a tidal stream, its headwaters consisting of numerous branches rising mainly in the northern section of Sussex County, Del. The river flows in a southwesterly direction into Tangier Sound, Chesapeake Bay, and the interests for the improvement of the river center at Seaford, 36 miles from the mouth.

The river and harbor act of August 18, 1894, appropriated $5,000 for improving Broad Creek River, Delaware, a branch of Nanticoke River, and provided that as much of it as might be necessary should be used for the removal of the bar extending from the railroad bridge at Seaford toward the mouth of Nanticoke River. With this appropriation the channel was dredged where necessary to a width of 100 feet and a depth of 9 feet at mean low water from the south side of the railroad bridge at Seaford to a point 8,000 feet below. A previous appropriation for the Nanticoke River in 1886 was, in accordance with the terms of the law, applied to Broad Creek River up to Laurel.

The existing project for the improvement of the Nanticoke River is based upon a survey made in 1895, and is for a channel 9 feet deep at mean low water and 100 feet wide, the width to be increased to about 150 feet at sharp turns of the channel, the improvements to be extended to within 100 feet of the county bridge, where the proposed channel is to widen out fan shape, at an estimated cost of $13,000. In 1898 the channel above and below the railroad bridge at Seaford was dredged to the project dimensions, except in a bend about 2,900 feet below, and the latter was dredged in 1900. No work has been done since, but the river and harbor act of March 3, 1905, appropriated $2,000, which it is proposed to expend in dredging shoal places and widening the channel in accordance with the project. The work is under advertisement at the close of the fiscal year 1905.

[a] The balance unexpended in the last annual money statement ($12,256.32) was in error. It should have been $9,297.78, as will appear on reference to the subtraction in the last annual report. The balance reported this year ($8,293.40) is arrived at by deducting $1,105.54, the Wicomico River balance, and adding $36.13 for La Trappe River and $65.03 for Manokin River, which were respectively withdrawn from and added to the consolidated appropriation in the river and harbor act of March 3, 1905.

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The amount expended to June 30, 1905, was $10,362.36, of which $5,000 was on a previous project, no part of which was applied to maintenance. The range of tide is about 3.4 feet at Seaford, the head of navigation.

The maximum draft that could be carried June 30, 1905, at mean low water over the shoalest part of the channel was 7 feet. Three steamers and 120 sailing vessels and barges are reported as plying in the river, the commerce being valued at $2,028.656.

The tonnage of the river is reported to be as follows:

	Tons.
1903	119,038
1904	120,229

The improvement has made no appreciable difference in freight rates.

The report of the survey upon which this project is based is printed in the Annual Report of the Chief of Engineers for 1895, pages 1165–1167.

July 1, 1904, balance unexpended	$736.50
Amount appropriated by river and harbor act approved March 3, 1905	2,000.00
	2,736.50
June 30, 1905, amount expended during fiscal year, for works of improvement	98.86
July 1, 1905, balance unexpended	2,637.64

(See Appendix J 7.)

8. Broad Creek River, Delaware.—This is a tributary of the Nanticoke River, and in 1881 the controlling depth was 1½ feet, with a mean range of tide of 3 feet. In 1889 a channel 6 feet deep at mean low water and 50 feet wide had been dredged under project dated February 4, 1880, from Bethel to Laurel, the head of navigation, about 7½ miles from the mouth of the river, at a cost of $35,000. The existing project, adopted August 5, 1892, is for a channel 70 feet wide and 8 feet deep at mean low water between Bethel and Laurel, at an estimated cost of $15,000. The projected channel was dredged, except for a short distance at the upper end, where it was reduced to 60 feet in width to secure the stability of some wharves. No dredging was done in the fiscal year 1905, but the expenditures have been for examinations and current expenses. The amount expended to June 30, 1905, is $15,000.

The maximum draft that could be carried June 30, 1905, at mean low water over the shoalest part of the channel is reported to be 6½ feet. It has been impracticable to obtain complete commercial statistics. The improvement has made no appreciable difference in freight rates.

July 1, 1904, balance unexpended	$324.80
June 30, 1905, amount expended during fiscal year, for works of improvement	324.80

(See Appendix J 8.)

9. Wicomico River, Maryland.—The portion of the river at and just below Salisbury, which is the head of navigation, has been under improvement by the United States since 1872, under project dated April 15, 1871. At that time the navigable channel, with a minimum depth of 8 feet at low water, extended to a point within 2 miles of

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Salisbury. The extreme upper portion, as far as the mill dam in the heart of the town, was quite shoal, and had an average depth of only 18 inches at low tide. Between 1872 and 1885 a channel 75 to nearly 100 feet wide and 7 feet deep at low water was dredged from deep water below to the drawbridge in the town, at a cost to the Government of about $50,000.

The existing project, based upon a survey of the river made in 1889 (printed in Annual Report for 1889, p. 918), provides for a channel 9 feet deep at mean low water from that depth below to the drawbridge at Salisbury, the width to be from 100 to 150 feet, at an estimated cost of $23,200. At the time this project was adopted there existed a 7-foot low-water channel from 75 to 100 feet wide to Salisbury. From 1891 to 1904 dredging was done at various times as funds became available until the project was practically completed. The river and harbor act of March 3, 1905, appropriated $5,000 for this stream, which it is proposed to expend in widening the project channel at some bends and in removing shoals that have formed in the channel. The work is under advertisement at the close of the fiscal year 1905. The amount expended to June 30, 1905, is $79,998, of which $50,000 was on previous projects. The maximum draft that could be carried June 30, 1905, at mean low water over the shoalest part of the channel under improvement was 9 feet. Two steamers and 80 sailing vessels and barges are reported as plying in the river, the commerce being valued at $4,761,095.

The tonnage of the river is reported to be as follows:

	Tons.
1903	197,306
1904	199,279

The improvement has made no appreciable difference in freight rates.

A preliminary examination is in progress at the close of the fiscal year 1905.

July 1, 1904, balance unexpended	$1,105.54
Amount appropriated by river and harbor act approved March 3, 1905	5,000.00
	6,105.54
June 30, 1905, amount expended during fiscal year, for works of improvement	1,105.54
July 1, 1905, balance unexpended	5,000.00

(See Appendix J 9.)

10. Removing sunken vessels or craft obstructing or endangering navigation.—During the past fiscal year wrecks were removed as follows: Barge *Charles Gring* from Roads Harbor, mouth of Elk River, Maryland, and schooner *Mary L. Colbourne* from Tangier Sound, Virginia.

In addition to the above, work was completed on removing sunken piles, rafts, etc., from Elk River and Back Creek, Maryland.

The amount expended for the removal of wrecks during the fiscal year ending June 30, 1905, was $21,793.82. The most of this expenditure was on account of outstanding liabilities from the fiscal year ending June 30, 1904.

(See Appendix J 10.)

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IMPROVEMENT OF POTOMAC RIVER AND ITS TRIBUTARIES, OF JAMES RIVER AND OF HARBOR OF MILFORD HAVEN, VIRGINIA, AND OF CERTAIN RIVERS IN MARYLAND AND VIRGINIA ON THE WESTERN AND EASTERN SHORES OF CHESAPEAKE BAY; PROTECTION OF JAMESTOWN ISLAND, VIRGINIA.

This district was in the charge of Col. A. M. Miller, Corps of Engineers, to September 14, 1904; in the temporary charge of Capt. William P. Wooten, Corps of Engineers, from September 14, 1904, to November 14, 1904, and in the charge of Lieut. Col. Smith S. Leach, Corps of Engineers, since November 14, 1904. Captain Wooten was on duty under the immediate orders of the officer in charge from July 1 to September, 1904, and since November 14, 1904. Division engineer, Col. Amos Stickney, Corps of Engineers.

1. Potomac River at Washington, D. C.—Before improvement, the Virginia channel was obstructed by two bars. The upper bar extended from Long Bridge to about one-half mile below Easbys Point, and the ruling depth on this bar was 8 feet. The lower bar was near Giesboro Point, and had a ruling depth of 14 feet. The ruling depth in the Washington channel was 10 feet. Georgetown Harbor was obstructed by several dangerous rocks. The flats which extended to the edge of the Virginia channel were largely bare at low water and were an active agent in spreading malarial and other diseases.

Between June 11, 1870, and March 3, 1881, the sum of $290,000 was appropriated by Congress for the improvement of the harbors of Washington and Georgetown. The project under which this sum was expended is not definitely stated, although it is understood that it provided for dredging channels 16 feet deep and 200 feet wide through the Georgetown and Washington channels and for the removal of the most dangerous rocks obstructing navigation in the harbor of Georgetown to a depth of 20 feet.

The existing project for the improvement was adopted August 2, 1882, and has for its object the improvement of the navigation of the river by widening and deepening its channels, the reclamation of the flats by depositing on them the material dredged from the channels, the freeing of the Washington channel of sewage, and the establishment of harbor lines. To effect these the project provided "that the channel depths * * * should be sufficient to accommodate the largest draft vessels that can be brought up to Arsenal Point" (the projected depth was not stated in feet, but by the above-imposed condition was at that time limited to 20 feet at low tide, whereas the ruling depth in the Potomac River below Washington has now been increased, by dredging, to 24 feet at low tide); that the flats be reclaimed to a height of 3 feet above the flood plane of 1877 (which, although the highest recorded freshet at that time, was exceeded by about 3 feet by the flood of 1889); for a tidal reservior to be provided with automatic inlet and outlet gates, and for an ample system of drainage for the reclaimed area. A training dike on the Virginia shore, extending downstream from Analostan Island, was added to the project in 1890. The project also provided for the rebuilding of Long Bridge and for the interception of all sewage discharged into the Washington channel, but neither of these works was included in the estimated cost of the improvement, which was $2,716,365. The estimate, as revised in 1897, is $2,953,020.

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The amount expended on the work of the existing project to June 30, 1905, was $2,477,503.40, of which about $693,500 was applied to maintenance.

The expenditure resulted in the dredging of a channel 20 feet deep and 550 feet wide through the bar above Long Bridge and in restoring the standard 20-foot navigation by redredging shoals due to freshets; in increasing the width of the natural channel just below Long Bridge by 50 to 500 feet and in deepening it to 20 feet; in dredging a channel 350 feet wide and 20 feet deep through the bar in the Virginia channel near Giesboro Point; in dredging the Washington channel to a width of 400 feet and a depth of 20 feet for navigation channel, and in dredging between this navigation channel and the wall of the adjacent reclaimed area to a depth of 12 feet; in dredging at the junction of the Washington and Virginia channels; in dredging the tidal reservoir (111 acres) to a depth of about 8 feet; in the construction of the reservoir outlet, and in the construction of 35,289 linear feet of sea wall, of which 5,680 linear feet has been taken down and relaid, and 5,965 linear feet of training dike.

The area of land reclaimed by these operations is 621.12 acres (or, including reservoir, 739.42 acres), which, by act of March 3, 1897, was declared to be a public park under the name of Potomac Park.

The maximum draft that could be carried June 30, 1905, at mean low water over the shoalest part of the Washington channel was 19 feet; for the Virginia channel it was 18 feet. The mean range of tide is about 3 feet.

The Potomac River is navigable to the foot of Little Falls, 3½ miles above Georgetown, but the Aqueduct Bridge, which crosses the river at Georgetown, 113 miles above the mouth of the river, has no draw and limits the navigation of large steamers and masted vessels.

The principal articles of commerce are coal, sand, gravel, lumber, ice, wood, stone, asphalt, oils, and miscellaneous merchandise, and the total tonnage is shown, as closely as it can be ascertained, by the following:

Commercial statistics.

	Tons.		Tons.
1887	618,972	1896	723,657
1888	581,575	1897	593,684
1889	488,680	1898	645,239
1890	519,696	1899	715,549
1891	551,219	1900	661,420
1892	766,954	1901	706,551
1893	653,433	1902	672,912
1894	644,588	1903	762,043
1895	693,450	1904	758,150

The value of the articles shipped is not known.

The benefits to navigation from the improvements made have been marked. Vessels of much deeper draft than those formerly used are now engaged in this trade, and it is understood that freight rates have been materially reduced.

The additional work proposed is for the purpose of extension of benefits and for the maintenance of the improvement in a serviceable condition.

It is proposed to apply the available funds toward dredging in the Virginia channel, the Washington channel, and the tidal reservoir; to the construction of the inlet gates, which, if constructed immediately

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after the dredging of the tidal reservoir, will prevent subsequent shoaling both in this reservoir and in the Washington channel; to the repair of the sea wall, the extension of the training dike, and the maintenance of the outlet gates.

Maps of the locality may be found in each Annual Report of the Chief of Engineers since 1877, with the exception of those for 1879, 1882, and 1893.

Reference to the report on the examination and survey of Potomac River at Washington, D. C., will be found on page 194 of the Annual Report of the Chief of Engineers for 1904.

July 1, 1904, balance unexpended	$83,981.03
Amount appropriated by river and harbor act approved March 3, 1905	50,000.00
	133,981.03
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	77,484.43
July 1, 1905, balance unexpended	56,496.60
July 1, 1905, outstanding liabilities	1,544.00
July 1, 1905, balance available	54,952.60
Amount (estimated) required for completion of existing project	469,020.00

(See Appendix K 1.)

2. Potomac River below Washington, D. C.—The Potomac River below Washington, D. C., is generally a wide and deep body of water, having the characteristics of a tidal estuary rather than of a fluvial stream.

Prior to improvement 24-foot navigation was obstructed by seven shoals over which the depth ranged from 19½ to 23 feet at low tide. Several of these shoals were long and formed serious obstructions to navigation by deep-draft vessels.

The present, which is also the original project for this improvement, was adopted March 3, 1899. This provides for the improvement of the waterway by dredging channels 24 feet deep and 200 feet wide through all obstructions to 24-foot navigation below Washington, D. C., at an estimated cost of $176,000.

The amount expended to June 30, 1905, was $171,448.03, of which about $31,000 was applied to maintenance.

As a result of this expenditure, channels 24 feet deep and at least 200 feet wide have been dredged through six of the shoals, while the dredging of the seventh is in progress and is nearly completed. The maximum draft that could be carried on June 30, 1905, at mean low water over the shoalest part of the locality under improvement was 23.5 feet, this depth occurring over the shoal not yet completed. The mean range of tide varies from about 1.6 feet at lower shoals to about 2.8 feet at the upper. Georgetown, 113 miles above the mouth of Potomac River, in the head of navigation for large vessels.

The principal articles of commerce are coal, ice, lumber, wood, sand, gravel, clay, stone, oil, asphalt, and miscellaneous merchandise. There is a large passenger traffic on the river. The total tonnage is shown as closely as it can be ascertained in the following:

Commercial statistics.

	Tons.
1903	1,350,000
1904	1,340,000

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The value of the articles shipped is not known.

As far as is known the work done has had no material effect upon freight rates.

The work provided for under the present project has been practically completed and no further appropriation is required therefor. A channel only 200 feet wide is, however, regarded as too contracted for a river of the width and importance of the Potomac, especially in view of the location of the Washington Navy-Yard upon its shores.

Maps of the locality may be found in the Annual Reports of the Chief of Engineers for 1890, 1900, 1902, and 1903.

For reference to the report on an examination and survey of Potomac River below Washington, D. C., see page 197 of the Annual Report of the Chief of Engineers for 1904.

July 1, 1904, balance unexpended		$17,845.55
Amount appropriated by river and harbor act approved March 3, 1905		10,000.00
		27,845.55
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$4,293.58	
For maintenance of improvement	9,000.00	
		13,293.58
July 1, 1905, balance unexpended		14,551.97
July 1, 1905, outstanding liabilities		346.00
July 1, 1905, balance available		14,205.97
July 1, 1905, amount covered by uncompleted contracts		6,182.75

(See Appendix K 2.)

3. Anacostia River, District of Columbia.—Before improvement the ruling depth from the mouth to the Navy-Yard Bridge was about 18 feet, the channel affording this depth being narrow and tortuous.

An allotment of $20,000 for work in the Anacostia was made from the appropriation of September 19, 1890, for improving Potomac River at Washington. Under this allotment channels 20 feet deep and about 200 feet wide were dredged through shoals near the foot of South Capitol street and opposite Washington Barracks. This dredging was completed in May, 1892, at a cost of $18,536.94.

The present project for this improvement was adopted June 13, 1902, and provides for the improvement of the portion of Anacostia River below the Navy-Yard Bridge by dredging a channel 20 feet deep for a width of 400 feet, gradually decreasing the depth to 6 feet at the bulkhead lines, and depositing the dredged material on the adjacent flats to an average elevation of 7 feet above low tide, the reclaimed area to be surrounded by an earthen embankment to a height of 14 feet above low tide, protected by a masonry sea wall, and provided with suitable drainage through the embankment, at an estimated cost of $1,218,525.

The amount expended on the existing project to June 30, 1905, was $149,950.36, none of which was applied to maintenance. As a result of this expenditure a channel 20 feet deep at mean low tide and at least 300 feet wide (except at Buzzard Point, where the width is about 240 feet) has been secured for a distance of 9,130 feet upstream from the mouth of the Anacostia (or up to the lower limits of the navy-yard).

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Incidental to the improvement of the channel about 110 acres of flats has been filled by the deposit of excavated material to an average height of 4 feet above low tide. Harbor lines have been established up to Pennsylvania Avenue Bridge.

The maximum draft that could be carried on June 30, 1905, over the shoalest part of the locality under improvement was 19 feet. The mean range of tides is about 3 feet.

Anacostia River is navigable for large vessels to the Navy-Yard Bridge, for tugs and small vessels to Pennsylvania Avenue Bridge, and for small scows and lighters to Bladensburg, Md., respectively 2, 2¾, and 8¾ miles above its mouth.

The principal articles of commerce are sand and gravel, brick, clay, stone, coal, oils, ice, piles, wood, asphalt, and miscellaneous freight, a large amount of which is shipped to and from the naval proving grounds at Indian Head, Md. The amount of trade is shown, as closely as it can be ascertained, by the following:

Commercial statistics.

	Tons.
1903	285,281
1904	280,605

The value of the articles shipped is not known.

The improvement already made has been of benefit to navigation, and has resulted in the diversion of considerable traffic from the Washington channel, where conditions were rapidly becoming congested. It is not known that any reduction in freight rates has resulted from the work done.

The additional work proposed is for the extension of benefits.

Maps of the locality will be found in the Annual Reports of the Chief of Engineers for 1903 and 1904.

Reference to reports upon examinations and surveys of this river will be found on page 198 of the Annual Report of the Chief of Engineers for 1904.

July 1, 1904, balance unexpended	$66,781.73
June 30, 1905, amount expended during fiscal year, for works of improvement	65,269.03
July 1, 1905, balance unexpended	1,512.70
Amount (estimated) required for completion of existing project	1,067,061.94

(See Appendix K 3.)

4. Breton Bay and Patuxent River, Maryland.—(*a*) *Breton Bay.*—Breton Bay is about 6½ miles long and well landlocked. Fifteen feet of water can be carried up the bay for a distance of 4 miles. At the time of the adoption of a project for its improvement 10-foot navigation in Breton Bay was obstructed by a shoal commencing 5 miles above the mouth and extending to the head of the bay. The least channel depth over this shoal was 5 feet at low tide.

The original project for improvement, adopted in 1878, provided for dredging a channel 150 feet wide and 9 feet deep from the 9-foot contour in Breton Bay to the Leonardtown wharf, with a turning basin for steamboats at the wharf 400 feet wide and 600 feet long, at an estimated cost of $30,000. In 1886 the project was amended so as to provide for a channel 200 feet wide and 10 feet deep, the turning

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basin to be 800 feet long and 400 feet wide. The estimated cost of the amended project was $49,000. In 1890 the original project was resumed, a width of 150 feet and depth of 9 feet being deemed sufficient to furnish all the facilities needed by navigation at that time.

From June 18, 1878, to September 19, 1890, nine appropriations, aggregating $37,500, were made. This sum was applied to dredging 214,229 cubic yards of material. The work called for by this project was completed August 25, 1891. The channel was then 9 feet deep at low tide from the original 9-foot contour in Breton Bay to the Leonardtown wharf. The width of the channel was 150 feet, and at the turn off Buzzards Point it was made 320 feet to facilitate the turning of steamers. The basin at Leonardtown was 9 feet deep, 370 feet wide, and 600 feet long.

The present project for this improvement was adopted June 13, 1902, and contemplates the dredging of a channel and turning basin 10 feet deep, the channel to have a minimum width of 200 feet, and the turning basin to be 400 feet wide and 600 feet long. The estimated cost of the project is $36,480.

The Board of Engineers for Rivers and Harbors considered this project and recommended that $6,000 be expended at the earliest practicable date in providing a channel 10 feet deep and wide enough to accommodate the boats now trading in this stream, including a turning basin of ample dimensions at Leonardtown wharf, $4,000 to be applied to new work and $2,000 to maintenance.

It was the opinion of the Board that the expenditure of $4,000 every four years thereafter would maintain a sufficient turning basin, a channel at least 100 feet wide and wider at the turn, all of a 10-foot depth.

The amount expended under the present project to June 30, 1905, was $6,000, none of which was applied to maintenance. As a result of this expenditure a channel at least 100 feet wide, 10 feet deep, and 3,800 feet long has been dredged through the shoalest portion of the bar, with the turning basin of the same depth 200 feet wide and 400 feet long. The maximum draft that could be carried on June 30, 1905, at mean low water over the shoalest part of the locality under improvement was 10 feet, but the channel affording this depth was narrow and crooked. The mean range of tides is about 1.7 feet. Leonardtown, 6 miles above the mouth of the bay, is the head of navigation.

It has been impracticable to obtain commercial statistics for this locality since 1899. The principal articles of commerce are wood, lumber, coal, farm produce, grain, tobacco, and general merchandise. In 1899 the total tonnage was estimated as 101,605 tons, and the number of passengers at about 2,000 a year. The value of the shipments was estimated as about $225,000 per annum.

It is stated that the improvement has resulted in a reduction in freight rates, the amount of which is not known. Shipments have been facilitated by the work done.

The additional work proposed is designed to improve the navigation facilities of the present channel, and is hence for the purpose of extending the benefits derived from the work heretofore done.

Maps of the locality may be found in the Annual Reports of the Chief of Engineers for 1887 and 1889.

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For reference to reports on examinations and surveys of this locality see page 199 of the Annual Report of the Chief of Engineers for 1904.

(*b*) *Patuxent River.*—Patuxent River is navigable for large river steamers to Bristol Landing, a distance of about 46 miles. The lower part of the river is a tidal estuary, with a width of 1 to 2 miles, and 18 feet can be carried at low tide to Swansons Creek, 24 miles above the mouth. Originally there existed two obstructions to 9-foot navigation—Swann Point bar, 43½ miles above the mouth, over which the ruling depth was 7.8 feet, and Bristol bar, at Bristol Landing, over which the ruling depth was 8 feet.

The original project for this improvement, adopted August 11, 1888, provided for dredging channels 200 feet wide and 12 feet deep through Bristol and Swann Point bars, at an estimated cost of $80,000. This project was modified in 1890 so as to provide for a channel 120 feet wide and 12 feet deep (then already dredged) at Bristol bar and a channel about 100 feet wide and 9 feet deep at Swann Point bar.

The sum of $10,617.30 was expended under these projects, the latter being completed in 1891.

The existing project for this improvement, adopted June 13, 1902, contemplates the dredging of a channel through Bristol bar 100 feet wide and 10 feet deep, with a turning basin of the same depth, 300 feet wide, and 400 feet long at the steamboat wharf, at an estimated cost of $10,500.

The amount expended under the present project to June 30, 1905, was $3,382.70, none of which was applied to maintenance.

As a result of this expenditure there has been dredged at Bristol bar a channel 10 feet deep and 100 feet wide, and a turning basin 240 feet wide, 350 feet long, and 10 feet deep. The maximum draft that could be carried June 30, 1905, at mean low tide over the shoalest part of the locality under improvement was about 9.5 feet, and the mean range of tide is about 2.3 feet. Bristol Landing, 46 miles above the mouth, is the head of navigation for steamers, although lighters and small sailing vessels occasionally ascend the river to Hills Landing, about 2 miles above Bristol Landing.

It has been impracticable to obtain accurate and definite statistics of the trade of this locality. The principal articles of commerce are corn, wheat, tobacco, fruit, miscellaneous farm produce, and general merchandise, and the value of receipts and shipments is estimated as about $150,000 per annum. The annual number of passengers is about 1,000. As far as is known the work done has not materially altered the freight rates, although shipments have been facilitated thereby.

In pursuance of a resolution of the Committee on Rivers and Harbors of the House of Representatives, the Board of Engineers for Rivers and Harbors has considered the project for this work and submitted a report adverse to its continuance, which will be found on pages 1048 to 1050 of the Annual Report of the Chief of Engineers for 1903. No appropriation for the work was made in the river and harbor act of March 3, 1905. Reports for this locality will therefore be discontinued.

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For reference to reports on examinations and surveys of this locality, see page 200 of the Annual Report of the Chief of Engineers for 1904.

Maps of the locality may be found in the Annual Reports of the Chief of Engineers for 1888 and 1890.

July 1, 1904, balance unexpended	[a]$3,371.65
Amount appropriated by river and harbor act approved March 3, 1905	[b]6,000.00
	9,371.65
June 30, 1905, amount expended during fiscal year, for works of improvement	[a]3,371.65
July 1, 1905, balance unexpended	[b]6,000.00
Amount (estimated) required for completion of existing project	[b]24,480.00

(See Appendix K 4.)

5. York, Mattaponi, and Pamunkey rivers, and Occoquan, Nandua, Aquia, and Carters creeks, Virginia.—(a) York River.—Prior to improvement 24 feet could be carried up York River for a distance of 32 miles, when Potopotank bar was encountered, over which the ruling depth was 18½ feet. Westpoint bar, the only other obstruction to navigation, had a ruling depth of 15½ feet.

The project for this improvement, adopted June 14, 1880, and revised in 1884 and 1887, proposed dredging channels 22 feet deep at mean low water and 400 feet wide through the bars, and the construction of a dike along the right bank at Westpoint bar, to maintain the channel, at a total estimated cost of $308,800.

The amount expended to June 30, 1905, was $242,451.84, of which about $62,500 was applied to maintenance. This expenditure has resulted in a dredged channel 105 feet wide and 22 feet deep at Potopotank, and one 22 feet deep and 160 to 260 feet in width at Westpoint bar. A training dike 10,142 feet long has been constructed at Westpoint bar and repaired where necessary, and examinations of the channel made subsequent to its construction show that the channel dimensions obtained by dredging are now being maintained.

The maximum draft that could be carried on June 30, 1905, at mean low tide over the shoalest part of the locality under improvement was about 20 feet. The mean range of tides is about 3 feet. York River is navigable throughout its entire length of 41 miles to Westpoint at its head.

The principal articles of commerce are farm produce, general merchandise, oysters, tobacco, fertilizer, canned goods, iron, lumber, etc., and a large number of passengers are carried to and from points on York River. The following table shows the tonnage of the river from 1888 to 1894:

Reported for—	Tons.	Reported for—	Tons.
1888	285,480	1892	345,559
1889	328,353	1893	351,390
1890	418,190	1894	379,808
1891	304,338		

Repeated efforts have been made to procure commercial statistics for years subsequent to 1894, but without success. Statistics re-

[a] For Patuxent River. [b] For Breton Bay.

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ceived for 1902 and 1903 were incomplete, the tonnage of one line of steamers aggregating about 62,000 tons in 1902 and about 62,150 tons during the year 1903. Much additional freight was carried by other steamers, sailing vessels, barges, etc. The value of the shipments is not known.

The work done has been of much importance to commerce, and it is understood that freight rates have been somewhat reduced.

The additional work proposed is for the purpose of extension of benefits and the preservation of work already done.

Maps of the locality may be found in the Annual Reports of the Chief of Engineers for 1886, 1887, and 1894.

For reference to report on examination and survey of York River see page 201 of the Annual Report of the Chief of Engineers for 1904.

(*b*) *Mattaponi River.*—The Mattaponi River is navigable for small steamers and vessels from its mouth to Aylett, about 39 miles, and can be made navigable for small barges from Aylett to Monday bridge, 16 miles. At the time of the adoption of the project the obstructions to a 5½-foot navigation below Aylett consisted of seven bars, upon which the ruling depths at low tide varied from 2.4 to 3.8 feet. Above Aylett there were numerous bars, but no work upon them has been proposed. The river was also obstructed by snags, wrecks, and overhanging trees.

The original project for improvement, adopted June 14, 1880, provided for removal of snags, wrecks, and leaning trees below Monday bridge, and the improvement of the bars below Aylett, so as to give a depth of 5½ feet at low tide and a channel width of 40 feet, at an estimated cost of $34,059. This project was extended by the terms of the river and harbor act of July 13, 1892, which provided for the removal of snags as far up as Guineas bridge, near Milford station, on the Richmond, Fredericksburg and Potomac Railroad. Estimated cost of this, which is the present project, $72,100.

The amount expended to June 30, 1905, was $30,038.58, of which about $8,650 was applied to maintenance. This expenditure resulted in the removal of snags, logs, and overhanging trees from the river between Robinsons bar, 34 miles above the mouth, and Monday bridge, 21 miles above Robinsons, and in keeping the river below Aylett free from such obstructions; in constructing 2,297 linear feet of dike at Robinsons bar, and in dredging channels of the full projected dimensions entirely through Line Tree and nearly one-third of the distance through Latané bar.

The maximum draft that could be carried at mean low water over the shoalest part of the channel June 30, 1905, was 2.4 feet at Walker bar. The mean range of tide is about 3 feet. Aylett, 39 miles above the mouth of the river, is the present head of navigation.

The principal articles of commerce are farm produce, grain, and general merchandise, and the tonnage per year is shown as closely as can be ascertained by the following:

	Tons.		Tons.
1890	32,650	1899	44,700
1891	52,060	1900	42,500
1892	32,690	1901	12,054
1893	36,420	1903	22,000
1894	39,300	1904	43,400

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Commercial statistics for the years 1895 to 1898 could not be procured.

The value of the articles shipped is not known.

The work done has been of considerable benefit to commerce, and it is understood that not only have shipments been facilitated, but freight rates have been somewhat reduced.

The additional work proposed is partially necessary to make the improvement available and partially for the purpose of extension of benefits.

Maps of the locality may be found in the Annual Reports of the Chief of Engineers for 1887, 1888, and 1890.

For reference to reports on examinations and surveys of this locality see page 212 of the Annual Report of the Chief of Engineers for 1904.

(*c*) *Pamunkey River.*—At the time of the adoption of the project for the improvement of Pamunkey River a draft of 7 feet could be carried at low tide to Buckland bar, 38½ miles above its mouth. Between this bar and Hanovertown, a distance of 20½ miles, there were six bars, the ruling depths on which varied from 5½ to 2 feet. Besides these bars the river was obstructed by wrecks, logs, snags, and overhanging trees.

The original, which is also the existing, project for the improvement of this river was adopted June 14, 1880, and amended in 1885. It contemplates securing 7-foot navigation to Bassett Ferry, 47 miles from Westpoint; thence 5-foot navigation to Wormley Landing, 7 miles farther; thence 3-foot navigation to Hanovertown, 5 miles farther, the 7-foot channel to have a width of 100 feet and the other channels a width of 40 feet. The wrecks, snags, logs, and trees obstructing navigation between Garlick Ferry and Hanovertown were also to be removed. The estimated cost of this project is $32,500.

The amount expended to June 30, 1905, was $26,500, of which about $6,300 was applied to maintenance. This expenditure has resulted in removing snags and similar obstructions from about 30 miles of river, in keeping the river free from such obstructions, in removing parts of 7 wrecks, in partly improving Spring and Skidmore bars, and in dredging a channel 100 feet wide and 7 feet deep through Buckland bar.

The maximum drafts that could be carried through the channels on June 30, 1905, at mean low tide were as follows: In the 7-foot channel, 5.3 feet, in the 5-foot channel, 3.5 feet, and in the 3-foot channel, 2.2 feet. The mean range of tide varies from 2 to 3.5 feet. Hanovertown, 59 miles above the mouth of the river, is the head of navigation.

The principal articles of commerce are wood, lumber, grain, ties, coal, farm produce, and general merchandise. Commercial statistics have been difficult to obtain. The total tonnage is represented as closely as can be ascertained by the following tabulation:

Commercial statistics.

	Tons.
1893	50,420
1894	42,250
1899	44,600

Repeated efforts were made to secure commercial statistics subsequent to 1899, but they could not be obtained.

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The value of the articles shipped is not known.

The work done has been of benefit to commerce, and it is understood that not only have shipments been facilitated but freight rates have been reduced.

The additional work proposed is for the purpose of extension of benefits.

Maps of the locality may be found in the Annual Reports of the Chief of Engineers for 1887, 1888, and 1890.

For reference to the report on an examination and survey of Pamunkey River see page 213 of the Annual Report of the Chief of Engineers for 1904.

(*d*) *Occoquan Creek.*—In 1872 navigation in Occoquan Creek was obstructed by three bars, designated as Lower Mud, Upper Mud, and Sand bars, over which but 1.2 feet could be carried at low tide. Aside from these obstructions the creek was amply wide and deep at low tide for vessels drawing up to 5 feet.

The original project for the improvement was adopted March 3, 1873, and provided for dredging channels 100 feet wide and 5 feet deep through these three bars at an estimated cost of $18,000. This project was modified in 1879 to include a new channel through and a dike at the sand bar, and the dredging of a channel of the above dimensions through Occoquan bar increasing the estimated cost of the improvement to $25,000. Four appropriations were made from 1873 to 1878, aggregating $25,000, and in 1880 the improvement was regarded as completed.

The existing project for this improvement was adopted September 19, 1890, and contemplates the dredging of channels 6 feet deep and 100 feet wide through the four bars, except the lower 2,000 feet of the Lower Mud bar, where the width is to be 150 feet, and the construction of dikes at Upper Mud, Sand, and Occoquan bars to maintain the depth obtained by dredging. The estimated cost of this project is $45,000.

The amount expended under the existing project to June 30, 1905, was $27,299.41, of which about $12,500 was applied to maintenance. As a result of this expenditure, channels of the full projected dimensions have been dredged through the four bars and redredged where shoaling occurred, and 1,614 linear feet of dike has been constructed at Occoquan bar and Sand bar, and repaired where injured by freshets and ice. The maximum draft that could be carried June 30, 1905, at mean low water over the shoalest part of the locality under improvement was about 5½ feet. The ruling depth on the bar in Occoquan Bay is, however, but about 5 feet. Although the improvement of this bar is not contemplated by the present project, it prevents the full advantages of the improvement from being obtained, and an increase of depth over it is regarded as desirable. The mean range of tide is about 2 feet. The town of Occoquan, 6 miles above the mouth, is the head of navigation of this stream.

The principal articles of commerce are stone, sand (for building), railroad ties, piles, wood, coal, fertilizers, flour, grain, and miscellaneous articles, and the tonnage per year is shown as closely as can be ascertained by the following:

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Commercial statistics.

	Tons.		Tons.
1891	8,205	1900	69,400
1892	56,705	1901	20,220
1894	8,900	1902	13,049
1895	10,475	1903	16,245
1896	41,670	1904	25,880
1897	15,835		
1898	29,865	Total for twelve years	316,449

Of the total tonnage, 109,600 tons was sand.

The value of the articles shipped is not known.

The work done has been of great benefit to navigation in this creek, and it is understood that not only have shipments been facilitated but freight rates have been materially reduced.

The additional work proposed is for the purpose of extending in point of time the benefits derived from the work heretofore done.

For reference to reports on examinations and surveys of this locality see pages 202 and 203 of the Annual Report of the Chief of Engineers for 1904.

(*e*) *Nandua Creek.*—Before improvement the entrance channel to this creek was indirect, narrow, and sinuous, and could be navigated only at mean low water by vessels of 5 feet draft. Within the mouth the channel was sufficient for all commercial needs.

The original project, which is also the existing project, was adopted May 11, 1899, and provides for dredging a channel 100 feet wide and 8 feet deep at low tide through the bar at the mouth of the creek, at an estimated cost of $6,000.

The amount expended to June 30, 1905, was $6,108.94, none of which was applied to maintenance. As a result of this expenditure a channel 1,200 feet long, 75 feet wide, and 8 feet deep at low tide has been dredged through the bar at the mouth of the creek. This cut afforded a temporary relief to navigation, but subsequent examination shows that the channel has shifted bodily to the southward and that the dredged cut has shoaled. The maximum draft that could be carried June 30, 1905, at mean low tide over the shoalest part of the locality under improvement was about 6 feet. The mean range of tides is about 1.9 feet. Nandua wharf, about 4 miles above the mouth of the creek, is practically the head of navigation.

The principal articles of commerce are farm produce, fish, oysters, and general merchandise, and the tonnage per year is shown as closely as can be ascertained by the following

Commercial statistics.

Tonnage for—	Tons.	Tonnage for—	Tons.
1898	8,550	1903	5,068
1900	1,167	1904	5,119

The value of the articles shipped is not known. So far as is known freight rates have not been affected by the improvement.

The sum contemplated by the approved project has been expended at this locality, and no appropriation for the continuance of this work was made by act of Congress of March 3, 1905. Furthermore, Nandua Creek is regarded as unworthy of further improvement by the

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General Government. Hence no additional appropriation is asked, no further work is proposed, and reports for this locality will be discontinued.

For reference to examination and survey reports upon this stream, see page 204 of the Annual Report of the Chief of Engineers for 1904. A map of the locality is printed in the Annual Report for 1895.

(*f*) *Aquia Creek.*—From Wharton Landing, 7½ miles above its mouth, to the Narrows, 4½ miles above its mouth, Aquia Creek has a well-defined channel 60 to 200 feet wide, in which the depth originally ranged from 2 to 17 feet. Below the Narrows the stream suddenly expands into a bay 1,000 to 6,000 feet wide, resulting in a continuous shoal on which the depth originally ranged from 2 to 4 feet, increasing to 7 feet near the mouth.

The original project was adopted June 10, 1872, and provided for dredging a channel 40 feet wide and 6 feet deep at low tide up to Wharton Landing, at an estimated cost of $10,500.

From June 10, 1872, to June 18, 1878, $10,500 was appropriated for this improvement, and by the close of 1878 this sum had been expended. A channel 40 to 50 feet wide and 4 to 5 feet deep at low tide was obtained by this expenditure.

A new project was adopted for this improvement September 19, 1890, which contemplated dredging a channel 150 feet wide and 8 feet deep between the mouth and the Narrows, and a channel 80 feet wide and 8 feet deep through the bar at the mouth of Austen Creek, at an estimated cost of $101,278. This project was modified December 4, 1890, to provide for a channel 80 feet wide and 6 feet deep between the mouth and the Narrows, at an estimated cost of $40,000, which was later reduced to $21,000. This is the existing project for the improvement of Aquia Creek.

The amount expended under the present project to June 30, 1905, was $30,564.84, none of which was applied to maintenance. As a result of this expenditure the channel was completed to the full projected dimensions during the season of 1897, and the locality was dropped from the list of improvements. The river and harbor act of June 13, 1902, included Aquia Creek in a consolidated appropriation with other works, and an examination of the channel was made in November, 1904, which showed that the channel still afforded practically the full projected dimensions. The maximum draft that could be carried June 30, 1905, at mean low tide over the shoalest part of the locality under improvement was about 6 feet. The mean range of tides is about 1.4 feet. Wharton Landing, 7½ miles above the mouth of the creek, is the head of navigation.

The trade of Aquia Creek is chiefly in wood, railroad ties, lumber, tobacco, and farm produce, and amounts to about 18,000 to 20,000 tons annually. The value of the shipments is not known. The improvement has been of material benefit to shippers, and freight rates are understood to have been somewhat reduced and shipments have been facilitated.

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The work contemplated by the existing project has been completed. Hence no additional appropriation is requested, no further work is proposed, and reports for this locality will be discontinued.

For reference to examination and survey reports upon this stream, see page 205 of the Annual Report of the Chief of Engineers for 1904.

(*g*) *Carters Creek.*—Before improvement the entrance to Carters Creek was obstructed by a bar over which but 10½ feet could be carried at low tide, and navigation was difficult near Gallyhook Point within the creek, owing to the projection of this point into the channel, which was about 12 feet deep at low tide.

The original, which is also the existing, project for this improvement was adopted June 13, 1902, and provides for dredging a channel at the mouth to afford a navigable depth at low tide of 15 feet, with a width of 200 feet, including necessary dredging at Crab Point, and the construction of a jetty for the protection of this channel, together with the dredging of a channel 12 feet deep and 100 feet wide at Gallyhook Point, at an estimated cost of $35,700.

The amount expended to June 30, 1905, was $7,298.93, none of which was applied to maintenance.

As a result of this expenditure a channel 140 feet wide and 15 feet deep has been dredged through the bar at the mouth of the creek, and for a length of 600 feet this channel has been made 170 feet wide. Harbor lines have been established.

The maximum draft that could be carried on June 30, 1905, at mean low tide over the shoalest part of the outer bar was 15 feet, and at Gallyhook Point was 12 feet, but the channel affording this depth was tortuous. Irvington, about 1½ miles above the mouth of the creek, is the head of navigation for large steamers, while small sailing vessels drawing up to 5 feet ascend about 1 mile farther.

The principal freight shipments consist of oysters, fish, fish guano, fish oil, crabs, lumber, wood, farm produce, flour, and general merchandise. There is a good passenger trade in Carters Creek, which is also an important harbor of refuge. The total tonnage, as furnished by residents of the locality, is shown in the following tabulation:

Commercial statistics.

	Tons.
1903	503,950
1904	357,150

These statistics are not regarded as entirely correct. The value of the articles shipped is not known.

The work done has been of considerable benefit to commerce, but as far as is known it has had no effect upon freight rates.

The additional work proposed is for the purpose of extension of benefits and for the preservation of work already done.

For reference to the report upon an examination and survey of Carters Creek, see page 206 of the Annual Report of the Chief of Engineers for 1904.

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July 1, 1904, balance unexpended		$16,942.59
Amount appropriated by river and harbor act approved March 3, 1905		[a] 28,000.00
		44,942.59
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$7,291.62	
For maintenance of improvement	1,579.98	
		8,871.60
July 1, 1905, balance unexpended		36,070.99
July 1, 1905, outstanding liabilities		750.00
July 1, 1905, balance available		35,320.99
Amount (estimated) required for completion of existing project		[b] 131,928.17

(See Appendix K 5.)

6. Nomini Creek, Virginia.—Before improvement, Nomini Creek navigation was obstructed by a bar at its mouth over which but 3 feet could be carried at low tide. Except for this bar a draft of 8 feet could be carried to Nomini Ferry, 4 miles above the mouth, and 5 feet could be carried 2 miles farther to the head of navigation.

The project for this improvement, adopted May 3, 1873, and modified in 1879, 1888, 1890, and 1897, provides for a channel through the bar 150 feet wide and 10 feet deep, with jetties at the mouth, and spur dikes inside White Point to check cross currents. The finally revised estimate of cost is $105,000.

The amount expended to June 30, 1905, was $69,763.87, of which about $17,500 was applied to maintenance.

As a result of this expenditure the channel has been dredged to a depth of 9 feet at low tide by a width of 140 to 150 feet and redredged, and 872 linear feet of the east jetty has been constructed at a height of 4 feet above low tide.

The maximum draft that could be carried on June 30, 1905, at mean low tide over the shoalest part of the locality under improvement was 9 feet. The mean range of tide is 1.8 feet.

The principal articles of commerce are farm produce, grain, flour, lumber, oysters, railroad ties, general merchandise, and wood. The total tonnage is represented as closely as can be ascertained by the following:

Commercial statistics.

	Tons.		Tons.
1889	13,542	1896	7,425
1890	15,825	1897	7,370
1891	62,300	1898	9,640
1892	21,010	1901	22,400
1893	17,558	1902	21,350
1894	18,110	1903	19,270
1895	15,248	1904	9,110

[a] Of this appropriation, and subsequent to the close of the fiscal year, $3,111.91 was allotted for York River, $5,971.44 for Occoquan River, $5,500 for Mattaponi River, $3,400 for Pamunkey River, and $9,116.65 for Carters Creek, Virginia, and these sums are available for improvement during the ensuing year; $900 was allotted for surveys for the several streams, of which sum $148.20 was expended during the fiscal year and $363.42 was outstanding, leaving $388.38 available for surveys.

[b] This item has been reduced $84.18, the amount transferred to improvement of Carters Creek from Nandua and Aquia creeks.

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The value of the articles shipped is not known.

The work done has been of substantial benefit to navigation, and it is understood that freight rates have been considerably reduced and shipments much facilitated.

The additional work proposed is for the purpose of extension of benefits and for the preservation of the work already done.

A map of the locality may be found in the Annual Report of the Chief of Engineers for 1889.

For reference to a report on an examination and survey of Nomini Creek see page 207 of the Annual Report of the Chief of Engineers for 1904.

July 1, 1904, balance unexpended	$2,733.75
Amount appropriated by river and harbor act approved March 3, 1905	4,000.00
	6,733.75
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	2,497.62
July 1, 1905, balance unexpended	4,236.13
July 1, 1905, outstanding liabilities	9.05
July 1, 1905, balance available	4,227.08
July 1, 1905, amount covered by uncompleted contracts	227.08
Amount (estimated) required for completion of existing project	31,000.00

(See Appendix K 6.)

7. Rappahannock River, Virginia.—The lower portion of Rappahannock River is generally a wide and deep body of water, having the characteristics of a tidal estuary rather than of a fluvial stream.

The obstructions to navigation before improvement was undertaken were nine bars between Tappahannock and Fredericksburg, over which the ruling depths were from 4 to 10½ feet. Seven of the bars were in the 12½ miles of river below Fredericksburg. Of these bars, Fredericksburg bar, with a least depth of 4 feet, and Spottswood bar, 4 miles below Fredericksburg, with a least depth of 6 feet, caused the most delay to steamboats and vessels.

The original project for the improvement of this river was adopted March 3, 1871, and contemplates securing a channel 100 feet wide and 10 feet deep by dredging, and the construction of dikes from Fredericksburg to Tappahannock, the wrecks obstructing the channel to be removed. The first estimate of the cost of this improvement was $83,760. In 1879 the project was amended so as to provide for dredging a channel 100 feet wide and 10 feet deep through the bars between Fredericksburg and Port Royal, and one 200 feet wide and 15 feet deep between Port Royal and Tappahannock, the depth obtained by dredging to be maintained by a system of wing dams and training dikes, the latter being also designed to secure the excavated material deposited behind them. The total estimated cost of this, which is the existing, project is $381,500.

The river and harbor act of March 3, 1905, authorized a survey of the river to be made at and below Fredericksburg, with a view to determining whether any change should be made in the existing plans for improvement and authorized the expenditure of the funds appropriated upon a modified project, if deemed advisable, provided the total cost should not exceed the amount estimated for the completion of the existing project.

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The amount expended to June 30, 1905, was $305,728.86, of which about $113,500 was applied to maintenance.

This expenditure has resulted in the partial improvement of the seven bars between Fredericksburg and Port Royal by means of dredging and rock excavation, construction of dikes, and removal of wrecks which obstructed navigation.

The maximum draft that could be carried June 30, 1904, at mean low tide over the shoalest part of the locality under improvement was about 9 feet. The mean range of tide is about 3 feet. Fredericksburg, 106 miles above the mouth, is the head of navigation.

The principal articles of commerce are ties, grain, oysters, farm produce, wood, fertilizer, lumber, flour, canned goods, and general merchandise. The total tonnage is represented, as closely as can be ascertained, by the following:

Commercial statistics.

	Tons.		Tons.
1888	83,600	1898	[a]166,586
1890	83,830	1899	[a]167,862
1892	[a]126,333	1900	[a]190,827
1893	[a]141,750	1901	[a]213,408
1894	[a]144,070	1902	[a]244,365
1895	[a]151,466	1903	[a]268,803
1896	[a]161,196	1904	[b]395,202
1897	[a]158,108		

The value of the articles shipped is not known.

The work done has been of benefit to commerce, and it is understood that freight rates have been reduced.

The additional work proposed is for the purpose of extension of benefits and maintenance of the work already done.

At Fredericksburg bar new deposits of sand are formed by each recurring freshet, and the annual reports for a number of years past have referred to the necessity of an annual appropriation of $7,500 for removal of such deposits from this bar alone.

Maps of this locality may be found in the Annual Reports of the Chief of Engineers for 1880, 1881, 1883, 1886, 1887, 1888, and 1890.

For reference to the report on an examination and survey of Rappahannock River, see page 208 of the Annual Report of the Chief of Engineers for 1904.

July 1, 1904, balance unexpended		$36,735.41
Amount appropriated by river and harbor act approved March 3, 1905		40,000.00
		76,735.41
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$1,500.00	
For maintenance of improvement	23,464.27	
		24,964.27
July 1, 1905, balance unexpended		51,771.14
July 1, 1905, outstanding liabilities		550.00
July 1, 1905, balance available		51,221.14
July 1, 1905, amount covered by uncompleted contracts		15,737.00
Amount (estimated) required for completion of existing project		49,000.00

(See Appendix K 7.)

[a] Furnished by Mr. William D. Scott, Fredericksburg, Va.

[b] Furnished by the city council and Business Men's Association of Fredericksburg, Va.

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8. Urbana Creek, Virginia.—Before the improvement of Urbana Creek a bar existed outside the mouth, over which but 6½ feet could be carried at low tide, and there was a shoal within the creek with a ruling depth of 7 feet.

The project for this improvement, adopted March 3, 1879, and modified in 1883, 1888, and 1897, provides for dredging a channel 150 feet wide and 10 feet deep through the outer and inner bars, with a turning basin of the same depth at the head, for a series of spur dikes at Baileys Point, and for a stone jetty to protect the cut through the outer bar. The final revised estimate of cost is $70,000.

The amount expended to June 30, 1905, was $33,598.49, of which about $10,500 was applied to maintenance.

As a result of this expenditure there has been dredged a channel 10 feet deep and 150 feet wide through the outer bar, a channel 10 feet deep and 135 feet wide through the inner bar, and a small turning basin 10 feet deep at the steamboat wharf. These channels have been redredged where shoaling occurred.

Harbor lines have been established.

The maximum draft that could be carried on June 30, 1905, at mean low tide over the shoalest part of the locality under improvement was about 8.5 feet. The mean range of tide is 1.5 feet. The town of Urbana, at the mouth of the creek, is the head of navigation for steamers and large vessels, while small vessels ascend the stream for a distance of 3 or 4 miles.

The principal articles of commerce are oysters, railroad ties, coal, lumber, wood, farm produce, guano, ice, excelsior, and general merchandise. The total tonnage, as furnished by residents of Urbana, is shown in the following tabulation:

Commercial statistics.

Calendar year.	Reported by Mr. F. A. Bristow.	Reported by Mr. J. D. Gresitt.	Reported by Mr. W. Key Howard.	Reported by Mr. W. H. Ryland.
	Tons.	*Tons.*	*Tons.*	*Tons.*
1891	19,500	22,100		
1892	20,095	17,125		
1893	55,885	61,290		
1894	82,395	88,305		
1895	66,530	92,320		
1896	137,485	138,925		
1897	153,875	181,500		
1900	179,543	179,414		
1901	548,250	494,200		
1902	547,650	538,100		
1903	645,700	740,200	745,600	
1904	1,052,400	1,086,525		1,130,800

Commercial statistics received for 1898 and 1899 were not in a form to be used.

These statistics are not regarded as entirely correct. The value of the articles shipped is not known.

The work done has been of benefit to commerce, and it is understood that freight rates have been reduced.

Further work on this project is interefered with by the existence of an unlawful structure, or dock, built by a private corporation in violation of the provisions of the act of March 3, 1899, in open contempt of an explicit mandate of the Secretary of War forbidding its construction beyond a certain line.

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This dock projects bodily into the area to be occupied by the proposed dredged channel, and its presence prevents further prosecution of the dredging along the lines authorized by Congress.

A criminal proceeding brought against the company resulted in an acquittal in the United States district court for the eastern district of Virginia. A civil proceeding was then instituted for a circuit court injunction to compel the removal of the structure. Until the proceeding is concluded no intelligent recommendation for the further prosecution of this work can be made.

For reference to the reports on examinations and surveys of Urbana Creek see page 210 of the Annual Report of the Chief of Engineers for 1904.

Amount appropriated by river and harbor act approved March 3, 1905	$10,000.00
June 30, 1905, amount expended during fiscal year, for works of improvement	98.49
July 1, 1905, balance unexpended	9,901.51
Amount (estimated) required for completion of existing project	26,500.00

(See Appendix K 8.)

9. Harbor at Milford Haven, Virginia.—Milford Haven is a tidal estuary about 4 miles long and from one-half to 1 mile wide. The depth in the channel ranges from 6½ to 15 feet, and in the portion navigated by steamers it is generally 9 feet or more. The haven has two entrances, one at the northwest end from Hills Bay, an arm of Piankatank River, and another at the southeast end, from Chesapeake Bay. Both entrances are obstructed by bars. The southeast entrance is exposed, and as the bar has a ruling depth of but 3 feet it is seldom used. The bar which obstructed the northwest entrance had, before improvement, a ruling depth of 8 feet. A bar also existed within the haven between Cricket Hill and Callis wharves, with a ruling depth of about 8 feet.

The original, which is also the present, project for this improvement was adopted March 3, 1899, and provides for dredging a channel 10 feet deep, with a minimum width of 200 feet, through the bar at the northwest entrance, at an estimated cost of $12,500. The dredging of a similar channel through the inner bar was added to the project June 13, 1902, the total estimated cost being increased to $17,500.

The amount expended to June 30, 1905, was $15,506.50, none of which was applied to maintenance.

As a result of this expenditure channels of the full projected dimensions have been dredged through both bars, which work has been of considerable benefit to navigation. The maximum draft that could be carried June 30, 1905, at mean low tide over the shoalest part of the locality under improvement was 10 feet. The mean range of tide is about 1.3 feet. The haven is navigable throughout its entire length by vessels drawing 6 feet, and Fitchett's wharf, about 3 miles above the northwest entrance, is the highest point reached by the large steamers.

The principal articles of commerce are oysters, farm produce, fish,

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flour, and general merchandise, and the tonnage per year is shown as closely as can be ascertained by the following:

Commercial statistics.

	Tons.		Tons.
1900	15,031	1903	17,892
1901	16,856	1904	18,071
1902	18,553		

The value of the articles shipped is not known.

As far as is known freight rates have not been materially affected by the improvement, although shipments have been facilitated.

The work contemplated in the project being completed, no further appropriation is asked.

For reference to reports on examinations and surveys of this locality see page 211 of the Annual Report of the Chief of Engineers for 1904.

July 1, 1904, balance unexpended	$8,814.75
June 30, 1905, amount expended during fiscal year, for works of improvement	3,788.28
July 1, 1905, balance unexpended	5,026.47

(See Appendix K 9.)

10. James River, Virginia.—Before improvement, the ruling depth of James River from the mouth to City Point, 68 miles, was 15 feet at mean low water, and to Trents reach, 18½ miles farther, 13 feet. This depth was accompanied by adequate width and other conditions of good navigation.

From Trents reach to Richmond, 17½ miles, the channel was narrow and tortuous in places, with a limiting depth of 7 feet at mean low water, and obstructed by wrecks, trees, and other obstacles placed in the river during military operations.

The original project, adopted in 1870, provided for obtaining a depth of 18 feet at full tide and the sum of $735,000 was appropriated and expended on the work.

The existing project was adopted by the river and harbor act of July 5, 1884, and contemplates the formation by means of regulation works and excavation of a channel 22 feet deep at mean low water, 400 feet wide, from the mouth of the river to City Point; thence 300 feet wide to Drewry Bluff, and thence 200 feet wide to the lower city limits of Richmond, at an estimated cost of $4,500,000. The river and harbor act of June 13, 1902, authorized the extension of the improvement to the head of navigation at the docks, at an estimated cost of $724,943.15; and the project was further extended by the act of March 3, 1905, to include the excavation of a turning basin at Richmond 22 feet deep by increasing the width of the improved channel to 400 feet for a distance of 600 feet, at a cost not to exceed $150,000, making the total estimate $5,374,943.15.

There had been expended on the present project up to June 30, 1905, $1,354,151.16, of which $5,000 was applied to maintenance.

As a result of these expenditures artificial obstructions have been removed, the regulating works have been completed, and the channel excavated to depths of 18 feet at mean low water from the mouth to Goode's rocks, 1½ miles below the city line of Richmond, thence to

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the city line, 16 feet, and above the city line, 12 feet. This channel has, with few exceptions, a navigable width of 100 feet or more.

The range of tides is 2½ feet at Fort Monroe, 2 feet at Jamestown, 3 feet at City Point, 3½ feet at Dutch Gap, and 4 feet at Richmond. The usual range of freshet heights is about 10 to 15 feet at Richmond, though occasional floods reach a much greater height.

The head of navigation is at Richmond, 104 miles above the mouth. This entire navigable portion of the stream is included in the project.

The improvement has been of benefit to commerce. River freights to James River points have been constantly lowering the rail rates.

Work during the fiscal year was done under contract.

At the beginning of the year 35 per cent of the contract, as shown by the contractor's estimates, was done. At the close of the fiscal year 73 per cent was done.

The time limit on the contract was April 4, 1905. On August 12, 1903, this time limit was waived, and on April 3 the charges for inspection were remitted for a period of six months.

The commerce affected by the improvement, as reported for the calendar year 1904, aggregated 273,609 tons at Richmond and 250,437 tons at other points. There were 1,854 and 1,660 (estimated) arrivals and departures, respectively, of vessels—steam, sail, and barge, the larger number being of steam vessels drawing 5 to 16 feet.

These figures indicate a decrease in tonnage for the preceding year of 25 per cent for river points outside of Richmond, due mainly to the item of lumber.

The principal articles of commerce are brick, asphalt blocks, coal, cement, lime, cord wood, fertilizers, fish, oysters, grain, lumber, oil, and miscellaneous package freight.

It is proposed to apply the available funds toward widening and deepening the channel mainly above the city line of Richmond and at Dutch Gap Cut-off, and toward the development of the turning basin as required by law.

For more extended information reference may be made to Annual Reports of the Chief of Engineers for 1871, pages 603 to 605; of 1882, pages 870 to 887, and of 1900, pages 1757 to 1760.

Maps of James River will be found in the Annual Reports of the Chief of Engineers for 1871, 1900, and 1904.

July 1, 1904, balance unexpended	$243,879.58
Amount appropriated by river and harbor act approved March 3, 1905	200,000.00
	443,879.58
June 30, 1905, amount expended during fiscal year, for works of improvement	110,530.74
July 1, 1905, balance unexpended	333,348.84
July 1, 1905, outstanding liabilities	1,245.00
July 1, 1905, balance available	332,103.84
July 1, 1905, amount covered by uncompleted contracts	85,113.00
Amount (estimated) required for completion of existing project	3,692,443.15

(See Appendix K 10.)

11. Protection of Jamestown Island, Virginia.—The original project of October, 1894, was for the protection of something more than half a mile of the bank of the island by a revetment of stone laid on a

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graded bank. At the lower end three pile jetties were built. This work was completed in 1895 at a cost of $10,000.

The protection was not a success.

The existing project, adopted in September, 1896, amended in 1897 and extended in 1900, provides for the protection of the same stretch of shore by a revetment of a more substantial type; the remaining old work to be removed and its materials incorporated into the new, so far as possible. It consists of a paving of concrete slabs, 8 inches thick, laid on a prepared slope, protected at the foot by a buttress of sheet piling, and at the top, where necessary, by a backing of rubble and clay.

Thirteen hundred feet of such work was completed in 1901 under an appropriation made in 1900. The remainder of the eroding bank will be covered by work done under the appropriation of $15,000 in sundry civil act of April 28, 1904.

Work during the fiscal year was done under contract, and the protection of an additional 1,125 feet was about 75 per cent completed, material fabricated but not placed and paid for, included.

It is proposed to continue the work under the contract until funds are exhausted.

The protection of this island can not be said to be necessary to the improvement or conservation of the navigation of the James River.

July 1, 1904, balance unexpended	$15,261.92
June 30, 1905, amount expended during fiscal year, for works of improvement	3,546.27
July 1, 1905, balance unexpended	11,715.65
July 1, 1905, outstanding liabilities	135.17
July 1, 1905, balance available	11,580.48
July 1, 1905, amount covered by uncompleted contracts	10,503.00

(See Appendix K 11.)

12. Removing sunken vessels or craft obstructing or endangering navigation.—(*a*) *Sunken raft in Potomac River near Swann Point, Maryland.*—This raft was reported as an obstruction to navigation on August 26, 1904.

An allotment of $50 was made August 30, 1904, for an examination of the raft, which was made on September 6 and 7. On September 16 a further allotment of $600 was made for the removal of the obstruction.

The removal of the wreck was delayed through the action of the owner of a derrick boat, which it was proposed to use on this work.

On November 17, 1904, it was found that the piles had become water-logged and had sunk to the bottom of the river, where they no longer obstructed navigation.

The total expenditure in connection with this wreck was $97.33.

(*b*) *Wreck of scow in Potomac River at Washington, D. C.*—This wreck was reported as an obstruction to navigation on September 9, 1904, and an examination of the wreck was at once made.

An allotment of $300 was made September 16, 1904, for its removal.

In November, 1904, the wreck was raised and entirely removed from the river and conveyed to Easbys Point.

The scow was repaired and is in use in connection with the Potomac River improvement, and the other articles recovered from the wreck

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were sold and the proceeds, amounting to $43.14, were deposited in the Treasury.

The total expenditure in connection with this work was $300.

(See Appendix K 12.)

IMPROVEMENT OF NORFOLK HARBOR, VIRGINIA, AND ITS APPROACHES, AND OF CERTAIN WATERWAYS AND HARBORS IN SOUTHEASTERN VIRGINIA AND NORTHEASTERN NORTH CAROLINA.

This district was in the charge of Capt E. Eveleth Winslow, Corps of Engineers. Division engineer, Col. W. A. Jones, Corps of Engineers, to June 26, 1905, and Lieut. Col. James B. Quinn, Corps of Engineers, since that date.

1. Harbor at Norfolk and its approaches, Virginia.—(a) General improvement.—The channel of this harbor was originally navigable at mean low water by vessels of 20 feet draft as far as the navy-yard, on the Southern Branch of the Elizabeth River, while in the Eastern Branch of this river there was a channel 15 feet in depth at mean low water to the Campostella bridge. The normal range of tide is 2.7 feet.

A project of improvement was adopted in 1878, revised in 1885, and amended in 1890, 1898, and 1905. It included the attainment of a channel 25 feet deep at mean low water from Hampton Roads to the navy-yard, a branch channel 22 feet deep at the same stage of the tide to the Campostella bridge on the Eastern Branch, and, within the limits of the first-named channel, a channel 450 feet wide and 28 feet deep at mean low water from deep water, in Hampton Roads, to the navy-yard. Above Fort Norfolk the excavation of the 25-foot channel was to be carried to within 75 feet of the pierhead line on both sides of the river, while below that point the contemplated width varied from 500 to 700 feet. There has also been included in the project the excavation of an area of 56 acres to a depth of 25 feet at mean low water for an anchorage at the mouth of the Western Branch, and the dredging to the depth of 28 feet at mean low water of the area between the western edge of the main channel and a line 75 feet outside of the established pierhead line along the railroad docks at Pinner Point. The cost of all this work was estimated at $1,421,290.98.

In addition to the above work $20,000 of the appropriation for the harbor and $30,000 of emergency funds have been authorized to be expended in the maintenance of the channel near Sewall Point.

To June 30, 1905, $1,343,465.87 has been expended for work of improvement and $26,281.84 additional has been applied to maintenance. All of the projected work has been completed with the exception of a part of the dredging in the Eastern Branch, at Berkley flats, and in the section between the Norfolk and Western and Campostella bridges, and the area in front of the railroad docks at Pinner Point.

On June 30, 1905, the main channel of the harbor is available for vessels of 28 feet draft as far as the navy-yard, which is located about 10 miles from deep water in Hampton Roads. The Eastern Branch channel is available for vessels drawing 22 feet as far as the Norfolk and Western Railroad bridge, a distance of 1 mile, and for vessels

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of 15 feet draft as far as the Campostella bridge, about 2,800 feet farther.

The commerce is general and extensive and is increasing rapidly. In the calendar year 1904 it amounted to over 10,000,000 tons, valued at about $800,000,000.

It is expected to expend the funds now available and the amount still to be provided in the maintenance of the existing channels and for the completion of the project in the following order: Dredging near Pinner Point, in the Eastern Branch, and at Berkley flats. The completion of all this wok is considered important.

The recent increase in the commerce of the port has shown the necessity for the improvement of its navigability.

July 1, 1904, balance unexpended	$21,050.55
Amount appropriated by river and harbor act approved March 3, 1905	40,000.00
Amount received from sales of property	1.61
Amount allotted from appropriation for maintenance of river and harbor improvements, act of April 28, 1904	30,000.00
	91,052.16
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	[a]26,281.84
July 1, 1905, balance unexpended	64,770.32
July 1, 1905, outstanding liabilities	2,670.92
July 1, 1905, balance available	62,099.40
July 1, 1905, amount covered by uncompleted contracts	21,029.33
Amount (estimated) required for completion of existing project	33,828.97

(*b*) *Hospital Point.*—The land of this point is the property of the United States and is a part of the grounds used by the Navy Department as a site for a hospital. Just off from the wharf on the point is the deep-water channel of Norfolk Harbor.

The project for this work, adopted in 1902, requires the cutting off of 450 feet of the point, the construction of a sea wall and wharf, and the dredging of the area on both sides of the old point. The depth to be secured in the dredging is to be the same as that of the harbor—25 feet at mean low water. The estimated cost of the work is $193,957, all of which has been appropriated.

On June 30, 1905, the expenditures had amounted to $122,955.21, resulting in the dredging of an area of 41 acres to a depth of from 20 to 25 feet at mean low water and the construction of the new sea wall.

Statements in the previous section of this report regarding the character and volume of the commerce affected by the improvement apply equally well to this section. The tidal range and state of navigability of the harbor are also the same.

On pages 1355 to 1364, Annual Report for 1897, full details of the scope of the project for this improvement will be found with maps explanatory thereof.

The unexpended funds will probably suffice to accomplish all the work covered by the project.

[a] Expended from regular appropriation for maintenance in current fiscal year, $17,054.41.

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July 1, 1904, balance unexpended	$174,391.43
June 30, 1905, amount expended during fiscal year, for works of improvement	103,389.64
July 1, 1905, balance unexpended	71,001.79
July 1, 1905, outstanding liabilities	5,050.26
July 1, 1905, balance available	65,951.53
July 1, 1905, amount covered by uncompleted contracts	63,662.44

(See Appendix L 1.)

2. Western Branch of Elizabeth River, Virginia.—The channel of the river, when the project for improvement was adopted, was 12 feet deep at mean low water and 50 to 300 feet wide.

The project adopted in 1896 provided for obtaining, by dredging, a channel 200 feet wide and 20 feet deep at mean low water from deep water in Norfolk Harbor for a distance of about 1 mile, at an estimated cost of $45,000.

Up to June 30, 1905, the sum of $44,666.73 has been expended on this improvement, the result being the completion of the project.

A draft of 20 feet at mean low water can now be carried in the improved channel. The average rise and fall of the tide is 2.7 feet.

The commerce in the main consists of manufactured lumber and farm products, and had increased from 211,653 tons in 1896 to 1,383,105 tons in 1901. It was reported for the calendar year 1903 at 1,225,709 tons, and for 1904 at 1,173,439 tons, valued at $11,615,185.

At high tide the river is navigable for a distance of about 9 miles by vessels drawing not over 4 feet.

The channel is ample in depth, but it may be necessary to widen it in the near future to provide anchorage space, and thus relieve the overcrowded condition of the area in Norfolk Harbor designated for that purpose.

July 1, 1904, balance unexpended	$333.27
July 1, 1905, balance unexpended	333.27

(See Appendix L 2.)

3. Hampton Roads, Virginia.—Before improvement vessels of more than 25½ feet draft could not reach Newport News on account of the shoal in Hampton Roads, known locally as Middle Ground bar.

Under an item in the act of June 13, 1902, provision was made for dredging a channel through the Middle Ground bar 500 feet in width and 30 feet in depth at mean low water. The estimated cost of the work was $225,000.

On June 30, 1905, the expenditures for the work had amounted to $223,371.42, and a channel of the required dimensions had been provided and still exists. Vessels of 30 feet draft could reach Newport News, Va., at mean low water. The average tidal range is 2.5 feet.

The commerce at the inception of the improvement (1902) was 2,663,669 tons. In the calendar year 1904 it amounted to 4,208,781 tons, valued at $79,063,375. For reference to details of the work contemplated and the published map of this locality, see page 220 of the Annual Report for 1904.

Some doubt exists as to the stability of the upper end of the improved channel, as the ebb tide sweeps across it nearly perpendicularly, and the flood tide during most of its duration comes in through the shoaler channel to the north of the light-house. It is probable,

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therefore, that work will be required in the near future for the maintenance of this channel, and its preservation in good condition is essential to the commercial interests.

July 1, 1904, balance unexpended	$112,551.90
June 30, 1905, amount expended during fiscal year, for works of improvement	110,923.32
July 1, 1905, balance unexpended	1,628.58

(See Appendix L 3.)

4. Nansemond River, Virginia.—The original channel of this stream permitted it to be navigated at mean low water by vessels drawing not more than 5 feet. This depth was increased to 8 feet at the same stage of tide, under appropriations made between 1873 and 1878, and aggregating $37,000.

The project under which the work has been carried on until recently was adopted August 11, 1888, and called for a channel 100 feet wide from Suffolk, the head of navigation, to the Western Branch, while from the latter place to Town Point its width was to vary from 200 to 400 feet. The depth to be obtained throughout was 12 feet at mean low water. This improvement was estimated to cost $152,500.

At present it is contemplated to provide a channel only 80 feet wide and 12 feet deep at mean low water between Suffolk and Town Point, which is deemed ample for the commerce of the stream, it having lately decreased materially.

The expenditures under the project of 1888 and its modification have amounted to $49,943.96 up to June 30, 1905, of which amount $9,266.85 has been applied to maintenance.

The channel between Suffolk and the Western Branch has been dredged to 80 feet in width and 12 feet in depth at mean low water, and a turning basin has been excavated at the former place.

At the close of the fiscal year a boat drawing 11 feet at mean low water could reach Suffolk, the head of navigation, 18 miles above the mouth of the river. The tidal variations are about 3 feet at Town Point and 3.8 feet at Suffolk.

The commerce of the stream consists principally of lumber and merchandise, and of late years has gradually decreased. In 1888 it is reported to have reached nearly 110.000 tons, while for the last calendar year it amounted to only 22,119 tons, valued at $459,225.

July 1, 1904, balance unexpended	$56.04
July 1, 1905, balance unexpended	56.04
Amount (estimated) required for completion of existing project	10,266.85

(See Appendix L 4.)

5. Pagan River, Virginia.—Originally the shoals in this stream limited the draft of vessels to 6½ feet at mean low water. The sum of $10,000 was expended in dredging a channel 60 feet wide and 8 feet deep at mean low water through three shoals between the mouth and Smithfield, Va., under a project adopted in 1880.

The project upon which the appropriation in the act of June 13, 1902, was based contemplated a channel 80 feet wide and 8 feet deep at mean low water, at an estimated cost of $28,870. The act of March 3, 1905, authorized the expenditure of the balance remaining of the appropriation of 1902 in securing a channel not less than 40

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feet wide and of such depth as might be obtained without exceeding said balance. In the project submitted under the above-cited provision of law it was stated that the unexpended balance would provide such a channel 10 feet in depth at mean low water.

Up to June 30, 1905, the expenditures had amounted to $867.90 for surveying and contingencies.

There is now a narrow and crooked channel 8 feet in depth. The average range of the tide is 2.6 feet. The head of navigation is at Smithfield, Va., which is located about 9 miles above the mouth of the river.

The commerce is handled by numerous small schooners and sloops and two regular steamers and consists largely of peanuts and oysters. The commerce has varied from year to year, according to whether conditions have been or have not been favorable for the production of peanuts or oysters. In 1901, 108,058 tons of freight was transported; in 1902, 75,614 tons; in 1903, 120,121 tons, and in 1904, 85,128 tons, the latter amount being valued at $6,651,300.

July 1, 1904, balance unexpended	$10,002.10
July 1, 1905, balance unexpended	10,002.10

(See Appendix L 5.)

6. Appomattox River, Virginia.—(a) Maintenance.—The original channel in this river was narrow and tortuous, and numerous shoals prevented vessels drawing more than 6½ feet from navigating it at mean high water.

The original project was adopted in 1871 and revised in 1893. The project as revised covers the attainment and maintenance of a channel 80 feet wide and 12 feet deep at mean high water between Point of Rocks and Petersburg. The cost of providing this channel was estimated at $473,920, and its maintenance at $10,000 annually.

On June 30, 1905, the sum of $423,830 had been expended toward the improvement, and the sum of $27,762.83 for maintenance.

The available channel depth at high water was, at the close of the fiscal year 1905, about 9 feet at the shoalest point. The average tide at Point of Rocks is 2.7 feet, and 2.6 feet at the town of Petersburg, the head of navigation, about 11½ miles from the mouth of the river.

The commerce in 1888 amounted to 30,626 tons; for the calendar year 1903 it amounted to 103,628 tons, slightly greater than during the previous year, and in the calendar year 1904 it was reported at only 42,245 tons, valued at $510,424.

The interests of commerce require that the work contemplated under the project should be completed and annually maintained.

July 1, 1904, balance unexpended		$4.70
Amount appropriated by river and harbor act approved March 3, 1905		10,000.00
Amount allotted from appropriation for maintenance of river and harbor improvements, act of April 28, 1904		12,000.00
		22,004.70
June 30, 1905, amount expended during fiscal year, for maintenance of improvement		599.23
July 1, 1905, balance unexpended		21,405.47
July 1, 1905, outstanding liabilities		1,465.20
July 1, 1905, balance available		19,940.27
July 1, 1905, amount covered by uncompleted contracts		8,534.80
Amount (estimated) required for completion of existing project		48,090.00

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(*b*) *At Petersburg.*—The project for the work contemplated is not to provide a navigable channel, but to excavate a new channel into which to deflect the river, and thus overcome the trouble experienced by the deposit of sediment in the navigable channel of the river in the neighborhood of Petersburg.

The project for this work, which was adopted June 13, 1902, contemplates the excavation to mean low water of a cut from 200 to 300 feet wide and 2½ miles long, and the diversion of the river into the said cut by means of a dam built across the present channel at the head of the harbor of Petersburg, and includes the construction of bridges for the highways and railway crossing the new channel, and other incidental work. The amount authorized for the work is $200,000.

At the close of the fiscal year 1905 the sum of $29,658.35 had been expended in connection with investigations, plans for the work contemplated under the project, the acquirement of part of the land needed, and the construction of a highway bridge across the line of the new channel.

The commerce to be affected by the improvement contemplated is the same as that mentioned in the preceding section, and all general statements made therein apply equally well to this section.

July 1, 1904, balance unexpended	$189,844.34
June 30, 1905, amount expended during fiscal year, for works of improvement	19,502.69
July 1, 1905, balance unexpended	170,341.65
July 1, 1905, outstanding liabilities	476.00
July 1, 1905, balance available	169,865.65
July 1, 1905, amount covered by uncompleted contracts	124,840.52

(See Appendix L 6.)

7. *Harbor at Cape Charles City, Va.*—The harbor proper is landlocked and covers an area of 10 acres, and it and the exposed channels leading thereto had, before the beginning of work, a depth of 12 feet at mean low water. The project was adopted in 1890 and requires the dredging of a channel through Cherrystone Inlet and bar 200 feet wide and 16 feet deep at mean low water, the dredging of an entrance channel 100 feet wide of the same depth, and dredging over the entire area of the protected and inclosed harbor to a depth of 14 feet at mean low water. Jetties of stone were to be constructed for the protection of the channel leading into the basin. This work was estimated to cost $142,340.

The expenditures to June 30, 1905, amounted to $75,027.48, resulting in the dredging and redredging of one-half of the inner harbor to the proper depth and the excavation of channels of the required dimensions through the inlet, bar, and the entrance to the basin, and the construction of 875 feet of the north jetty and 232 feet of the south jetty. The north jetty is 1,625 feet in length, but 750 feet of this was built without expense to the United States. The range of the tide is 2.5 feet.

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On June 30, 1905, a vessel drawing 12 feet could enter the harbor at mean low water. The docks within the landlocked harbor are about 3 miles from the 16-foot contour in Chesapeake Bay at Cherrystone bar.

The commerce, in the main, consists of fertilizer, produce, miscellaneous freight, and a small quantity of oysters and fish. At the inception of the improvement the commerce amounted to about 400,000 tons annually. In the calendar year 1904 it amounted to 1,404,146 tons. The interests of commerce demand that the project should be completed and thereafter maintained.

July 1, 1904, balance unexpended	$1.53
Amount appropriated by river and harbor act approved March 3, 1905	25,000.00
	25,001.53
June 30, 1905, amount expended during fiscal year, for works of improvement	29.01
July 1, 1905, balance unexpended	24,972.52
Amount (estimated) required for completion of existing project	42,340.00

(See Appendix L 7.)

8. Waterway from Norfolk, Va., to the sounds of North Carolina.—This waterway extends from Norfolk, Va., via the Southern Branch of the Elizabeth River to Deep Creek, thence through the Dismal Swamp Canal to South Mills, N. C., and from the latter point through Turners Cut to the Pasquotank River and Albemarle Sound, and thence to Pamlico Sound by Croatan Sound.

The draft which could be carried through this waterway at the time of the adoption of the project for improvement was limited to 2½ feet at mean low water, owing to the deterioration of the Dismal Swamp Canal, which originally had had a depth of about 6 feet.

The project, adopted March 3, 1899, is to obtain channels in Deep Creek and Turners Cut 100 feet wide and 10 feet deep, and through a shoal in the Pasquotank River near Shipyard bar a channel of the same dimensions, and to dredge a channel 12 feet deep at mean low water and 200 feet wide through a bar near Croatan light in Croatan Sound. It also covered the placing of sheet piling where necessary for the protection of the banks in Turners Cut. The cost of this work was estimated at $274,310.

To the close of the fiscal year 1905, the sum of $253,310.88 has been expended, of which amount $2,114.42 was applied to maintenance.

The dredging contemplated at all the localities had been performed and the sheet piling erected in Turners Cut.

On June 30, 1905, vessels drawing 10 feet of water can, at mean low water, navigate from Norfolk, Va., through all sections of the route which have been improved by the United States. The canal, which extends from Deep Creek to South Mills, is maintained at the expense of a private corporation which tries to keep it available for vessels of 10 feet draft, but on June 30, 1905, the limiting depth for the entire route was only 9 feet, owing to the existence of shoal places in the canal. Deep Creek is the only tidal portion of the improvement, and there the rise and fall averages 3 feet; in the other sections the water level changes according to the direction and velocity of the wind. The route is about 67 miles in length.

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The commerce of the route in 1902 was valued at $2,502,161, at $2,634,590 in 1903, and at $2,880,087 in 1904.

No work is now necessary for navigation, except possibly some cutting away of the points of abrupt bends in the Pasquotank River, North Carolina, and the work required almost annually in removing logs and other obstructions from the channel.

July 1, 1904, balance unexpended	$2,486.81
Amount appropriated by river and harbor act approved March 3, 1905	3,000.00
	5,486.81
June 30, 1905, amount expended during fiscal year for maintenance of improvement	927.69
July 1, 1905, balance unexpended	4,559.12

(See Appendix L 8.)

9. Inland water route from Norfolk, Va., to Albemarle Sound, North Carolina, through Currituck Sound.—This route extends from Norfolk, Va., to Albemarle Sound, via the Southern Branch of the Elizabeth River, Albemarle and Chesapeake Canal, North Landing River, Currituck Sound, Coanjock Bay, North Carolina Cut, and North River. The canal and cut mentioned are now controlled by a private corporation.

This route had a good 5-foot mean low-water channel, but navigation was obstructed by snags, sunken logs, and overhanging trees. Sharp bends added to the other difficulties of navigation. Until the act of September 19, 1890, the work of improvement was carried on under several separate projects. They were consolidated in one item in that act.

The present project, adopted September 19, 1890, provides for obtaining a channel 80 feet wide and 9 feet deep at mean low water through the whole extent of the waterway to be improved by the United States, at an estimated cost of $306,667.08. Previous to this $240,169.69 had been expended on the separate projects, and since then to June 30, 1905, the sum of $70,396.20 has been expended, of which latter amount $20,109.20 was used for maintenance by dredging and removing sunken logs.

The channels through the various portions of the route are now from 60 to 80 feet wide and have a depth of 9 feet at mean low water. The draft of vessels which can pass through the route at mean low water on June 30, 1905, is 9 feet. The route is about 67 miles long.

There is no lunar tide in any portion of the route, except in the Southern Branch of the Elizabeth River, where the average rise and fall is 2.7 feet. In the other sections the water level varies according to the velocity and direction of the wind, for which an allowance of 0.5 foot is made, but severe storms may cause an elevation or depression of 2 feet or more.

The commerce has varied considerably since the route was opened to navigation. The highest reported was for the calendar year 1890, when it amounted to 403,111 tons. For the calendar year 1903 it was given at 203,812 tons, and for 1904 at 144,041 tons, the lowest amount ever reported.

Some work is now required by the interests of navigation in dredging a number of shoals that exist in this route. Considerable difficulty is experienced in keeping the waterway free from sunken logs dropped from rafts, due to the improper construction of these rafts.

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July 1, 1904, balance unexpended	$2,939.32
Amount appropriated by river and harbor act approved March 3, 1905	22,000.00
Amount received from sale of property	100.00
	25,039.32
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	2,935.52
July 1, 1905, balance unexpended	22,103.80

(See Appendix L 9.)

10. Perquimans River, North Carolina.—In the lower river the channel is wide, but navigation is obstructed by numerous stumps just below the town of Hertford, N. C., which limits the draft of vessels to 7 feet. The channel of the upper river, or above Hertford, is available for vessels of the same draft as the lower part. Near the head of navigation the bends are very abrupt and the channel is very narrow.

The first appropriation for the Perquimans River was made in 1876, and was based on a project to provide a channel 200 feet wide with a depth of 9½ feet at mean low water through a stumpy reach near Hertford, N. C., and the amount provided ($2,500) was expended in obtaining said channel, which was completed in 1877.

The present project, adopted by Congress March 3, 1905, is to provide a channel 200 feet wide and 9 feet deep at mean low water through the stumpy reach about 800 feet below Hertford, N. C., at an estimated cost of $11,250.

To June 30, 1905, $34.75 had been expended for printing and contingencies. At the close of the fiscal year a contract to cover all the work under the project had been authorized.

There is no lunar tide in the river, the level of the surface of the water varying according to the direction and velocity of the wind. The average difference in elevation is about one-half foot, but storms may cause a difference of as much as 2 feet or more. The head of navigation is at Newby's bridge, about 26 miles from the mouth of the river.

An estimate in 1902 placed the commerce at about 36,000 tons, valued at $400,000. For the calendar year 1904 it is estimated to have amounted to 38,300 tons, valued at $548,000. The principal items of freight transported were farm products, general merchandise, lumber, and logs.

Reports upon preliminary examinations of this stream may be found on page 361 of Part 1 of the Annual Report for 1876, pages 1045 and 1046 of Part 2 of the Annual Report for 1885, and pages 1380 to 1386 of Part 2 of the Annual Report for 1904. For map see House Document No. 302, Fifty-eighth Congress, second session.

Amount appropriated by river and harbor act approved March 3, 1905	$11,250.00
June 30, 1905, amount expended during fiscal year, for works of improvement	34.75
July 1, 1905, balance unexpended	11,215.25

(See Appendix L 10.)

11. Edenton Bay, North Carolina.—Before improvement a shoal obstructed navigation. The minimum depth was 6½ feet at mean low water.

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During the years 1878 and 1879 a channel 100 feet wide and 9 feet deep at mean low water was provided, at a cost of $5,000.

The present project was adopted in 1884 and covers the dredging of a channel 150 to 200 feet wide and 9 feet deep at mean low water and providing a turning basin of the same depth 12 acres in area. The cost was estimated at $18,000, all of which has been appropriated.

At the close of the fiscal year ending June 30, 1905, the sum of $17,779.37 has been expended in providing a channel in the bay 150 to 200 feet wide, with a depth of 9 feet at mean low water, and the projected turning basin has been dredged to the same depth over an area of 9½ acres.

A boat drawing 8½ feet can now enter the bay at mean low water. There is only a slight difference in the ordinary water level, which varies according to the force and direction of the wind.

In 1898 the commerce amounted to 160,109 tons. It was slightly less in the calendar year 1902, having amounted to 149,246 tons. In 1903 it is reported at 180,520 tons, and for 1904, 137,172 tons.

The head of navigation on this bay is Edenton, a distance of about 2 miles from deep water in Albemarle Sound.

No additional work is now considered necessary.

July 1, 1904, balance unexpended	$220.63
July 1, 1905, balance unexpended	220.63

(See Appendix L 11.)

12. Roanoke River, North Carolina.—Originally the navigable channel to Indian Highland bar, 67 miles above the mouth, was 10 feet deep at mean low water, and thence to the town of Weldon, which is 129 miles from the mouth, the minimum depth was 2½ feet at the same stage.

The project adopted in 1871 contemplates a channel with a least width of 50 feet from Hamilton to Weldon, 5 feet deep at mean low water, and the removal in the lower portion of the river, below the former point, of such obstructions as may be necessary to accommodate vessels navigating the North Carolina sounds. The estimated cost of the work was $269,000.

The expenditures to June 30, 1905, amounted to $228,690.23, with which the channel obstructions were removed and a channel depth of 4 feet at mean low water over the projected width provided between Hamilton and Weldon. On June 30, 1905, vessels drawing 10 feet can go as far as Hamilton, and beyond that point to within a short distance of Weldon 4 feet can be carried at mean low water. The upper river is subject to heavy freshets, which cause the only variation in the level of the water surface.

The commerce has varied considerably since the improvement was undertaken, the maximum amount of freight transported having been in 1891, when it was 376,181 tons. For the calendar year 1902 it amounted to 163,564 tons; in 1903, 115,875 tons. In the calendar year 1904 it was reported at 32,790 tons, valued at $209,000.

The head of navigation is at Weldon, N. C., which is 129 miles above the mouth of the river.

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July 1, 1904, balance unexpended	$5,826.63
Amount appropriated by river and harbor act approved March 3, 1905	10,000.00
Amount received from sale of property	13.75
	15,840.38
June 30, 1905, amount expended during fiscal year, for works of improvement	5,178.86
July 1, 1905, balance unexpended	10,661.52
July 1, 1905, outstanding liabilities	446.00
July 1, 1905, balance available	10,215.52
Amount (estimated) required for completion of existing project	31,000.00

(See Appendix L 12.)

13. Removing sunken vessels or craft obstructing or endangering navigation.—Wreck of schooner J. B. Taylor.—The wreck of this vessel lies in the Appomattox River, Virginia, in 6 feet of water at mean high tide, about 6 miles below Petersburg, Va. Its removal was authorized June 5, 1905.

Proposals have been invited for the work of removal.

(See Appendix L 13.)

IMPROVEMENT OF CERTAIN RIVERS AND HARBORS IN NORTH CAROLINA.

This district was in the charge of Capt. R. P. Johnston, Corps of Engineers, to May 5, 1905; in the temporary charge of Capt. E. Eveleth Winslow, Corps of Engineers, from May 5, 1905, to June 30, 1905, when Captain Johnston resumed charge. Division engineer, Lieut. Col. James B. Quinn, Corps of Engineers.

1. Scuppernong River, North Carolina.—From the mouth to Columbia is 5 miles; to Spruill's bridge, 23 miles.

Before work was commenced on the river there was only about 5 feet over the bar at its mouth. The upper portion was obstructed by logs, snags, stumps, overhanging growth, and abrupt bends, permitting navigation by small vessels only.

The original project, adopted in 1876, was to dredge the bar, make cut-offs at sharp bends, and remove obstructions so as to obtain a channel 60 feet wide and 9 feet deep at low water up to Spruill's bridge. Prior to 1902 $8,000 had been expended.

The present project, adopted by act of June 13, 1902, provides for dredging a channel 3,400 feet long, 150 feet wide, and 9 feet deep at mean low water across the bar at the mouth of the river, at a cost of $14,000.

The amount expended on present project for improvement up to June 30, 1905, was $9,967.04. None of this was for maintenance, but of the sum spent during the fiscal year 1904, $1,869.08 was for the construction of new plant, repairs to old plant, superintendence, etc.

When active work ceased in 1903 the condition was a channel 90 feet wide with a least depth of 9 feet at mean low water across the bar at the mouth of the river; thence to Cross Landing, 14 miles above, a good open channel of 7 feet at mean low water, free from obstacles; thence to Spruill's bridge, 9 miles farther, 7 feet at mean low water could be carried, but the river in many places was narrow and crooked and obstructed by overhanging trees on banks and by logs

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and snags in channel. Some deterioration of the channel has doubtless taken place since that date, though none has been reported.

This is a nontidal stream with no slope, the oscillations of the surface being controlled by the winds.

Spruill's bridge, 23 miles from its mouth, is the head of navigation, to which point 7 feet can be carried at mean low water.

The commerce for 1904 amounted to 51,473 tons, valued at approximately $2,539,259, an increase of 5,260 tons over last year. It consisted principally of lumber, timber, cotton, and other farm products.

The additional work proposed with the balance on hand is the widening of the cut across the mouth of the river to the project width and restoring any deterioration existing in the present cut.

References: The adopted project is printed in the Annual Report of the Chief of Engineers for 1901, page 1543.

July 1, 1904, balance unexpended	$32.96
Amount appropriated by river and harbor act approved March 3, 1905	5,000.00
July 1, 1905, balance unexpended	5,032.96

(See Appendix M 1.)

2. Ocracoke Inlet, North Carolina.—Report of Chief of Engineers for 1904 gives condition of this improvement up to the cessation of work.

Section 7 of the river and harbor act approved March 3, 1905, required that the unexpended balance in hand to the credit of this improvement be returned to the Treasury.

The money expended during the year ($90.97) was to defray the expenses of an inspection made by the district engineer in November, 1904.

July 1, 1904, balance unexpended	$8,000.00
June 30, 1905, amount expended during fiscal year, for works of improvement	90.97
June 30, 1905, covered into surplus fund, United States Treasury	7,909.03

3. Fishing Creek, North Carolina.—When improvement began the stream was badly obstructed by masses of fallen timber, overhanging trees on banks, logs and snags in channel, and was navigable by rafts only a few miles above the mouth.

The original project of 1889 was to clear the stream of logs, snags, trees, etc., up to Bellamy's mill. It was amended in 1896 to limit the work to that part below the Wilmington and Weldon Railroad bridge, and completed in 1901. The sum of $22,715.10 was spent on this project.

The project for improvement having been completed, there is now no project except for restoration or maintenance.

Amount expended on present project, for maintenance, $1,991.52.

Results: The stream has been cleared of obstructions to the Wilmington and Weldon Railroad bridge, but it is not navigable above Beech Swamp on account of its tortuous course and rapid current. Below that point it is navigable during the higher stages about eight months annually.

The extreme lower end of the stream is in good condition. It is reported by those interested in its navigation to be in poor condition from the third mile post to Beech Swamp, being badly obstructed by fallen trees, logs, and snags. Between Beech Swamp and the railroad

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bridge the condition of the stream is unknown, but it is presumably bad. The owners of the vessels navigating this stream report that there are so many obstructions that it is unsafe to navigate unless the water is at least 2 feet higher than the stages at which it was safe to navigate just after the stream had been cleared out.

The present head of navigation is Beech Swamp, 17.5 miles from its mouth, to which about 2 feet can be carried during about three months of the year.

The water surface varies from a minimum depth of 6 inches at low water to 10 feet during the high freshet stages.

The commerce for 1904 amounted to 1,806 tons, valued at approximately $26,165, a loss of 2,862½ tons over the previous year; it consisted principally of cotton seed, timber, fertilizers, and peanuts. Additional work proposed with balance available is the maintenance of the natural channel as far as Beech Swamp.

References: Annual Reports for 1890, page 1179; 1893, page 1377; 1900, page 1796.

July 1, 1904, balance unexpended	$500.14
Amount appropriated by river and harbor act approved March 3, 1905	500.00
	1,000.14
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	456.76
July 1, 1905, balance unexpended	543.38
July 1, 1905, outstanding liabilities	9.08
July 1, 1905, balance available	534.30

(See Appendix M 2.)

4. Pamlico and Tar rivers, North Carolina.—(One river, called the Pamlico, below Washington, N. C., and the Tar, above that point.) Distance from Washington to Greenville, 22 miles; to Tarboro, 49 miles; to Fishing Creek, 56 miles; to Little Falls, 88 miles; to Rocky Mount, 89 miles.

Prior to its improvement, which was begun in 1876, the stream below Washington was obstructed by war blockades, sunken logs, snags, stumps, and sand shoals.

The governing low-water depths were 5 feet to Washington and perhaps 1 foot to Tarboro, the navigation to which place was practicable during freshet stages only. About 3 feet could be carried to Tarboro during about eight flush-water months per year.

The original project for the improvement of the river below Washington is that submitted in December, 1875 (Report Chief of Engineers, 1876, p. 361), and adopted by Congress in August, 1876, to provide 9 feet at low water from Washington to its mouth by dredging and the removal of piles and obstructions at an estimated cost of $28,050. In the project proper the proposed draft to be provided was not specified, but work under the project was devoted to securing 9 feet at mean low water.

Under this project the sum of $18,000 was appropriated, of which $17,877.12 was expended; the remainder, $122.88, was transferred to the improvement of the Pamlico and Tar rivers, when the improvements were combined in 1880.

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The Tar River (that portion of the stream above Washington), prior to improvement, was obstructed by sunken logs, piles, wrecks, stumps, snags, and trees in the channel, and overhanging trees along its banks.

The original project for this portion of the stream was that of 1879 (Report Chief of Engineers, 1879, p. 700) for the removal of obstructions between Washington and Tarboro at an estimated cost of $10,000. An appropriation of $3,000 was made for this purpose in 1879, of which $2,867.27 was expended, leaving a balance of $132.73, which was transferred to the joint improvement.

Prior to the consolidation of these two improvements there had been expended under the above projects $20,744.39. To June 30, 1888, $37,031.94 had been expended on the consolidated project, to which add the aggregate amount expended on the single projects, $20,744.39, which makes the total amount expended for the improvement of this stream $57,776.33. The total final estimate for the project submitted in 1888 was $76,000.

In 1889 the project was extended to clear the natural channel above Tarboro, 34 miles to Little Falls, and the estimate was increased $16,200, making the total estimate $92,200.

The present project is that of 1875 (for Pamlico River), and of 1879 and 1889 (for Tar River), somewhat modified to secure a channel 100 feet wide and 9 feet deep at mean low water to Washington; thence a channel 60 feet wide and 3 feet deep at low water for 22 miles farther to Greenville; thence a channel 60 feet wide and 20 inches deep at low water for 26 miles farther to Tarboro; thence to keep clear of obstructions the natural channel 34 miles farther to Little Falls, 2 miles below Rocky Mount, N. C.

Amount expended on previous projects prior to 1876	$10,000.00
Amount expended on present project, for improvement	134,495.57
Amount expended on present project for maintenance	19,055.52
	153,551.09

Dredging in the channel below Washington was carried on during the fiscal year, resulting in a cut 33⅓ feet wide, 5,060 feet long, 9 feet deep, extending from the second angle in the cut downstream, and widening to 100 feet the cut of the previous year. From the end of this cut the dredging was extended down the river for 2,050 feet, 100 feet wide, and 9 feet deep at mean low water. Below this point the dredging was extended 820 feet, 66⅔ feet wide, and 9 feet deep at mean low water on the south side of the channel.

Snagging was carried on and the stream was cleared of stumps, logs, trees, etc., at a total cost for both dredging and snagging of $7,757.49.

The controlling depth to Washington is 8.5 feet at mean low water; thence to Greenville, 22 miles, 2.5 feet can be carried at mean low water. Above this point the river is navigable only during the freshet stages, of variable duration, extending over six to eight months of the year.

The stream is nontidal. Below Washington the only surface variations of importance are due to the wind, with an extreme range of 3 feet under normal conditions; long protracted easterly or westerly

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winds sometimes cause variations of 7 or 8 feet. The variations of the upper portion of the river are affected by freshets only.

The head of navigation is Dunbar's bridge, 108 miles from the mouth.

The commerce for the year 1904 amounted to 514,401 tons, valued at approximately $17,041,203.50, a decrease since the previous year of 330,976 tons. It consisted principally of cotton, cotton-seed productions, grains, potatoes, wood, timber, lumber, fertilizers, machinery, general merchandise, etc.

The tendency of the improvement is to keep down freight rates.

References: History and maps, Annual Reports, 1890, page 1114; 1891, page 1347; 1896, pages 161 and 1101.

Examinations and surveys: Annual Reports, 1873, page 555; 1879, page 700; 1891, page 1429; 1895, page 1365; 1897, page 1425.

July 1, 1904, balance unexpended		$9,058.95
Amount appropriated by river and harbor act approved March 3, 1905		8,000.00
Received from sales		123.10
		17,182.05
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$8,006.43	
For maintenance of improvement	1,054.06	
		9,060.49
July 1, 1905, balance unexpended		8,121.56
July 1, 1905, outstanding liabilities		350.84
July 1, 1905, balance available		7,770.72

(See Appendix M 3.)

5. Contentnia Creek, North Carolina.—Distance from the mouth to Snowhill, 31½ miles; Speight's bridge, 50½ miles; Stantonsburg, 63 miles.

Previous to improvement this stream was obstructed throughout its entire length by fallen timber, sand shoals, and overhanging growth, and was navigable for shallow-draft craft during only the higher freshet stages of about three to six months of the year.

The original project of 1881 was to clear the stream of these obstructions, so as to obtain from its mouth to Stantonsburg, 63 miles, a depth of not less than 3 feet during the higher stages, about nine months of the year, at a cost estimated in 1888 at $77,500.

The project of 1881 as extended in 1894 included maintenance below Snowhill, and was again extended in 1899 to include maintenance from Stantonsburg to the mouth. This constitutes the existing project.

Amount expended up to June 30, 1905:	
For improvement	$64,394.56
For maintenance	7,372.01
Total	71,766.57

At the close of the fiscal year 1905 the creek between its mouth and Snowhill was in fair condition and could be navigated by boats drawing 3 to 4 feet during six months of the year, depending upon the rainfall. Snowhill, 31½ miles from its mouth, is practically the head of navigation, although during the higher stages of water boats can ascend the stream to Speight's bridge, 50½ miles from its mouth. The portion of the stream between Snowhill and Speight's bridge

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has been partially resnagged since it was originally cleared of obstructions, but no boat has ascended the stream above Snowhill since the resnagging.

No further work except maintenance is now proposed.

The commerce for the year 1904 amounted to 15,010 tons, valued at approximately $832,150, an increase of 1,168 tons over the previous year. It consisted principally of cotton, cotton-seed meal, timber, lumber, fertilizer, general merchandise, etc.

References: Annual Reports, 1881, page 1009; 1890, page 1118; 1896, page 1103.

July 1, 1904, balance unexpended	$102.23
Amount appropriated by river and harbor act approved March 3, 1905	1,000.00
Amount allotted from appropriation for maintenance of river and harbor improvements, act of April 28, 1904	500.00
	1,602.23
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	368.80
July 1, 1905, balance unexpended	1,233.43

(See Appendix M 4.)

6. Neuse and Trent rivers, North Carolina.—(a) Neuse River.—Distance from Newbern to Contentnia Creek, 32 miles; to Kinston, 50 miles; to Whitehall, 74 miles; to Goldsboro (Wilmington and Weldon Railroad bridge), 94 miles; to Smithfield, 150 miles.

There is considerable uncertainty as to the conditions existing prior to 1878, when improvement by the Government was begun. In the report of a survey made in 1871 by William Popp, assistant engineer, it was stated that "the governing depth of water in the channel from Goldsboro to Kinston is 4½ feet, below Kinston 5 feet." In the report of an examination by S. T. Abert in 1875 (Report Chief of Engineers, 1876, p. 363), it was stated that "the present low-water depth above Kinston is about 3 feet, and 4 feet of water (or 5) can be carried to Newbern at the same stage." It is known that before the civil war, and probably for sometime afterwards, light-draft steamers made more or less regular trips as high up as Smithfield. It is very doubtful, however, whether the depths above referred to ever actually existed at low water, for the report of 1879 (Report Chief of Engineers, p. 707) speaks of a bar near Kinston on which only 18 inches was found at low water, and there are many other evidences that the earlier statements were too favorable. The channel is known to have been obstructed by wrecks, snags, logs, and trees, and also by blockades built both above and below Newbern during the civil war.

The original project of 1871, as extended in 1878–79 and 1880 and continued to date, provides for an 8-foot navigation up to Newbern during the entire year, 4 feet to Kinston, and during nine months of the year 3 feet to Smithfield, by the removal of war obstructions, dredging, jettying, and snagging, at a total estimated cost of $374,000; extended in 1902 to include dredging a channel 300 feet wide below Newbern and 200 feet wide to Newbern, to a depth of 8 feet at dead low water, at an estimated additional cost of $59,081.25. This estimate has, since its adoption above recited, been reduced to $24,000.

In 1902 the improvement of this river was combined with that of Trent, under a joint appropriation of $20,000 for the two rivers.

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Amount expended on the foregoing projects to June 30, 1905:	
For improvement	$312,953.48
For maintenance	10,857.97
Total	323,811.45

All war blockades have been cleared away, and the natural channel has been cleared to Smithfield, 150 miles above Newbern. No attempt has been made to maintain the stream above Waynesboro Landing (Goldsboro), 98¼ miles above Newbern. At low water 8 feet can be carried to Newbern, 4 feet to Village Creek, 25 miles above, 2.5 feet to the mouth of Contentnia Creek, 31½ miles above Newbern, and 1 foot to Kinston, 50 miles above Newbern, above which point the river is only navigable during the freshet stages of variable durations.

The channel of the river between Newbern and Kinston is free from all obstructions. Between Kinston and Whitehall the channel in many places is badly obstructed by logs, snags, and fallen trees.

The practicable head of navigation is Waynesboro Landing, 128 miles from the mouth of the river.

The stream is nontidal. The variation of the water surface below Newbern is due entirely to the influences of the wind. The maximum range is 3.3 feet during severe northwest winds to 8½ feet during violent northeast gales. The upper river is subject to freshets, which rise 17 feet at Smithfield, 18 feet at Waynesboro Landing, and 20 feet at Kinston.

It is proposed to expend the balance of the funds available to complete dredging at and below Newbern and maintain the channel to Kinston.

The commerce for the year 1904 amounted to 501,751 tons, valued at approximately $17,994,449, an increase of 10,015 tons over the previous year, consisting principally of grains, timber, lumber, fertilizer, general merchandise, etc.

Freight rates are materially lessened by reason of the improvement.

References: Annual Reports of 1879, page 71; 1900, pages 268 and 1802; 1901, page 1545.

(*b*) *Trent River.*—Distance from the mouth at Newbern to Pollocksville, 18 miles; to lower Quaker bridge, 27 miles; to Trenton, 38 miles. Its original condition was a channel of 6 feet depth to Pollocksville, and the stream was fairly clear to lower Quaker bridge, above which point it was badly obstructed.

The original project of 1879 (see Report Chief of Engineers 1879, p. 711), was to secure 3 feet depth at low water to Trenton; extended in 1886 to obtain 8 feet depth through Foys flats; extended in 1889 to clear out obstructions to upper Quaker bridge, 40 miles above Trenton. The sum of $64,262.64 was expended on this project and its modifications.

In 1896 the project of 1879 was amended to provide for the maintenance of a channel only 30 feet wide and 3 feet deep from Newbern to Trenton, at an annual estimated cost of $2,500. This was extended in 1902 to include dredging at Newbern to 8 feet depth at dead low water from harbor line to channel, at an estimated cost of $24,000 additional. The existing project, therefore, is to dredge to 8 feet dead low water at Newbern and maintain a channel 30 feet

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wide and 3 feet deep at low water to Trenton. In 1902 the improvement of this river was combined with that of the Neuse under a joint appropriation of $20,000 for the two.

Amount expended on present project up to June 30, 1905:		
For improvement		$3,779.90
For maintenance		8,700.89
Total		12,480.79

With the $1,410.03 expended during the fiscal year for the maintenance of this stream the channel was cleared of snags, stumps, logs, etc., and a small amount of dredging was done immediately below Trenton.

The improvement above Trenton has been abandoned.

Between Trenton and Newbern the present project depth of 3 feet exists, and the stream is in good condition. The maximum draft that can be carried June 30, 1905, to Trenton, 38 miles above the mouth, which is the head of navigation, is 3 feet.

The retaining wall to the turning basin at Trenton, constructed of wood, is in bad condition and is in need of repairs. There is also some dredging needed adjacent to the wall to restore the basin to its original dimensions.

Near the mouth the water level varies about 3 feet under normal conditions, according to the prevailing winds. Long protracted easterly or westerly winds sometimes cause a variation of 7 or 8 feet. At Trenton the stream is subject to freshets of about 3 to 5 feet during the winter months.

The commerce during 1904 amounted to 284,935 tons, valued at $14,793,947, an increase of 33,880 tons over the previous year. It consists principally of lumber, general merchandise, fertilizers, cotton, and other farm products.

In addition to the maintenance of the present channel to Trenton, the work proposed with the available balance is to deepen to 8 feet the area between the harbor line at Newbern and the deep river channel, thus enlarging the harbor and enabling vessels from any part of the harbor to reach the channel.

References: Annual Reports of 1879, page 711; 1900, pages 268 and 1802; 1901, page 1545.

July 1, 1904, balance unexpended		$3,333.08
Amount appropriated by river and harbor act approved March 3, 1905		40,000.00
Amount received from sales		200.00
Amount allotted from appropriation for maintenance of river and harbor improvements, act of April 28, 1904		500.00
		44,033.08
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$2,380.46	
For maintenance of improvement	2,909.70	
		5,290.16
July 1, 1905, balance unexpended		38,742.92
July 1, 1905, outstanding liabilities		2,875.43
July 1, 1905, balance available		35,867.49
Amount (estimated) required for completion of existing project		82,500.00

(See Appendix M 5.)

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7. Waterway between Newbern and Beaufort, N. C. (via Neuse River, Clubfoot Creek, Clubfoot and Harlowe Canal (private), Harlowe Creek and Newport River).—Distances: Newbern to Clubfoot Creek, 20 miles; thence to Clubfoot and Harlowe Canal, 6 miles; thence to Harlowe Creek, 3.2 miles; thence to Newport River, 3¼ miles; thence to Beaufort, 7 miles.

The first appropriation for this work was made by the river and harbor act of 1882, which provided that $5,000 from the appropriation for Neuse River and a like sum from the appropriation for Beaufort Harbor should be "applied to the improvement of the line of inland navigation from Newbern to Beaufort Harbor."

No estimate or project for said improvement had at that time been made, but in October, 1883 (Report Chief of Engineers, 1884, p. 1067) an estimate was prepared which contemplated a channel 80 feet wide and 9 feet deep, at an estimated cost of $883,580, exclusive of the cost of a tide lock and of the canal company's franchise and property.

The available funds being totally inadequate for this improvement, the project adopted in 1884 for the expenditure of said funds contemplated a channel 30 feet wide and 5 feet deep at mean low water, the estimated cost being $92,000.

This project of 1884 constitutes the existing project.

All work of improvement has been confined to the natural channels in Clubfoot and Harlowe creeks and Newport River. No expenditures have been made for maintenance.

The governing depth in the approaches to the canal was increased to about 5 feet several years ago, but for lack of maintenance has shoaled to about 1 foot. The depth in the canal is only about 2 feet, and it is obstructed by logs dropped from passing rafts. The water level varies at Harlowe Creek end, where there is a tidal range of about 1½ feet, and at the Clubfoot Creek end, where there is a variation of level of from a few inches to 2 feet, due to the wind.

The amount expended on this project to June 30, 1905, is $33,850.90, of which the amount spent prior to the past year, viz, $28,700, was for improvement, and the amount spent during the past year, viz, $5,150.90, was for maintenance or restoration. By this expenditure the shoal at the mouth of Harlowe Creek was restored to its former depth, but the shoal in Clubfoot Creek has not yet been restored, and hence the governing low-water depth remains the same as it was last year—1 foot. This shoal in Clubfoot Creek is to be removed as soon as plant, now occupied elsewhere, can be spared for the purpose.

The commerce for 1904 amounted to 82,019 tons, valued at approximately $3,240,976, a decrease since 1903 of 7,632 tons. It consisted principally of cotton, cotton seed, cotton-seed meal, and cotton-seed oil, hay, grains, fish, oysters, clams, lumber, timber, general merchandise, etc. The falling off in the commerce is directly attributable to deterioration of the waterway. It is thought that should the project depth of 5 feet and width of 30 feet be secured and maintained the commerce would greatly increase and freight rates between Newbern, Beaufort, and Morehead City would be lessened.

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July 1, 1904, balance unexpended	$6,300.00
June 30, 1905, amount expended during fiscal year, for works of improvement	5,150.90
July 1, 1905, balance unexpended	1,149.10
Amount (estimated) required for completion of existing project	57,000.00

(See Appendix M 6.)

8. Harbor at Beaufort, N. C.—When improvement (begun in 1836) was resumed in 1881, the erosion at Fort Macon and Shackelford Point was causing serious deterioration of the inside channels and threatening deterioration of the bar channel and bar. The governing low-water depth on the bar was 15 feet, and 2 feet at Beaufort, N. C.

The original project is that of 1881, to stop erosion at the inlet (Fort Macon and Shackelford Point) by jetties, and to provide a channel 200 feet wide and 9 feet deep at ordinary low tide to Beaufort, and a channel 100 feet wide and 6 feet deep from Beaufort to the 6-foot contour of the channel leading up North River, estimated to cost $82,103.38, increased in 1885 to $159,000, and modifying the project by reducing the channel to Beaufort to 100 feet and its depth to 5 feet at mean low water, and eliminating the channel east from Beaufort. In 1887 the estimate for the above work was increased to $163,000.

The project was again modified, in 1890, by increasing the depth of the bulkhead channel to 7 feet. The project as modified was completed.

The amount expended under the original project as modified was $148,843. To the above amount should be added $5,000 appropriated July 4, 1836, making the total cost $153,843.

The existing project of 1896 includes the maintenance of jetties and sand fences at Fort Macon and Shackelford Point and the main tenance of the 7-foot channel across Bulkhead shoal, and thence to the wharves at Beaufort.

The amount expended on present project for maintenance to June 30, 1905, was $11,341.49.

A draft of 7 feet can now be carried across Bulkhead shoal and 6 feet can be carried from there to the wharves at Beaufort at mean low water.

The tide rises 2 feet at Beaufort and 3 feet at the inlet.

The commerce for the year 1904 amounted to 62,226 tons, valued at approximately $9,902,960.50, an increase of 1,426 tons over the previous year.

It is proposed to maintain the sand fences at Fort Macon and Shackelford Point, and to restore project depth across Bulkhead shoal to Beaufort.

The maintenance of this channel tends to prevent the rise in freight rates by allowing the larger vessels to reach the wharves at Beaufort.

References: Annual Reports, 1881, page 1013; 1893, page 1457; 1896, page 1115; 1899, page 1498.

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July 1, 1904, balance unexpended	$772.05
Amount appropriated by river and harbor act approved March 3, 1905	2,000.00
Amount allotted from appropriation for maintenance of river and harbor improvements, act of April 28, 1904	1,000.00
	3,772.05
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	2,606.54
July 1, 1905, balance unexpended	1,165.51
July 1, 1905, outstanding liabilities	267.07
July 1, 1905, balance available	898.44

(See Appendix M 7.)

9. Beaufort Inlet, North Carolina.—There exists a channel over the bar with approximately 12 feet at mean low water.

The original project is printed on page 1415 of the Annual Report of the Chief of Engineers for 1904, and was adopted by Congress in 1905. It contemplates a channel 300 feet wide, 20 feet deep at mean low water across the bar, at an estimated cost of $45,000.

There has been expended on present project to June 30, 1905, for improvement $138.67.

The money expended during the fiscal year was for survey of the bar for the purpose of establishing ranges for dredging.

The average rise and fall of the tide at the bar is about 3.5 feet.

The commerce for 1904 amounted to 4,000 tons, valued at approximately $502,000.

Amount appropriated by river and harbor act approved March 3, 1905	$45,000.00
June 30, 1905, amount expended during fiscal year, for works of improvement	138.67
July 1, 1905, balance unexpended	44,861.33
July 1, 1905, outstanding liabilities	62.33
July 1, 1905, balance available	44,799.00

(See Appendix M 8.)

10. Inland waterway between Beaufort Harbor and New River, North Carolina.—Distance from Beaufort to Swansboro, 30 miles, with access at Swansboro to the Atlantic Ocean, through Bogue Inlet. Distance from Swansboro to New River, 22 miles.

When improvement began in 1886, the governing low-water depth was 18 inches to Swansboro and 6 inches thence to New River.

The original project is that of 1885, to provide a channel 100 feet wide and 3 feet deep at ordinary low water between Beaufort Harbor and Swansboro, estimated to cost $6,000; this estimate was increased in 1887 to $50,000, and again increased in 1892 to $71,040.

No project was adopted for the part beyond Swansboro, but in 1889 a separate project for a channel 40 feet wide by 3 or 4 feet deep over this portion of the waterway was adopted, the estimated cost being $43,000. The act of 1890 made a separate appropriation of $5,000 for this portion of the route, designating it as the "waterway between New River and Swansboro." (See pp. 1376–1378, Report of the Chief of Engineers for 1891.) No work other than surveys has ever been done on this latter project for the reason that an act of the North Carolina legislature had granted to a private corporation exclusive navigation privileges.

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On February 6, 1905, the surviving incorporators (J. H. Chadbourn, jr., and H. G. Smith) executed a legal relinquishment of their claims, and it is therefore contemplated that work on the improvement of this portion of the waterway will begin as soon as Government plant, now occupied on other work, becomes available.

Amount expended on present project (that of 1885) to June 30, 1905, for improvement, $50,689.34.

At the close of the fiscal year 1905 the project depth of 3 feet prevailed throughout the entire length of 30 miles between Beaufort Harbor and Swansboro, obtained by dredging a channel aggregating 5.03 miles in length, 3 to 4 feet deep, as follows: 100 feet wide through one shoal, for 980 feet; 60 feet wide through six shoals, aggregating 24,696 feet, and 40 feet wide through one shoal, for 874 feet.

The tide at Beaufort Inlet and Bogue Inlet, situated at either end of this waterway, rises approximately 3½ feet; where the tides meet in Bogue Sound it rises and falls about 1 foot.

The commerce of 1904 amounted to 37,323 tons, valued at approximately $2,024,849, an increase over the previous year of 1,231 tons. It consisted principally of lumber, fish, and farm products.

It is proposed to continue the work of improvement to obtain the project width with the funds now available.

References: Annual Report, 1885, page 1133; 1891, page 1378; 1892, page 1141; 1893, page 1397; 1894, page 1034; 1896, page 1117; 1897, page 1398.

July 1, 1904, balance unexpended	$6,775.12
June 30, 1905, amount expended during fiscal year, for works of improvement	4,464.46
July 1, 1905, balance unexpended	2,310.66
Amount (estimated) required for completion of existing project	18,040.00

(See Appendix M 9.)

11. Waterway between New River and Swansboro, N. C.—This waterway is a part of the waterway between Beaufort Harbor and New River (see pp. 1124–1127, Annual Report of the Chief of Engineers for 1889), but in 1890 two separate appropriations were made—one for the "inland waterway between Beaufort Harbor and New River" and the other for the "waterway between New River and Swansboro," and hence separate reports are made for the two improvements, although one embraces the other.

This waterway (the portion between New River and Swansboro) is about 22 miles long, and consists of tortuous tidal channels winding through the marine marsh, which extends from Swansboro to New River, between the mainland on one side and the barrier beach, or "banks," which separates it from the ocean, on the other. In the vicinity of the four inlets communicating with the ocean its width is several hundred feet and its depth from 12 to 15 feet, while between them its width diminishes to about 12 feet in places and its depth to 6 inches at ordinary low water.

The original project, adopted in 1889, is to enlarge it by dredging to a minimum width of 40 feet and minimum depth of 3 to 4 feet at mean high water, at an estimated total cost of $43,000.

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The existing project is the same as the original project.

To June 30, 1905, $814.89 had been expended in surveying the shoals, leaving an available balance of $4,185.11.

The present conditions are similar to those existing prior to the formation of the project.

The waterway is navigable at high tide for very small boats throughout its entire length, a distance of approximately 22 miles. At mean low water some of the shoals are bare.

The rise and fall of the tide varies from 2.2 to 4 feet in the neighborhood of the inlets to about 1 foot at the points most distant from the inlets.

The commerce of 1904 amounted to 830 tons, at an approximate value of $36,560. It consisted principally of cotton, fish, oysters, clams, and salt. This can not be taken as indication of the amount of commerce that will utilize the waterway after the proposed improvement is made, for the difficulty and delay incident to navigation now are so great that commerce naturally seeks other routes.

For the reason that an act of the general assembly of North Carolina, ratified February 13, 1889, incorporated the Wrightsville and Onslow Navigation Company with the exclusive right to navigate this waterway, as set forth in House Executive Document No. 26, Fifty-second Congress, first session (p. 1147 of the Annual Report of the Chief of Engineers for 1892), no work has been done under the project since the survey of the route in April and May, 1891.

On February 6, 1905, however, a paper was obtained from the two survivors of the four parties named in the charter of said Wrightsville and Onslow Navigation Company, in which paper it was declared that the privileges and franchises granted in said charter had never been exercised, and that said privileges and franchises had, "to all intents and purposes, been surrendered and abandoned."

It is therefore contemplated that work on this improvement will be resumed at an early date.

For description of this waterway see Annual Reports for 1892, page 1146, and 1893, pages 1399 and 1400.

July 1, 1904, balance unexpended	$4,376.27
June 30, 1905, amount expended during fiscal year, for works of improvement	191.16
July 1, 1905, balance unexpended	4,185.11
Amount (estimated) required for completion of existing project	38,000.00

(See Appendix M 10.)

12. New River, North Carolina.—Appropriations were made for the river in 1836, 1837, and 1838, after which no further appropriations were made until 1882, when $5,000 was appropriated. Another appropriation of $5,000 was made in 1884, but since these amounts were considered too small to justify undertaking the improvement no work was done until 1886, when still another appropriation of $10,000 was made.

When improvement began in 1886 the governing low-water depth was 4 feet for a distance of 23 miles to Jacksonville, and the channel included two circuitous parts around Wrights Island and Cedar Bush Marsh.

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The original project of 1886 was to dredge a cut 4 feet deep and 100 feet wide through Wrights Island, and a second cut 4 feet deep and 150 feet wide through Cedar Bush Marsh. Both were completed, but the Cedar Bush Marsh cut deteriorated at the upper end and was abandoned, and the project of June 18, 1894, to obtain 4 feet depth around Cedar Bush Marsh by dredging and training wall was adopted and successfully carried out.

The present project for the expenditure of the balance left from the project of June 18, 1894, is to expend such balance in rebuilding dike with oyster shells, in dredging to restore project width, and in necessary surveys.

Amount expended to June 30, 1905:	
For improvement	$29,628.74
For maintenance	152.84
Total	29,781.58

The project depth of 4 feet has twice been obtained and twice lost, through lack of maintenance. The project depth now exists, but in a channel so crooked as to be of little value. The tidal range of the inlet is about 3½ feet, and at the head of the marshes about 1 foot. The head of navigation for all practical purposes is Tar Landing, 3 miles above Jacksonville, and 26 miles from the mouth of the river, to which a present depth of approximately 4 feet can be carried.

The commerce for 1904 amounted to 5,812 tons, valued at approximately $375,990, a decrease of 365 tons since the previous year. It consisted principally of naval stores, fish, lumber, cotton, and general merchandise.

It is proposed to apply the available balance to rebuilding dike with oyster shells and dredging to restore the project width.

References: Annual Reports, 1882, page 1117; 1886, page 992; 1891, page 1380; 1899, page 1501. Report on preliminary examination of New River, authorized by the river and harbor act of June 13, 1902, is printed in House Document No. 239, Fifty-eighth Congress, second session, and also as Appendix M 19 of Report of the Chief of Engineers for 1904.

July 1, 1904, balance unexpended	$3,231.49
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	12.97
July 1, 1905, balance unexpended	3,218.52

(See Appendix M 11.)

13. Northeast and Black rivers, and Cape Fear River above Wilmington, N. C.—(*a*) *Northeast River.*—Distance from mouth to Bannerman's bridge, 48 miles; to Hallsville, 88 miles; to Kornegay's bridge, the head of navigation, 103 miles.

The original condition when improvement began was a channel badly obstructed by logs, snags, and overhanging trees. The river was navigable to Bannerman's bridge, with governing low-water depth of 6 feet.

The original project of 1889 is still in force and includes the clearing of the natural channel for small steamers to Hallsville and for pole boats to Kornegay's bridge, at an estimated cost of $30,000.

Additional work proposed is for maintenance only.

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Amount expended on present project:	
For improvement	$10,687.96
For maintenance	8,815.83
Total	19,503.79

During the year there was expended for maintenance $1,118.04, which includes outstanding liabilities at the end of the year, resulting in the removal from the channel of 836 large snags, and from the banks 822 trees were cut and hauled back.

The result obtained has been a cleared channel whenever funds were available, permitting navigation at all stages to Bannerman's bridge and during high water to Hallsville, the governing low-water depth being 6 feet to Bannerman's bridge, 48 miles, and 3 feet thence to Croom's bridge, 8 miles farther, and 0.5 foot to Hallsville, 32 miles, and 0.1 foot to Kornegay's bridge, 15 miles.

From Bannerman's bridge to Kornegay's bridge, the head of navigation, the river is so shallow that its navigation is dependent on freshets, which are liable to occur at any time, although during the summer low stages usually prevail.

There is a tidal range of about 2 feet at the mouth of this stream, which decreases to nothing at Bannerman's bridge.

The channel is at present badly obstructed by snags above the sixty-eighth mile board.

The commerce for 1904 amounted to 105,800 tons, estimated at approximately $1,077,633, an increase of 3,617 tons over previous year, and consisted principally of timber, naval stores, general merchandise, building material, fertilizers, cotton, and other farm products.

References: Annual Reports, 1885, page 1123; 1890, page 1181; 1895, page 1389, and 1896, page 1122.

(*b*) *Black River.*—The original condition when improvement began was a natural channel cleared fairly to Point Caswell and roughly to Lisbon, with governing low-water depths of 4 feet to Point Caswell, 2.5 feet to Haws Narrows, and 1.5 feet to Lisbon.

The original project of 1885 included clearing the natural channel and banks to Lisbon and the cutting off of a few sharp points at bends. It was amended in May, 1893, by omitting that part of the river above Clear Run, and, as amended, was completed September 20, 1895.

The existing project of 1894 is to maintain the natural channel to Clear Run, at an estimated cost of $2,000 per annum.

Amount expended:	
On previous project, mentioned above	$12,358.40
On present project, for maintenance	8,326.65
Total	20,685.05

During the year $1,022.41 was spent in maintenance, removing 568 large snags from the channel, and 698 trees were cut and removed from the banks.

The result obtained has been a cleared channel whenever funds were available, permitting navigation to Point Caswell, 24 miles above the mouth, at all stages, and to Clear Run, 66 miles above the mouth, at stages of 1.5 feet or higher above low water, the governing low-water depths at present being 5 feet to Point Caswell, 2.5 feet to Haws Narrows, 32 miles above the mouth, and 1.5 feet to Clear Run.

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There is no steamboat navigation above Clear Run. Lisbon, 74 miles from the mouth, is the head of navigation. The low-water stages prevail usually from May to August, inclusive; during the rest of the year the stage is about 5 to 8 feet higher.

The channel is at present badly obstructed by snags.

No further work, excepting maintenance, is now proposed.

The commerce during 1904 amounted to 72,677 tons, estimated value, $1,223,759, a decrease of 1,446 tons as compared with 1903. It consisted principally of timber, general merchandise, naval stores, fertilizers, cotton, and other farm products.

References: For history, see Annual Report for 1896, page 1125. For report on examination, see Annual Reports for 1884, page 1061, and 1885, page 1145.

(*c*) *Cape Fear River above Wilmington, N. C.*—The original condition when work began was a channel badly obstructed above Kellys Cove by logs, snags, etc., and with governing low-water depths of 4 feet to Kellys Cove and 1 foot to Fayetteville.

The original project of January 26, 1881, was to clear the river to Fayetteville and obtain a continuous channel by jettying and dredging; estimated in July, 1893, to cost $275,000 for a channel 4 feet deep to Elizabethtown, and 3 feet deep to Fayetteville.

The existing project, adopted by act of June 13, 1902, is to obtain, by canalizing, a low-water depth of 8 feet to Fayetteville, at an estimated cost of $1,350,000.

In consequence of this new project the former project has been abandoned, excepting for the maintenance of the natural channel, pending the construction of locks and dams.

Amount expended on previous project:	
For improvement	$134,436.96
For maintenance	13,769.27
Total	148,206.30
Amount expended on present project for improvement by locks and dams	9,389.55

At present the low-water depths are 8 feet to Kings Bluff, 38 miles above Wilmington; 2½ feet to Elizabethtown, 73 miles above Wilmington; and 2 feet to Fayetteville, 115 miles above Wilmington. Owing to frequent freshets no snagging has been done on this river since November, consequently the channel, on the shoals, is badly obstructed by snags during low stages. There is no steamboat navigation above Fayetteville, the head of navigation. Low-water stages prevail from 2 to 4 months during each summer, and freshets of 15 to 50 feet occur about once a month, during the remainder of the year.

The commerce for 1904 amounted to 150,016 tons, estimated value of $2,411,190, a decrease as compared with that of the previous year, of 6,676 tons; it consisted principally of timber, naval stores, fertilizers, general merchandise, cotton, and other farm products.

The sum of $50,000 was appropriated by the act of June 13, 1902, for the purchase of suitable sites for locks and dams. The survey for the determination of the sites, in progress at the beginning of the fiscal year, was completed in September, with the exception of investigating and purchasing sites, and putting in permanent bench marks.

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There was spent during the year for maintenance, $892.02, and on the survey under the canalization project, $2,869.93; total $3,761.95.

References: Annual Reports for 1872, page 742; 1881, page 1018; 1901, page 1559, and 1904, page 1493.

NORTHEAST AND BLACK RIVERS, AND CAPE FEAR RIVER ABOVE WILMINGTON.

July 1, 1904, balance unexpended	$3,214.80
Amount appropriated by river and harbor act approved March 3, 1905	9,000.00
	12,214.80
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	2,458.87
July 1, 1905, balance unexpended	9,755.93
July 1, 1905, outstanding liabilities	573.60
July 1, 1905, balance available	9,182.33

CAPE FEAR RIVER ABOVE WILMINGTON.

July 1, 1904, balance unexpended	$44,303.52
June 30, 1905, amount expended during fiscal year, for works of improvement	3,693.07
July 1, 1905, balance unexpended	40,610.45
July 1, 1905, outstanding liabilities	5.00
July 1, 1905, balance available	40,605.45
Amount (estimated) required for completion of existing project	1,300,000.00

(See Appendix M 12.)

14. Cape Fear River at and below Wilmington, N. C.—The condition of the river prior to the opening of New Inlet (which seems to have occurred during an equinoctial storm in 1761) is rather uncertain, but old maps indicate that there was a low-water depth of 14 feet across the bar at the mouth, the least depth between Wilmington and the mouth being 7.5 feet. There is also some uncertainty as to the conditions in 1829, when the improvement was first undertaken by the United States, but the most reliable information is that there was then about 7 to 7.5 feet at low water in the river, about 9 feet in Baldhead channel, 9 feet in the Rip channel, and 10 feet at New Inlet. Work on the bar was first begun in 1853, at which time the bar depths at low water were 7.5 feet in Baldhead channel, 7 feet in Rip channel, and 8 feet at New Inlet, the governing low-water depths in the river having been increased to 9 feet.

The original project of 1827 was to deepen, by jetties, the channel through the shoals in the 8 miles next below Wilmington. This project resulted in a gain of 2 feet available depth. The project of 1853 was to straighten and deepen the bar channel by dredging, jettying, diverting flow from the New Inlet, and closing breaches in Zekes Island. This project was incomplete when the civil war began.

After the civil war the first project was that of 1870, to deepen the bar channel by closing breaches between Smiths and Zekes islands, with the ultimate closure of New Inlet in view. The project of 1873

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included that of 1870, and in addition the dredging of the bar channel and closing of New Inlet. The project of 1874 was to obtain, by dredging, a channel 100 feet wide and 12 feet deep at low water up to Wilmington. The project of 1881 was to obtain, by dredging, a channel 270 feet wide and 16 feet deep at low water up to Wilmington. These projects had been practically completed in 1889.

The existing project, dated February 28, 1889 (see Annual Report of Chief of Engineers for 1889, p. 1132), is to obtain a mean low-water depth of 20 feet and a width of 270 feet from Wilmington to the ocean, at an estimated cost of $1,800,000. This project was modified by act of June 13, 1902, to authorize the construction of mooring dolphins at Wilmington, at a cost of $30,000, and to provide for the removal of obstructions at mouth of Brunswick River, at an estimated cost of $1,000.

The river and harbor act of March 3, 1905, appropriated $150,000 for continuing the improvement, and provided, in addition, "That a contract or contracts may be entered into by the Secretary of War for such materials and work as may be necessary to prosecute said improvement, to be paid for as appropriations may from time to time be made by law, not to exceed in the aggregate three hundred thousand dollars, exclusive of the amounts herein and heretofore appropriated." No continuing contracts have, as yet, been made, however. The act also directs an examination to be made of this improvement with a view to determining whether any modifications therein are desirable.

EXPENDITURES.

Prior to civil war	$363,228.92
Since civil war, on previous projects	2,102,271.93
	2,465,500.85
On existing project to June 30, 1905, not including outstanding liabilities:	
For improvement	878,611.68
For maintenance	235,347.22
	1,113,958.90

Of the expenditures during the year, $14,000 was for improvement and the remainder ($42,200.77) for restoration and maintenance, the expenditures for restoration being necessary on account of the great depreciation that had occurred between March, 1901, and September, 1902, during which time there was no work on account of exhaustion of funds. As a result of these expenditures, the best conditions that had ever previously existed in the channels have been restored and maintained; and, in addition, the long shoal just below Wilmington, known as Alligator Creek shoal, has been widened from 148 feet to 259 feet through 6,000 feet of its length, and to 222 feet through the remaining 3,800 feet of its length. The work of repairing the injuries sustained in 1899 by the New Inlet and swash-defense dams has been begun, and was progressing favorably at the end of the fiscal year.

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The conditions on the shoals and bar at mean low water at the end of the fiscal year are shown by the following table:

Name of shoal.	Distance below Wilmington.	Length.	Width.	Depth.	Remarks.
	Miles.	*Feet.*	*Feet.*	*Feet.*	
Wilmington	0	8,200	270	20	In addition an average width of 150 feet between channel and harbor lines has been dug 20 feet deep.
Alligator Creek	1.5	9,800	222–259	20	6,000 feet is 259 feet wide, 3,800 feet is 222 feet wide.
Brunswick River	3.0	8,600	185–222	20	Upper 1,000 feet is 222 feet wide, lower 7,600 feet is 185 feet wide. Slight shoaling.
Logs and Big Island	7.0	16,700	148	20	
Keg Island	9.5	4,000	148	20	
Lilliput	11.0	17,200	148	20	Slight shoaling.
Old Brunswick Cove	13.5	5,000	148	20	Do.
Midnight	16.0	14,500	148	20	
Reaves Point	19.0	2,000	148	20	
Snows Marsh	20.0	9,600	150	18–20	18-foot channel 150 feet wide.
Ocean bar	30.0	6,000	250–300	20	

The total results obtained on the project up to the end of the fiscal year may be summarized as follows:

At the ocean bar a 20-foot mean low-water channel exists from deep water inside to deep water outside, the width being 300 feet, excepting for a length of about 400 feet, where it is only 250 feet.

From the ocean bar to Wilmington there is a 20-foot mean low-water channel, with a least width of 148 feet, excepting at Snows Marsh channel, where the depth is from 18 to 20 feet, with a narrow 20-foot channel nearly throughout the shoal.

The old Woodbury jetty, built at the mouth of the river in 1853, but which had been flanked to such an extent as to be worse than useless, has been removed to a depth of 25 feet, and the obstructions at the mouth of Brunswick River have been removed.

The distance from the ocean bar to Wilmington is 30 miles, and the river is navigable 115 miles farther up, to Fayetteville, the head of navigation.

The additional work proposed is the completion of the existing project.

The commerce for 1904 amounted to 856,011 tons, an increase of 12,674 tons over the preceding year, and consisted principally of cotton, naval stores, manufactured lumber and shingles, fertilizers, building material, coal, and general merchandise, the estimated value of which is $44,724,500. The gain in tonnage was more than seven times as great as the gain during the preceding year. The increase from 220,000 tons in 1869 is due to the improvement of the river.

As a result of the improvement vessels coming to Wilmington are much larger than formerly, the average tonnage in 1886 being 421, while in 1904 the average was 1,032. This increase in tonnage has caused a corresponding decrease in freight rates on shipments by water.

References: For special descriptions, see Annual Reports of the Chief of Engineers for 1873, page 44; 1887, page 1047; 1895, page 1335; 1896, page 1131, and 1901, page 1552.

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July 1, 1904, balance unexpended		$60,413.13
Amount appropriated by river and harbor act approved March 3, 1905		150,000.00
Amount received from rents and sales during fiscal year		1,932.11
		212,345.24
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$14,000.00	
For maintenance of improvement	42,200.77	
		56,200.77
July 1, 1905, balance unexpended		156,144.47
July 1, 1905, outstanding liabilities		7,299.85
July 1, 1905, balance available		148,844.62
July 1, 1905, amount covered by uncompleted contracts		5,235.00
Amount (estimated) required for completion of existing project		835,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905		250,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix M 13.)

IMPROVEMENT OF WACCAMAW RIVER, NORTH CAROLINA AND SOUTH CAROLINA, AND OF CERTAIN RIVERS AND HARBORS IN SOUTH CAROLINA.

This district was in the charge of Capt. G. P. Howell, Corps of Engineers. Division engineer, Lieut. Col. James B. Quinn, Corps of Engineers.

1. Waccamaw River, North Carolina and South Carolina, and Little Pedee River, South Carolina.—(*a*) *Waccamaw River.*—In 1880 this stream was navigable for 12-foot-draft boats at all stages of water from Georgetown, 23 miles, to Bull Creek, and at high water 4 miles farther, to Bucks lower mills; thence for 7-foot-draft boats, at high water, 22 miles farther, to Conway; thence it possessed an obstructed channel for 3-foot-draft boats, at ordinary winter water, 68 miles, to Reeves Ferry; thence an obstructed channel, with 3 feet at high water, for 30 miles, to Lake Waccamaw.

The project of improvement, adopted in 1880, provides for a channel 12 feet deep at all stages of water, with 80 feet bottom width from the mouth of the river to Conway, thence a cleared channel to Lake Waccamaw.

The original estimated cost was $29,370, which was revised in 1885 and increased in the Annual Report of that year to the present figure, $138,400. In the Annual Report of the Chief of Engineers for 1886, page 170, maintenance is estimated at $4,000 per year after completion of improvement.

The total expenditure to June 30, 1905, was $112,457.73. The river had been cleared of snags to a distance of 128 miles above the mouth, and this portion of the river had been frequently resnagged as appropriations permitted, 44,139 snags, etc., having been removed since June 30, 1884. Some work had been done toward increasing the original depth on eight shoals below Conway. As nearly as could be determined from the records, about $75,977.81 had been expended in

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originally snagging the lower 128 miles of the river and in constructing pile and plank dikes at eight shoals, and $34,135.27 in maintenance.

Dredging was begun in 1903, 15,732 cubic yards having been removed, at a cost of $2,425.72.

All the expenditures during the year were for maintenance. From the channel and banks 851 obstructions were removed.

The available depths reported as now existing do not differ greatly from the original depths. At mean low water about 11 feet can be carried to Bucksville, 34 miles above the mouth; about 6 feet to Toddsville, 38½ miles; about 5 feet to Conway, 50 miles; about 2 feet to Wortham's bridge, 97 miles. At high water large side-wheelers can go to Red Bluff, 74 miles, and small boats to Reeves Ferry, 117 miles. The usual variation in water level is about 7.5 feet at Conway, 50 miles above the mouth, and about 12 feet at Star Bluff, 84 miles above the mouth.

The tidal influence at low water extends 97 miles above the mouth.

Commercial statistics.

Year.	Total tons.	Value.	Year.	Total tons.	Value.
1887	.....	$2,129,231.75	1897	241,300	$2,406,390.00
1889	.....	2,308,915.00	1898	258,191	2,666,280.00
1890	67,195	2,317,368.50	1899	376,822	3,135,214.00
1891	76,245	2,231,112.00	1900	467,887	3,481,072.00
1892	83,103	2,178,309.00	1901	302,655	3,885,700.00
1893	70,976	2,095,548.00	1902	141,686	1,844,019.00
1894	99,298	2,120,864.00	1903	143,813	1,884,700.00
1895	128,466	2,063,697.00	1904	190,435	2,119,040.00
1896	203,388	2,314,175.00			

Prior to the year 1902 the commerce on the Great Pedee River has been included, as it is carried over the lower 22 miles of the Waccamaw River to get to Georgetown.

The vessels engaged in traffic on this river are steamers and tugboats of from 10 to 550 tons, seagoing schooners of from 300 to 500 tons, pole boats, rafts, etc. The additional work proposed is necessary to make the improvement available. It is intended to obtain a 6-foot channel below Conway, and afterwards to maintain the present cleared channel above Conway, dredging at a few of the shoalest places. No new line of transportation was established during the year. For references to examinations and surveys see page 246, Annual Report of the Chief of Engineers, 1904.

The sum of $9,000 has been allotted for this work from the appropriation for improving Waccamaw River, North Carolina and South Carolina, and Little Pedee River, South Carolina, act of June 13, 1902, and $13,800 from the appropriation made in act of March 3, 1905.

(*b*) *Little Pedee River.*—The river in its original condition was much obstructed by snags and overhanging trees and by 10 bridges without draws. In places it was divided into several branches, in none of which was there a good channel.

Under the plan of improvement adopted in 1888 it is proposed to snag the river and close unnecessary branches, providing for steamboat navigation up to the mouth of Lumber River, 65 miles, and for

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pole-boat navigation 48 miles farther, to Little Rock, at an estimated cost of $50,000.

The total expenditures to June 30, 1905, were $23,592.70. The river had been well snagged up to the mouth of Lumber River and roughly cleared for pole-boat navigation to Little Rock. No work had been done toward increasing the original depths. As nearly as could be determined from the records, about $19,549.99 had been expended in originally snagging the river, and about $4,042.71 in maintenance.

All the expenditure during the fiscal year was for maintenance. From the channel 1,180 obstructions and from the banks 336 trees and 59½ cords of brush were removed.

The available depths now existing do not probably differ greatly from the original depths. The usual variation in water level at Gilchrist bridge, about 65.5 miles above the mouth, is about 9.5 feet.

Commercial statistics.

Year.	Total tons.	Value.	Year.	Total tons.	Value.
1891	4,614	$52,760	1898	11,900	$105,750
1892	7,115	92,964	1899	16,685	144,787
1893	6,153	101,535	1900	23,780	173,500
1894	8,375	114,600	1901	51,460	399,000
1895	12,438	117,470	1902	57,050	416,000
1896	17,050	198,500	1903	77,750	560,500
1897	13,162	100,400	1904	88,100	645,000

Two vessels ply on the river as far as Gallivant's bridge, 47 miles above its mouth; the river is probably navigable at its mean low-water stage for boats with 3-foot draft as far as Gallivant's bridge. One new line of transportation was established during the year.

The additional work proposed is necessary to make the improvement available.

For outline map of river see page 1214, Annual Report of the Chief of Engineers for 1890. For preliminary examination and survey see page 1111, Annual Report of the Chief of Engineers for 1887.

The sum of $1,500 has been allotted for this work from the appropriation for improving Waccamaw River, North Carolina and South Carolina, and Little Pedee River, South Carolina, act of June 13, 1902, and $1,200 from the appropriation made in act of March 3, 1905.

July 1, 1904, balance unexpended	$804.58
Amount appropriated by river and harbor act approved March 3, 1905	15,000.00
	15,804.58
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	1,455.01
July 1, 1905, balance unexpended	14,349.57
July 1, 1905, outstanding liabilities	732.19
July 1, 1905, balance available	13,617.38
Amount (estimated) required for completion of existing project	76,100.00

(See Appendix N 1.)

2. Great Pedee River, South Carolina.—The river in its original condition was dangerously obstructed by logs everywhere. Boats

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drawing 9 feet of water were able to reach Smith Mills, 52 miles above the mouth. Those drawing 3½ feet could get 54 miles farther up at low water, to Little Bluff, or at high water to Cheraw, 172 miles from the mouth.

The project of improvement adopted in 1880 provides for a thoroughly cleared 9-foot navigation to Smith Mills and a 3½-foot navigation to Cheraw at all stages of water.

The original project contained no estimate of cost. From 1880 to 1886, inclusive, $47,000 was appropriated. In the Annual Report of the Chief of Engineers for 1886, page 170, it was estimated that $70,000 in addition to this $47,000 would complete the improvement, and that $5,000 a year would be required for maintenance.

A project for the improvement of the upper river (the 64 miles between Cheraw and the bridge of the Wilmington, Columbia and Augusta Railroad) was adopted in 1902. (See Annual Report of the Chief of Engineers for 1901, p. 1607.) This project provides for obtaining, by snagging and dredging, a cleared channel, with a least depth of 3½ feet at mean low water, at a cost of $118,300; and the work was placed in the continuing-contract class. A total of $77,000 has been appropriated, but no work has yet been done.

The total expenditures to June 30, 1905, were $157,460.78. The river had been well cleared of snags from the mouth to the Wilmington, Columbia and Augusta Railroad bridge, 108 miles, and less thoroughly snagged between the bridge and Cheraw, 40,918 snags, etc., having been removed since June 30, 1884. No work had been done toward increasing original depths.

As nearly as could be determined by the records, about $78,919.13 had been expended in originally clearing the river of snags and in preliminary examination and survey made in 1900, and about $41,758.60 in maintenance.

The expenditure for maintenance during the fiscal year resulted in removing about 329 obstructions from the river.

The present available depths are believed to be not far different from those originally existing, though there are a large number of shoals above the bridge on which the depth at low water is less than 3½ feet.

At mean low water 8 feet can be carried to Smith Mills, 52 miles above the mouth; about 3 feet to the Wilmington, Columbia and Augusta Railroad bridge, 108 miles above, and about 2 feet to Cheraw, the head of navigation, 172 miles above.

The usual variation in water level is 16.4 feet at Smith Mills and 34.2 feet at Cheraw.

Commercial statistics.

Year.	Total tons.	Value.	Year.	Total tons.	Value.
1891	62,344	$1,367,330	1898	75,280	$1,228,385
1892	92,471	1,401,088	1899	134,072	1,602,709
1893	94,661	1,166,874	1900	154,727	2,645,560
1894	91,025	1,169,070	1901	188,912	2,811,080
1895	106,115	893,480	1902	152,008	1,328,970
1896	220,964	1,326,250	1903	153,014	1,338,759
1897	114,177	1,167,914	1904	162,566	1,507,181

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The vessels engaged in traffic on this river are steamers of 400 tons and less, seagoing schooners, pole boats, rafts, etc. One new line of transportation has been established during the past year.

The additional work proposed is necessary to make the improvement available and for the extension of the benefits.

For references to examinations and surveys, see page 249, Annual Report of the Chief of Engineers for 1904.

Available funds and additional appropriation recommended will be applied to maintaining the general improvement and in obtaining the channel in the upper river.

July 1, 1904, balance unexpended		$61,777.38
Amount appropriated by sundry civil act approved March 3, 1905		15,000.00
Amount appropriated by river and harbor act approved March 3, 1905		5,000.00
		81,777.38
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$34,526.61	
For maintenance of improvement	711.55	
		35,238.16
July 1, 1905, balance unexpended		46,539.22
July 1, 1905, outstanding liabilities		4,737.39
July 1, 1905, balance available		41,801.83
July 1, 1905, amount covered by uncompleted contracts		3,513.30
Amount (estimated) required for completion of existing project		41,300.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905. Submitted in compliance with requirements of sundry civil act of June 4, 1897.		20,000.00

(See Appendix N 2.)

3. Winyah Bay, South Carolina.—This large bay is connected with the ocean by a passage between the shores of North and South islands 2½ miles long, 1 mile wide at the bay, three-fourths mile wide at the gorge, and 1¼ miles wide at the ocean, or southeasterly end of North Island. Through the passage, which trends north-northwest and south-southeast, there was a bold channel 36 feet deep at the bay, retaining a depth of not less than 20 feet until about 3,000 feet southerly from the end of North Island and of not less than 15 feet to a point about 1 mile south of the island, where the channel divided into two. One of these two channels, known as Main channel, continued 3¼ miles farther, through extensive shoals, to the 18-foot contour in the ocean. This channel was south-southeast, and in alignment with the main channel through the straits. The other, known as Bottle channel, after flowing about 2,500 feet southeasterly, 1,500 feet easterly, and about 3,000 feet northeasterly, reached the 18-foot contour in the ocean at a distance of about 1½ miles in a direction from the point of separation from the main ship channel almost at right angles with the direction of that channel and of the channel through the passage. At mean low water the depth on the crest of the bar was variable in both channels and about 7 to 9 feet in the Main channel and 6 to 8 feet in Bottle channel. The mean range of tide is 3½ feet.

The present project, adopted in 1889, provides for the construction of two jetties, springing, respectively, from North and South islands

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and converging toward the bar, the jetties to consist of mattress foundation and a superstructure of large riprap stone raised to a height of 6 feet above mean low water, the south jetty to extend due east across the bar and the north jetty to converge toward it, so as to produce the necessary contraction on the bar. The depth to be secured is 15 feet at mean low water. The river and harbor act of June 3, 1896, authorized the completion of the work under continuing-contract system, at a cost not exceeding $1,996,250, in addition to the $20,000 appropriated by the act. A total of $1,923,500 has been appropriated by sundry civil acts since that date. The project was extended by the river and harbor act approved June 13, 1902, to permit dredging at the shoal places in Winyah Bay, between the entrance and the city of Georgetown, S. C., over which the least channel depths might at any time be less than at the entrance to the bay, provided that the expenses of this dredging, added to that of improving the entrance to the bay, should not exceed the total amount authorized under the continuing-contract system.

The total expenditures to June 30, 1905, were $2,160,746.67, of which $428,750 was appropriated prior to June 3, 1896. For maintenance, $3,540.20 has been spent. The jetty work, which since June 3, 1896, had been under a continuing contract, had been completed. The north jetty extends a distance of 11,139 feet from the shore end, with crest from 4½ to 6 feet above mean low water, except the outer 100 feet, which is submerged. The south jetty extends a distance of 21,051 feet from the shore end, with crest at heights varying from 10 feet above mean low water at the inner end to nothing at the outer end. The stone superstructure has practically no top width. The seagoing suction dredge *Winyah Bay* has been built, and this dredge and the similar dredge *Charleston* have removed 1,123,132 cubic yards of material from the entrance channel and 286,735 cubic yards of material from the eastern channel in upper Winyah Bay. Spur dikes have been built to protect the South Island beach. A mud dike has been built from the high land on South Island to the high land near the Santee River to prevent the tides from cutting around the shore end of the south jetty, and the stone work of the jetty has been extended about 2,600 feet by a work of sheet piling covered with mud to connect with this dike. The expenditure for maintenance during the year was for sodding the mud dike.

The controlling entrance depth is 15 feet at mean low water. The maximum draft that can be carried from Georgetown through Winyah Bay to the sea is 13 feet at mean low water. The mean range of tide is 3½ feet.

The additional work proposed is for the extension of benefits.

Commercial statistics.

Year.	Total tons.	Value.	Year.	Total tons.	Value.
1891	261,370	$8,071,600	1899	120,587	$6,337,853
1892	271,966	.....	1900	129,639	6,749,433
1893	268,640	.....	1901	247,960	8,457,906
1894	293,822	.....	1902	337,471	9,310,682
1896	171,059	6,228,350	1903	368,502	9,359,581
1897	149,374	5,817,960	1904	369,774	9,546,843
1898	125,008	5,587,880			

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The vessels using the entrance channel are steamers of 1,850 tons and less and sailing vessels of various kinds. The freight carried is principally lumber, naval stores, and general merchandise. There are two lines of steamships plying between Georgetown and northern ports. No new line of transportation has been established during the year. The water rate on lumber, the chief export, has decreased from $5.50 per thousand feet B. M., in 1892, to $4.12½, in 1905.

For references to examinations and surveys see page 250, Annual Report of the Chief of Engineers for 1904.

July 1, 1904, balance unexpended		$247,178.35
Amount appropriated by sundry civil act approved March 3, 1905		75,000.00
Amount appropriated by river and harbor act approved March 3, 1905		10,000.00
Received for rent of dredge		5,670.00
		337,848.35
June 30, 1905, amount expended during fiscal year:		
Treasury settlement	$10.15	
For works of improvement	107,365.91	
For maintenance of improvement	3,240.20	
		110,616.26
July 1, 1905, balance unexpended		227,232.09
July 1, 1905, outstanding liabilities		9,006.79
July 1, 1905, balance available		218,225.30
July 1, 1905, amount covered by uncompleted contracts		3,513.30
Amount (estimated) required for completion of existing project		72,750.00

(See Appendix N 3.)

4. Santee, Wateree, and Congaree rivers, and Estherville-Minim Creek Canal, South Carolina.—(*a*) *Santee River and Estherville-Minim Creek Canal.*—This river in its original condition was considerably obstructed at all stages of water by sunken logs and snags. Its bar entrance was narrow, crooked, and shifting, with only about 4 feet of water at low tide, and so situated as to be difficult and expensive to improve.

The original project, adopted in 1880, contemplated providing an outlet for the river into Winyah Bay by constructing a canal from the river through Mosquito Creek into the bay. On this project there was expended $99,750.

The present project, adopted in 1889, contemplates providing a more satisfactory outlet into the bay by cutting a canal 70 feet wide and 6 feet deep at mean low water from the Estherville plantation to Minim Creek and for snagging the entire river. The estimated cost is $350,000, not including the amount expended under the original project.

The total expenditures under the present project to June 30, 1905, were $186,439.95, of which about $14,254.63 was for maintenance. The first cut of the canal had been made entirely through, and this had been widened through a portion of its length. From the Santee River proper 1,809 obstructions had been removed.

All the expenditure during the fiscal year was for maintenance; 10,978 cubic yards of material and 68 obstructions were removed from the canal, and 213 obstructions were removed from the river proper.

Except at the Winyah Bay end, where on account of the softness of the banks the width has been reduced to 40 feet and the depth to 4

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feet, the canal is nowhere less than 50 feet wide and 5 feet deep. The mean rise of tide at the canal is about 3½ feet. The least available depth in Santee River is about 4 feet at low water. The usual variation in water level at the Atlantic Coast Line bridge, about 54½ miles above the mouth, is about 19 feet, and at its junction with the Wateree and Congaree rivers, 143 miles above the mouth, about 20 feet. The river is navigable its entire length.

Commercial statistics.

Year.	Total tons.	Value.	Year.	Total tons.	Value.
1891	100,255	$2,743,000	1898	112,205	$2,208,800
1892	110,523	2,775,800	1899	154,327	2,679,100
1893	124,182	2,679,600	1900	179,090	2,622,200
1894	115,428	2,375,000	1901	204,375	1,809,000
1895	117,090	2,224,800	1902	215,600	1,882,500
1896	134,135	2,204,800	1903	220,900	1,840,000
1897	134,206	2,159,940	1904	242,800	1,662,500

The vessels using the river and canal are steamers of from 10 to 500 tons, small sailing craft, pole boats, rafts, etc. No new line of transportation has been established during the fiscal year.

The additional work proposed is necessary to make the improvement available and for extending the benefits.

For references to examination and surveys and other information concerning the work, see page 252, Annual Report of the Chief of Engineers, 1904.

The sum of $22,000 has been allotted for this work from the appropriation for improving Santee, Wateree, and Congaree rivers, South Carolina, act of June 13, 1902, and $25,000 from the appropriation made in act of March 3, 1905.

(*b*) *Wateree River.*—In its original condition this stream had a low-water depth of from 3 to 4 feet from its mouth, 67 miles, to Camden. The lower 14 miles was completely blocked at all stages of water by logs, snags, etc., and at moderate stages by the bridges of the South Carolina and the Wilmington, Columbia and Augusta railroads, then without drawspans; thence to Camden navigation was possible, but dangerous, except during high water. Its commerce was practically nothing.

The present project of improvement, adopted in 1881, provides for safe and unobstructed 4-foot navigation for steamers from Camden to the mouth, at an estimated cost of $60,000.

The appropriation of September 19, 1890, completed the estimate for the project, but appropriations have since been made for maintenance. The work is one of snagging only, and, as snags are continually lodging, it is not susceptible of completion. Snagging work should be done annually in order to keep the channel open.

The total expenditures to June 30, 1905, were $72,373.30. To June 30, 1900, the river had been kept fairly clear of obstructions from the mouth to Camden. Since June 30, 1884, 24,912 obstructions had been removed, the records prior to that date not giving number removed.

The only expenditure during the fiscal year was for work in connection with new plant for this improvement, and is properly chargeable against maintenance.

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So far as known the available depths now existing do not differ greatly from the original depths. The usual variation in water level is about 17 feet at a point about 4 miles above the mouth and about 28.5 feet at Camden, 67 miles above the mouth.

Commercial statistics.

Year.	Total tons.	Value.	Year.	Total tons.	Value.
1891	1,005	$51,210	1898	68,568	$274,050
1892	2,244	86,040	1899	109,170	272,200
1893	6,242	117,729	1900	98,024	155,000
1894	18,075	94,334	1901	10,417	50,000
1895	21,697	127,565	1902	42,575	92,500
1896	35,002	233,525	1903	41,050	87,000
1897	43,770	202,800	1904	15,600	29,700

Rafting is the only business done on this river. No new line of transportation was established during the year.

The additional work proposed is necessary to make the improvement available.

For references to examinations and surveys see page 253, Annual Report of the Chief of Engineers, 1904.

The sum of $25,000 has been allotted for this work from the appropriation for improving Santee, Wateree, and Congaree rivers, South Carolina, act of March 3, 1905.

(*c*) *Congaree River* (*open-channel work*).—In 1886 this stream in its original condition had a low-water depth of 3 to 4 feet from its mouth to the railroad bridge at Columbia, thence 1 foot low-water depth 2 miles farther to its head. The navigation of the lower 47 miles was blocked at all stages of water by the South Carolina Railroad bridge and by sunken logs, snags, and overhanging trees. The navigation of the remaining 2 miles was prevented by swift currents and numerous rock ledges and bowlders. Its commerce was nothing.

The project of improvement, adopted in 1886, proposes to secure a thoroughly cleared 4-foot navigation over the lower 47 miles at all stages of water and a cleared channel 100 feet wide through the ledges and bowlders above, at an estimated cost of $54,500.

The total expenditures to June 30, 1905, were $35,875.49. The channel had been thoroughly snagged from the mouth to Granby, 2 miles below Columbia. A total of 11,119 obstructions had been removed below Granby. As nearly as can be determined from the records, about $19,523.82 had been expended in originally snagging the river and about $16,351.67 in maintenance. All the expenditure during the fiscal year was for maintenance. One hundred and sixty-two obstructions were removed from the stream.

So far as known the available depths now existing do not differ greatly from the original depths.

About 4 feet can be carried at mean low water to Granby, the present head of navigation. The usual variation in water level at a point 2 miles above the mouth is about 24.3 feet and at Columbia about 33.2 feet.

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Commercial statistics.

Year.	Total tons.	Value.	Year.	Total tons.	Value.
1891	2,401	$47,840	1898	81,362	$201,700
1892	3,686	62,025	1899	88,696	191,700
1893	2,781	71,125	1900	121,363	197,000
1894	7,974	40,760	1901	14,588	70,000
1895	8,993	45,700	1902	58,075	123,500
1896	18,307	178,900	1903	114,310	271,400
1897	40,857	110,100	1904	43,035	98,900

Rafting is the principal business on the river. No new line of transportation was established during the fiscal year.

The additional work proposed is necessary to make the improvement available.

For preliminary examination and survey, see page 1140, Annual Report of the Chief of Engineers for 1885. For outline map of river, see page 1194, Annual Report of the Chief of Engineers for 1889.

The sum of $5,000 has been allotted for this work from the appropriation for improving Santee, Wateree, and Congaree rivers, South Carolina, act of June 13, 1902, and $25,000 from the appropriation for lock and dam in Congaree River as authorized by the river and harbor act of March 3, 1905.

July 1, 1904, balance unexpended	$9,480.49
Amount appropriated by river and harbor act approved March 3, 1905	50,000.00
Amount transferred from Congaree River	25,000.00
	84,480.49
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	5,655.73
July 1, 1905, balance unexpended	78,824.76
July 1, 1905, outstanding liabilities	21.96
July 1, 1905, balance available	78,802.80
Amount (estimated) required for completion of existing project	152,000.00

(See Appendix N 4.)

5. Congaree River, South Carolina, from Gervais Street Bridge, Columbia, to Granby.—For original condition of this portion of the river, see preceding report on Congaree River, South Carolina.

Pursuant to House resolution dated December 15, 1893, a project and estimate were submitted January 2, 1894, for extending steamboat navigation from Granby to Gervais Street Bridge, Columbia, by the construction of a lock and movable dam near Granby. This document and a letter concerning it are printed on pages 1182–1189, Annual Report of the Chief of Engineers for 1896.

The river and harbor act approved March 3, 1899, appropriated $50,000 for beginning this work, and authorized continuing contracts to be made for its completion, at a total cost not exceeding $200,000 in addition to the $50,000 appropriated. Three appropriations, aggregating $200,000, have since been made for this work, completing the amount authorized by the act. The river and harbor act approved March 3, 1905, appropriating for improving Santee, Wateree, and

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Congaree rivers and the Estherville-Minim Creek Canal, contained the provision:

The Secretary of War may expend upon such improvement the unexpended balance of the appropriation heretofore made for a lock and dam in the Congaree River provided for by the act of March third, eighteen hundred and ninety-nine.

The total expenditures to June 30, 1905, were $204,353.94. The necessary land had been acquired and lock keeper's house and other buildings constructed. A contract for constructing the lock and dam abutment, except metal work, at a total cost, based on estimated quantities, of $77,621, was approved October 20, 1900, the contract time for completion being January 30, 1902. Owing to the unusual number of freshets an extension of time was granted. During the fiscal year 1904 the contract was completed. The lock irons and gate members were purchased under a contract approved August 10, 1901. They had all been delivered. The gates had been built by hired labor and had been hung.

Contract was made October 2, 1902, for building the movable dam, 376 feet long, of Chanoine wickets. During the fiscal year 1904 the dam was completed, the last of the wickets and trestles being placed in position on June 30, 1904. During the past year work has been in progress of clearing the channel above the lock of obstructions, mostly rock ledges and bowlders.

There is no navigation at present on this portion of the river. The additional work proposed is necessary to make the improvement available. The usual range of water level at Columbia is about 33.2 feet.

A steamboat to run between Columbia and Georgetown, S. C., is in process of construction. Connection will be made at Georgetown with the Clyde Line steamers for New York. A reduction of 20 per cent in freight rates is expected.

July 1, 1904, balance unexpended		$87,782.33
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$42,136.27	
Transferred to Congaree River improvement by open-channel work	25,000.00	
		67,136.27
July 1, 1905, balance unexpended		20,646.06
July 1, 1905, outstanding liabilities		942.95
July 1, 1905, balance available		19,703.11

(See Appendix N 5.)

6. Inland waterways between Charleston Harbor, South Carolina, and opposite McClellanville.—These waterways consist of a series of creeks, sounds, rivers, and bays, which afford a route sheltered for the most part from the sea by the numerous islands which form the outer coast line. The route is tidal throughout, the range of tide varying from about 4.6 to 5.3 feet. It is now obstructed by a number of shallow reaches and narrow, crooked passages, particularly at points where the tides meet. The passage across Bulls Bay, besides being very shallow, is much exposed. The present commerce is comparatively small, as only very small vessels can get through without excessive delays.

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The river and harbor act approved June 13, 1902, contains the following item:

Improving the inland waterways between Charleston Harbor, South Carolina, and opposite McClellanville, in accordance with the report submitted by the Chief of Engineers, March twenty-sixth, nineteen hundred and two, fifty thousand dollars, the same to be expended at the end of the route from Charleston northward in procuring a channel of four feet depth and sixty feet bottom width: *Provided*, That all land required for the same shall be relinquished free of cost to the Government.

The total estimated cost of improvement to the dimensions stated is $125,290, the work to consist of improving present channels and of avoiding certain crooked and dangerous sections by canals.

The titles to the land required have been obtained. Actual work will be begun during the coming fiscal year.

For references to reports of examinations and surveys, see page 256, Annual Report of the Chief of Engineers for 1904.

Commercial statistics.

Year.	Tons.	Value.
1903	33,344	$579,520
1904	39,064	573,770

The additional work proposed is for the extension of benefits.

July 1, 1904, balance unexpended	$50,000.00
July 1, 1905, balance unexpended	50,000.00
July 1, 1905, outstanding liabilities	221.80
July 1, 1905, balance available	49,778.20
Amount (estimated) required for completion of existing project	75,290.00

(See Appendix N 6.)

7. Charleston Harbor, South Carolina.—There were originally four channels across the bar, the deepest having about 12 feet depth at low water. Commerce was then using the Pumpkin Hill channel, about 3 miles south of the present jetty channel. Where the present jetty channel is situated there was then the Swash channel, with a best depth of 10½ feet of water, too crooked for safe use. The natural channels were shifting in position and variable in depth.

The original project, adopted in 1878, provided for establishing and maintaining, by means of two jetties and auxiliary dredging, a low-water channel of not less than 21 feet depth across the bar. The Swash channel was selected for improvement. The estimated cost was $3,000,000.

In 1888 it became necessary to modify the height of the crest line of the jetties and to revise the estimate. This increase in the estimate was largely due to the fact that money had been appropriated so slowly that reasonable contract prices could not be obtained. The annual appropriation up to that time had been only 5½ per cent of the original estimate. In the revised project the jetties were increased in height and length, but no change was made in their position or distance apart. The revised estimates were $4,380,500 if the jetties were

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brought up to low-water level throughout, and $5,334,500 if brought up 3 feet higher. The former estimate was adopted by Congress in the river and harbor act approved July 13, 1892.

The present project, adopted by the river and harbor act approved March 3, 1899, provides for obtaining a channel at the entrance to Charleston Harbor not less than 26 feet deep at mean low water (mean range of tide about 5.2 feet) and 600 feet wide, by constructing a large seagoing suction dredge, at a cost of not exceeding $150,000, and operating her, together with the existing dredge *Charleston*, for three years. The estimated cost of constructing the new dredge and operating this dredge as above was $285,000. Of this amount, $175,00 had been appropriated prior to the enactment of the river and harbor act of June 13, 1902, which made available an additional sum of $208,000, increasing to $383,000 the amount authorized for the project for the new dredge and its operation.

The new dredge, *General Abbot*, was completed and placed in operation on the work during the year. Details of construction are given in Appendix H 7, herewith.

The total expenditures to June 30, 1905, were $4,536,083.89, including about $2,500 expended at Sullivans Island and $10,000 at Mount Pleasant. Of this amount, $4,172,500 had been expended on the original project and on maintenance.

The jetties had been completed; a channel 21 feet deep at mean low water had been obtained in 1898; during the fiscal year 1903 the project depth of 26 feet at mean low water was obtained, but the channel was narrow; during the present year the width has been increased until it is not less than 400 feet at any point. The mean tidal range is 5.2 feet.

The river and harbor act of March 3, 1905, authorizes the Secretary of War, in his discretion, to cause the new dredges employed on this work to be utilized at such times as they are not employed in dredging on the outer bar for dredging in the channels between said outer bar and the city of Charleston.

For references to examinations and surveys and to projects, see page 257, Annual Report of the Chief of Engineers for 1904.

COMMERCIAL STATISTICS.

[Furnished by the collector of customs.]

Foreign commerce.

Year.	Aggregate registered tons.	Value.	Year.	Aggregate registered tons.	Value.
1889	211,203	$16,744,951	1897	226,750	$12,101,763
1890	224,962	16,041,397	1898	214,180	10,961,250
1891	274,149	23,110,664	1899	174,525	6,385,168
1892	169,379	11,829,607	1900	150,631	11,170,910
1893	193,336	11,940,129	1901	141,008	5,276,757
1894	208,169	11,560,372	1902	219,069	7,095,294
1895	140,988	10,586,326	1903	142,198	5,237,119
1896	158,325	11,785,846	1904	146,966	6,100,295

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Commerce through Charleston Harbor, ocean entrance.

Year.	Total imports and exports.	Value.
	Tons.	
1901	784,812	$39,454,515
1902	822,845	34,746,997
1903	695,908	47,659,427
1904	880,896	49,994,894

Regarding effect on freight rates since improvement began in 1878, the only change that seems due to the improvement is a lowering of about 12½ cents per ton on business done by coastwise sailing vessels.

The vessels using the entrance channel are steamers, sailing vessels, barges, etc. The steamers of the regular lines number 15. The business of the Clyde Steamship Company has been done by 13 vessels.

The additional work proposed is for extension of benefits.

July 1, 1904, balance unexpended		$157,094.76
Received for rent of dredge *Charleston*, from Savannah, Ga., office		2,240.00
Received from auction sales		506.96
Amount appropriated by sundry civil act approved March 3, 1905		25,000.00
Amount appropriated by river and harbor act approved March 3, 1905		25,000.00
		209,841.72
June 30, 1905, amount expended during fiscal year, for works of improvement		[a]117,483.37
July 1, 1905, balance unexpended		92,358.35
July 1, 1905, outstanding liabilities		4,015.63
July 1, 1905, balance available		88,342.72
July 1, 1905, amount covered by uncompleted contracts		4,500.00

(See Appendix N 7.)

8. *Wappoo Cut, South Carolina.*—Wappoo Cut in its original condition was a narrow, crooked tidal stream, not over 2 feet in depth in some places. It connects Ashley and Stono rivers.

The existing project, adopted in 1881, revised in 1888, provides for straightening, widening, and deepening to secure a fairly direct channel 6 feet deep at mean low water and 60 feet wide. It includes the construction of two training walls at the Stono River entrance, revetting Elliotts Cut, constructing three closing dams, and dredging a cut 200 feet wide and 7 feet deep across the Ashley River bar. The estimated cost of the project was $88,000, including expenditures between 1881 and its date.

The total expenditures to June 30, 1905, were $70,500, of which amount about $11,010.36 was for maintenance. A channel of the projected width and depth had been dug and the banks of Elliotts Cut revetted. Two of the closing dams had been built, and a cut of about 200 feet wide and 7 feet deep had been dredged across the Ashley River bar. A 6-foot channel 60 feet wide existed through the canal proper. The cut through the Ashley River bar had narrowed to 70 feet and shoaled to 6 feet. The entire expenditure for the year was

[a] Includes $33,025.77 on account of dredge construction.

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for maintenance, and was for dredging at the Ashley River bar to the required dimensions of 200 feet wide and 7 feet deep. The mean range of tide is about 5.5 feet.

The project is regarded as completed.

Commercial statistics.

Year.	Total tons.	Value.	Year.	Total tons.	Value.
1891	140,000	$1,976,000	1899	235,830	$2,005,695
1892		1,997,500	1900	158,849	2,531,399
1893	142,800	1,865,500	1901	177,320	2,782,460
1894	238,350	1,683,000	1902	143,165	2,637,481
1895	250,230	2,260,100	1903	153,594	2,682,115
1896	271,800	2,410,000	1904	200,712	2,639,560

The vessels using the cut were steamers of from 40 to 400 tons, sloops, lighters, rafts, etc. Freight rates have been reduced about 33⅓ per cent.

July 1, 1904, balance unexpended	$7,160.24
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	7,160.24

(See Appendix N 8.)

9. Inland waterway between Charleston and Beaufort, S. C.—This waterway consisted originally of a series of creeks, sounds, rivers, and bays affording a practicable route for small vessels, being well sheltered from the sea except at the crossing of St. Helena Sound. A 6-foot depth at mean low water existed throughout its length except in Wappoo Cut, Church flats, Mosquito Creek, and Brickyard Creek (part of Beaufort River). The first and last of these obstructions have been improved to depths of 6 and 7 feet, respectively. At Church flats the mean low-water depth is about 4 feet, and in Mosquito Creek about 2 feet. The latter is, moreover, extremely narrow and tortuous.

By the river and harbor act approved June 13, 1902, an appropriation was made for constructing a canal between South Edisto and Ashepoo rivers at Fenwicks Island, South Carolina, whereby the difficult passage through Mosquito Creek might be avoided. The cost of such a canal, 7 feet deep at mean low water and 90 feet wide at bottom, was estimated in 1888 as $61,600. The land required was obtained through condemnation proceedings at a cost of $1,500.

The total expenditures to June 30, 1905, were $17,528.77. Dredging had been done at both entrances to the canal.

The mean range of tide in the proposed canal will be about 7.5 feet.

For report on preliminary examination and survey, see page 999, Annual Report of the Chief of Engineers for 1888.

Commercial statistics for Wappoo Cut are given under that head, and those for Brickyard Creek under the head of Beaufort River.

Vessels can not yet use the canal. The additional work proposed is necessary to make the improvement available.

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July 1, 1904, balance unexpended	$26,071.53
Amount appropriated by river and harbor act approved March 3, 1905	20,000.00
	46,071.53
June 30, 1905, amount expended during fiscal year, for works of improvement	13,600.30
July 1, 1905, balance unexpended	32,471.23
July 1, 1905, outstanding liabilities	3,165.34
July 1, 1905, balance available	29,305.89
July 1, 1905, amount covered by uncompleted contracts	9,910.00
Amount (estimated) required for completion of existing project	11,600.00

(See Appendix N 9.)

10. Beaufort River, South Carolina.—There was originally a thoroughly good 7-foot channel between the town of Beaufort and Coosaw River, except at a point called Brickyard, near the Coosaw mouth. The least depth here was about 4 feet at low water, and the channel, when deep enough, was too narrow.

The plan of improvement adopted in 1890 was to deepen and widen the channel by dredging to give a continuous, sufficiently wide 7-foot channel at low water all the way through. The estimated cost was $25,000. A layer of rock having been encountered at a higher level than was found by the preliminary borings, the work could not be completed for the amount of the original estimate. On April 15, 1893, the estimate was increased to $40,000.

The total expenditures to June 30, 1905, were $33,000. A channel 7 feet deep had been secured all the way through, with minimum width of 150 feet. The mean range of tide is about 7.7 feet.

The project is regarded as completed.

For references to reports on examinations and surveys, see page 260, Annual Report of the Chief of Engineers for 1904.

Commercial statistics.

[Commerce passing through Brickyard Creek.]

Year.	Tons.	Value.
1902	65,668	$571,597
1903	22,835	459,200
1904	7,881	266,350

The vessels using the river were steamers of from 40 to 400 tons, schooners, sloops, lighters, rafts, etc.

July 1, 1904, balance unexpended	$1,850.50
June 30, 1905, amount expended during fiscal year, for works of improvement	1,850.50

(See Appendix N 10.)

11. Mingo Creek, South Carolina.—To June 30, 1897, $17,000 had been expended on improvement to provide steamboat navigation up to Williams Landing and pole-boat navigation at high water up to the head of navigation by snagging and clearing the banks.

Deterioration having occurred, the sum of $300 has been allotted from the emergency appropriation provided by the river and harbor

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act of March 3, 1905, to be applied to removal of obstructions and overhanging trees. The work has not yet been begun.

Amount allotted from appropriation for maintenance of river and harbor improvements, act of March 3, 1905	$300
July 1, 1905, balance unexpended	300

12. Removing sunken vessels or craft obstructing or endangering navigation.—An allotment of $2,000 had been made for removing the wreck of an old vessel which had been converted into a phosphate barge, and which was sunk in Ashley River, near Lambs, S. C. It had been removed to a depth sufficient to accommodate the navigation of the river, excepting a small portion. An additional allotment of $500 was made during the present year. The wreck has been removed.

The total expenditures were $2,286.96.

An allotment of $15,000 has been made for removing the wreck of the schooner *Kate V. Aitken* from the jetty channel, Charleston Harbor, South Carolina. No work has been done and no expenditures have been made.

(See Appendix N 11.)

IMPROVEMENT OF RIVERS AND HARBORS IN EASTERN GEORGIA; OF INSIDE WATER ROUTE BETWEEN SAVANNAH, GA., AND FERNANDINA, FLA., AND OF CUMBERLAND SOUND, GEORGIA AND FLORIDA.

This district was in the charge of Lieut. Col. James B. Quinn, Corps of Engineers.

1. Savannah Harbor, Georgia.—This covers the estuary of the Savannah River from about 2 miles above the city of Savannah to the ocean bar, about 22 miles below the city. In 1873 the channel was in places not more than 9 feet deep at mean low water.

The original plan of improvement is dated February 11, 1853, and another for removal of obstructions is dated about 1871. A later plan of improvement is dated August 28, 1873, and was supplemented March 19, 1879. It contemplated the establishment of a channel from the city to the sea, practicable at high tide for vessels drawing 22 feet of water. This project was replaced by an enlarged one (January 16, 1882, Annual Report of the Chief of Engineers for 1882, Appendix J 4) contemplating the same channel depth. The amount expended under these projects up to June 30, 1890, was $1,875,061.59.

The project in force up to June 13, 1902, adopted in 1890, providing for a mean high-water depth of 26 feet from the city to the sea, is printed as part of Appendix O, Annual Report of the Chief of Engineers for 1890. The channel depth contemplated by it was reported as having been obtained at the end of the fiscal year 1896. While the project depth was literally obtained, the channel was very crooked and of much less than the project width.

A supplemental plan of improvement was submitted December 7, 1894, providing for a detached extension of the Oyster Bed training wall, for the purpose of sheltering the anchorage in Tybee Roads, as well as for protecting the ship channel over the outer part of Tybee Knoll against the destructive action of heavy storms. This project, which is printed as part of Appendix M 1 of the Annual Report of the Chief of Engineers for 1895, was authorized by act of Congress of

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June 3, 1896, its estimated cost being $992,250. The same act authorized the completion of work for improving the inside route from Savannah, Ga., to Beaufort, S. C., at an additional cost of $106,700, and dredging for maintenance in Savannah Harbor, and the sum of $1,005,000 was appropriated to complete these works.

The amount expended under the project of 1890 up to June 30, 1896, was $3,460,049.99, of which $974,504.88 was for dredging and $2,356,720.10 for contraction work. There had previously been expended $1,875,061.59, giving a total of $5,335,111.58. Betweeen June 30, 1896, and June 30, 1902, $712,918.84 was expended on the modified 26-foot project, of which $84,850.98 was for maintenance.

From the time of the reported completion of the project of 1890, in July, 1896, until June 30, 1902, extensive dredging was done, both for maintenance and as part of the modification of the project.

The present project was adopted by act of Congress approved June 13, 1902, and is printed in House Document No. 123, Fifty-sixth Congress, second session, and also in the Annual Report of the Chief of Engineers for 1901, page 1723. The project provides for the establishment of a channel from the old waterworks above Savannah to the ocean, 28 feet deep at mean high water, with bottom widths of 350 to 500 feet, to be accomplished by dredging, and the raising of all existing training walls between Savannah and Tybee Roads. It also provides for the construction of mooring dolphins at two points in the harbor, the Bight and Venus Point. The estimated cost of the work is $1,567,791. This amount was increased by $210,000 by act of Congress approved March 3, 1905.

Continuing contracts are authorized for work in this harbor, and dredging operations during the fiscal year have been carried on by this method.

The amount expended under the present project up to June 30, 1905, was $1,352,907.20, of which $96,012.90 was for maintenance.

The total amount expended for the improvement of Savannah Harbor up to June 30, 1905, was $7,400,937.62.

During the past fiscal year 1,230,886.8 cubic yards of material was dredged under two contracts. There were dredged, for maintenance, by the U. S. dredge *Cumberland*, from Tybee Knoll, 99,214 cubic yards, and from Long Island Crossing, under supplemental contract, 293,077.8 cubic yards; 1,651.46 cubic yards of stone was placed on training walls to raise them to the proper height. The U. S. dredge *Savannah* removed from Tybee Knoll and the outer bar 107,030 cubic yards of material, a coaling wharf for United States dredges was constructed at the Venus Point mooring dolphin, and a new hull was constructed for the U. S. steamer *Angler*. The *Savannah* is a new dredge built for this work, and reference is made to Appendix H 7, herewith, for details of construction.

All inside dredging provided for under the approved project has been completed, and the dredging on Tybee Knoll and across the outer bar with Government seagoing dredge is in progress. At the close of the fiscal year all training walls were in good condition and there existed a channel of the project depth of 28 feet at mean high water, with bottom widths ranging from 350 to 500 feet, from above the Ocean Steamship Company's wharves to Tybee Knoll, except at two points where shoaling has occurred and where the controlling depth is 19 feet at mean low water (25.5 feet at mean high water).

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A contract for restoring the project depth at these two points has been authorized. On Tybee Knoll the controlling depth is 20 feet at mean low water (26.7 feet at mean high water) and on the outer bar 19 feet at mean low water (26 feet at mean high water). The mean rise and fall of tide on the outer bar is 7 feet, on Tybee Knoll 6.75 feet, and from that point to the city it averages 6.5 feet.

The additional work proposed is for the extension of benefits.

The amount estimated as a profitable expenditure will be applied toward dredging on Tybee Knoll and the outer bar with Government seagoing dredges and the maintenance of existing works of improvement.

In 1872 the tonnage of vessels arriving and clearing at Savannah Harbor was somewhat more than 1,000,000, the total value of imports and exports about $34,000,000. Cotton, lumber, wool, hides, naval stores, and rice were principally dealt in. In 1890 the total tonnage was reported to have increased to about 2,000,000 and the value of imports and exports to $152,000,000. Besides the articles named above, fruit, produce, and iron were handled extensively.

For the calendar year 1904 the total tonnage was 3,230,346, valued at about $193,820,760.

The various projects of improvement will be found printed in the following documents:

Senate Executive Document No. 1, Thirty-third Congress, first session, and Annual Report of the Chief of Engineers for 1853, page 468.

Project for removal of Confederate obstructions, Annual Report of Chief of Engineers for 1872, page 653.

Project for 22 feet depth at high water, Annual Report of Chief of Engineers for 1873, page 736, and modifications in the following reports: For 1875, Part 2, page 34; for 1876, Part 1, page 437; for 1880, Part 1, page 933, and for 1882, Part 2, page 1152.

Project for 26 feet depth at high water, Annual Report of the Chief of Engineers for 1890, Part 2, page 1258, and modifications as follows: House Executive Document No. 115, Fifty-third Congress, third session; Annual Report of the Chief of Engineers for 1895, Part 2, page 1459, and for 1900, Part 3, page 1922.

Project for 28 feet depth at high water, House Executive Document No. 57, Fiftieth Congress, first session, and Annual Report of the Chief of Engineers for 1888, Part 2, page 1057; modifications in House Document No. 123, Fifty-sixth Congress, second session, and Annual Report of the Chief of Engineers for 1901, page 1719.

A detailed history of the work of improvement may be obtained by consulting Annual Report of the Chief of Engineers for 1888, Part 2, page 1013, and report for 1896, Part 2, page 1218; also report for 1903, pages 1146–1152, and report for 1904, pages 1644–1647.

Maps showing the condition of the works at various dates may be found in the following documents:

Annual Reports of the Chief of Engineers for 1880, Part 1, page 933; for 1885, Part 2, page 1202; for 1888, Part 2, page 1072; for 1891, Part 2, page 1496; for 1896, Part 2, page 1245; for 1902, Part 2, page 1178, and for 1904, page 1646, and House Executive Documents No. 57, Fiftieth Congress, first session (1888), and No. 115, Fifty-third Congress, third session (1895).

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July 1, 1904, balance unexpended		$451,038.96
Amount received from proceeds of Government property		10.00
Amount appropriated by sundry civil act approved March 23, 1905		175,000.00
Amount appropriated by river and harbor act approved March 3, 1905		75,000.00
		701,048.96
June 30, 1905, amount expended during fiscal year:		
For works of improvement	[a] $461,139.65	
For maintenance of improvement	75,863.88	
		537,003.53
July 1, 1905, balance unexpended		164,045.43
July 1, 1905, outstanding liabilities		7,343.53
July 1, 1905, balance available		156,701.90
Amount (estimated) required for completion of existing project		210,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905		210,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.		

(See Appendix O 1.)

2. Savannah River, Georgia, below Augusta.—This river is navigable from Savannah to Augusta, Ga., a distance of 202 miles. Previous to improvement there were numerous shoals in the river with less than 3 feet at summer low water, the other obstructions consisting of overhanging trees, snags, and sunken logs. The aggregate length of river upon which there was less than 5 feet was about 9,800 feet, divided up into 10 shoals, and the controlling depth was about 2½ feet.

The original project, submitted December 22, 1880, provided for a 5-foot channel, 80 feet wide, by means of removal of snags, trees, sand bars, etc., and protection of banks, at a cost of $91,000.

Under this project there was expended, prior to operations under the existing project, $93,480.09.

The existing project, adopted in 1890, provides for the establishment of a navigable steamboat channel 5 feet deep at ordinary summer low water between the cities of Augusta and Savannah, to be accomplished by removing sand and gravel bars, regulating portions of the river, revetting caving banks, closing incipient cut-offs, and removing snags and logs from the channel and overhanging trees from the banks of the stream.

The total estimated cost of this improvement, in round numbers, is $332,000, on the supposition that funds are regularly and adequately supplied, besides $3,000 to $5,000 annually for maintenance.

The amount expended upon the work under the existing project up to the close of the fiscal year ending June 30, 1905, was $365,227.67 (of which $11,774.21 was for maintenance), which, added to the amount previously expended, gives a total expenditure for this work of $458,707.76.

The work done under the present project has resulted in the removal of great numbers of snags and stumps from the river channel and the cutting of numerous overhanging trees on the banks. Sand bars have been removed by means of training dikes and shore protection at

[a] Includes $128,626.42 on account of construction of dredge.

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eleven localities, viz, Gardners bar, Kirks bar, Sand Bar Ferry, Blue House bar, Tweedys bar, Rifle Cut, Buggs bar, Twiggs bar, Flowery Gap, Brighams bar, and Half Guinea bar. A great deal of work, however, remains to be done, principally in the upper 30 miles of the river, where there are sand shoals with only 3 feet of water over them. A great many snags also require removal.

The work done for maintenance during the fiscal year resulted in the removal from the river channel of 3,595 snags and 245 stumps, the cutting of 1,382 overhanging trees and 77 logs on the banks, the girdling of 17 trees, and the removal of 1 clay bank.

The controlling depth on June 30, 1905, was 3 feet at ordinary summer low water. The river very rarely goes below this, and rises more than 30 feet in time of floods, frequently standing for long periods at several feet above summer low water.

In the upper 30 miles of the river the banks in many places cave more or less with every high freshet, and the problem of obtaining and maintaining the project depth is easily solved if the erosion of the banks can be stopped. The necessary training dikes for the contraction of the river at the wide reaches are, with two or three exceptions, constructed, and the shore protections recently built are, as far as they go, efficient in preventing the erosion of the banks. These shore protections do not have to be constructed to the top of the slope, but just high enough to prevent the undermining of the banks at an ordinary stage, so that at a high stage of water the falling in of the crest of the steep banks is prevented. The improvements are at present just at that stage where it is necessary to continue the work of revetting the banks and keeping in repair the numerous dikes. Quite a large number of snags in the river and overhanging trees on the banks require removal.

The district officer reports that it has not been possible to complete all the work embraced in the project of 1890, and believes that certain work should be done at an early date to secure the results contemplated in the project. There has been prepared an estimate of cost of the work remaining to be done.

The additional work proposed is for extension of benefits.

Prior to the improvement the commerce was small, but its quantity unknown. At times since, previous to the construction of railroads, it has probably been greater than it is now, as since the advent of railroads the river has never been in a good navigable condition until recently. The commodities carried consist principally of cotton, naval stores, fertilizers, and general merchandise. Excluding timber, the tonnage for the year 1904 amounted to 61,353 tons, valued at $6,154,521, besides 107,000 bushels of rice, valued at $82,600, received at Savannah in small boats. There was also rafted down the river during 1904, 28,430,400 feet B. M. of timber, valued at about $330,110.

The various projects of improvement will be found printed in the following documents:

Original project, Annual Report of the Chief of Engineers for 1881, Part 2, page 1088, and House Executive Document No. 23, Forty-sixth Congress, third session. Modifications of original project, Annual Report of the Chief of Engineers for 1886, Part 2, page 1098, and for 1887, Part 2, page 1166. Present project, Annual Report of the Chief of Engineers for 1890, Part 2, page 1324, and House Executive Document No. 255, Fifty-first Congress, second session.

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A detailed history of the work of improvement may be obtained by consulting Annual Reports of the Chief of Engineers as follows:

Report of 1888, Part 2, page 1029; for 1890, Part 2, page 1324, and for 1899, Part 2, page 1569.

Maps showing the condition of the work at various dates may be found in the following documents:

House Executive Document No. 23, Forty-sixth Congress, third session; Annual Reports of the Chief of Engineers for 1883, Part 1, page 908; for 1884, Part 2, page 1106; for 1885, Part 2, page 1210; for 1886, Part 2, page 1094, and for 1902, Part 2, page 1185, and in House Executive Document No. 255, Fifty-first Congress, second session.

July 1, 1904, balance unexpended	$6,616.45
Amount appropriated by river and harbor act approved March 3, 1905	13,000.00
Amount allotted from appropriation for maintenance of river and harbor improvements, act of April 28, 1904	5,000.00
Amount received from proceeds of sale of Government property	15.00
	24,631.45
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	11,774.21
July 1, 1905, balance unexpended	12,857.24
July 1, 1905, outstanding liabilities	51.00
July 1, 1905, balance available	12,806.24
July 1, 1905, amount covered by uncompleted contracts	6,220.00

(See Appendix O 2.)

3. Savannah River, above Augusta, Ga.—This portion of the Savannah River is navigable only by pole boats from the locks, 7 miles above the city of Augusta, to Petersburg, a distance of 48 miles. In its original condition the river at low water was navigable only with great difficulty, on account of shallow water, obstructing logs, etc.

The original project of improvement, submitted February 8, 1879, provided for a 3-foot channel, 30 feet wide, from Augusta, Ga., to Trotters shoals, and the removal of snags, trees, etc., to the Tugaloo River, at a cost of $45,000.

Under this project there was expended, prior to operations under the existing project, $39,000.

The existing plan of improvement, adopted by Congress July 13, 1892, provides for the establishment, between Petersburg and the locks, of a downstream channel 12 to 25 feet in width and navigable during ordinary summer low water for pole boats drawing 2 feet and of an upstream channel navigable for pole boats drawing 1.3 feet of water. This is to be obtained by removing logs and overhanging trees; excavating rock, sand, or gravel, and with excavated materials raising crests of ledges; constructing training walls to increase flow of water through sluices. The total estimated cost is $33,000.

The total amount expended under the present project up to June 30, 1905, was $19,935.55, which, added to that previously expended, gives a total for this work of $58,935.55. No funds have been expended for maintenance.

The work accomplished under this project has given a downstream channel about 2 feet deep and an upstream channel of the project

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depth. In many places, however, these channels are difficult to navigate and are capable of greater improvement. The additional work proposed is for extension of benefits.

In 1876–77 about 2,000 tons of freight went upstream from Augusta and about 12,000 bales of cotton came down. In 1888 the downgoing freight was estimated at about 5,000 bales of cotton, and in 1904 the total freight carried on the river, excluding timber, amounted to 1,094 tons, valued at $119,802.41.

The various projects of improvement will be found printed in the following documents: Original project, Annual Report of the Chief of Engineers for 1879, Part 1, page 747; present project, Annual Report of the Chief of Engineers for 1890, Part 2, page 1366, and House Executive Document No. 213, Fifty-first Congress, first session.

A detailed history of the work of improvement may be obtained by consulting the Annual Reports of the Chief of Engineers for 1888, Part 2, page 1032, and for 1900, Part 3, page 1930.

Maps may be found in the following documents: Annual Report of the Chief of Engineers for 1886, Part 2, page 1094, and House Executive Document No. 213, Fifty-first Congress, first session.

July 1, 1904, balance unexpended	$64.45
Amount appropriated by river and harbor act approved March 3, 1905	2,000.00
July 1, 1905, balance unexpended	2,064.45
Amount (estimated) required for completion of existing project	11,000.00

(See Appendix O 3.)

4. Harbor at Darien, and Doboy bar, Georgia.—(a) Darien Harbor.—In its original condition this harbor was obstructed at seven points by shoals with mean low-water depths of from 6½ to 10½ feet. Between the shoals there was nowhere less than 12 feet at mean low water.

There was expended on this harbor in 1879 for dredging $8,000, without any project having been recommended or adopted.

The project for the improvement of this harbor adopted in 1885 contemplates the establishment of a navigable channel 12 feet deep at mean low water between Darien and Doboy, at an estimated cost of $170,000. Work was not begun under this project until 1891. The total amount expended under it up to June 30, 1905, was $145,674.38 (of which $20,572.75 was for maintenance), which, added to the amount previously expended, gives a total for this work of $153,674.38.

At the close of the fiscal year the approved project was practically completed, there remaining only about 5,000 cubic yards of material to be removed to give a channel 12 feet deep at mean low water from Darien to Doboy bar, a distance of 13 miles. During the fiscal year work for maintenance resulted in the removal of 58,504.3 cubic yards of material and the raising to high-water mark of 2,340 linear feet of spur dams.

The additional work proposed is for extension of benefits.

The total tonnage for 1878 was estimated at about 200,000, and the value of exports at between $600,000 and $700,000. In 1904 the total annual trade, consisting almost entirely of timber, was 121,224 tons, valued at $917,240.

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By act of Congress approved June 13, 1902, this work was consolidated with Doboy bar, Georgia, and $30,000 appropriated for their improvement, of which amount there was allotted, for Darien Harbor, on November 7, 1902, $6,000 for repairing spur dams and $18,000 for dredging, in addition to an unexpended balance of $10.46. This work was reimbursed by the appropriation for improving Cumberland Sound, Georgia and Florida, to the amount of $1,500 for materials transferred. There was also allotted for this work on November 23, 1904, from the balance of the consolidated appropriation on hand, $26,865.96 for dredging and repairs to spur dams.

The present project will be found in the Annual Report of the Chief of Engineers for 1885, Part 2, page 1238.

A detailed history of the work of improvement may be obtained by consulting the Annual Reports of the Chief of Engineers for 1895, Part 2, page 1473, and for 1896, Part 2, page 1253.

A map showing the jetties constructed will be found in the Annual Report of the Chief of Engineers for 1895, Part 2, page 1477.

(*b*) *Doboy bar.*—In 1888 $5,795.40 was spent in harrowing and water-jet work on this bar without result. In its original condition there was about 12 feet at mean low water in the old channel, which was very crooked, so that the entrance was not much used.

The project for its improvement, adopted by act of Congress of March 3, 1899, provides for creating a channel by dredging 24 feet deep at mean high water and 300 feet wide, estimated to cost $70,000. The proposed channel is some distance north of the old channel.

The amount expended under the project up to June 30, 1905, was $21,177.59, which, added to the amount previously expended, gives a total expenditure for this work of $26,972.99. No funds have been expended for maintenance.

By act of Congress approved June 13, 1902, this work was consolidated with Darien Harbor.

An allotment of $2,000 was made on December 23, 1903, from the appropriation of $30,000 made by act of Congress approved June 13, 1902, for the purpose of making a complete survey of Doboy bar, to determine the best route for a channel across the bar. On November 23, 1904, an additional allotment of $28,000 was made from the balance of the consolidated appropriation on hand for dredging a channel across the bar.

The latest reports indicate that the controlling depth on the bar in the present ship channel is 10 feet at mean low water. The tide rises 7.3 feet. The improvement of a channel to the north of the present channel was begun in 1899, and 120,000 cubic yards of material removed. The contractor abandoned the work December 16, 1900. A survey of the bar was made during the past fiscal year, and bids for dredging were called for. These were so excessive, however, that they were rejected, and it has been determined to dredge the projected channel with a Government seagoing dredge.

The additional work proposed is necessary to make the improvement available.

The commerce interested in this bar consists of lumber from the Altamaha River, the bulk of which is now shipped from Sapelo Sound and St. Simon Sound, north and south, respectively, of Doboy bar. During the calendar year 1904 it is estimated that about 15,000,000 feet B. M. of lumber, valued at $150,000, crossed the bar.

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The projects of improvement will be found printed in the following documents:

Original project, Annual Report of the Chief of Engineers for 1887, Part 2, page 1179. Present project, Annual Report of the Chief of Engineers for 1897, Part 2, page 1539, and House Document No. 13, Fifty-fifth Congress, first session.

A detailed history of the work of improvement may be obtained by consulting the Annual Reports of the Chief of Engineers, as follows:

Report for 1887, Part 2, pages 1179 and 1199; for 1888, Part 2, page 1041; for 1899, Part 2, page 1573, and for 1901, Part 2, page 1639.

Maps may be found in the following documents:

Annual Report of the Chief of Engineers for 1888, Part 2, page 1042; House Document No. 13, Fifty-fifth Congress, first session, and Annual Report of the Chief of Engineers for 1899, Part 2, page 1573.

July 1, 1904, balance unexpended		$62,825.90
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$9,605.12	
For maintenance of improvement	13,572.75	
		23,177.87
July 1, 1905, balance unexpended		39,648.03
July 1, 1905, outstanding liabilities		4,397.83
July 1, 1905, balance available		35,250.20
July 1, 1905, amount covered by uncompleted contracts		653.80

(See Appendix O 4.)

5. Altamaha River, Georgia.—This river is formed by the junction of the Oconee and Ocmulgee rivers. At a point some 25 miles from its mouth the river branches and the river traffic reaches the ocean by two routes—one by the north branch by way of Darien and the other by the south branch to where it intercepts the inside waterway, which passage is taken to Brunswick.

The river is navigable from the forks to Darien, a distance of 131 miles, and to where it reaches the inside waterway. The lower section of the river is affected by the tides. The worst shoal is at Coupers bar, which at low water has only a foot of water, but by waiting on tides 5 feet can be had at this place. The controlling depth above the tidal range is about 2 feet at summer low water. The river is subject to freshets, and in the upper sections the freshet height at times goes 20 feet above the low summer stage. The lower section is bordered by low swamp lands and the freshets rise from 5 to 10 feet over the banks.

Before improvement the Altamaha River was obstructed by rock ledges, sand bars, snags, sunken logs, and overhanging trees. The low-water depths at some points did not exceed 1 foot.

The original project of improvement, submitted in 1875, contemplated a channel 4 feet deep and 80 feet wide from Macon to Darien, by the removal of sand bars, rock shoals, snags, overhanging trees, etc., at a cost of $162,000.

Under it and its modifications there was expended up to June 30, 1890, $69,776.59.

The existing project of improvement, adopted by Congress in 1890, provides for the establishment of a channel 3 feet deep at summer low water throughout the river above Darien. This is to be accomplished

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by removing rock shoals and sand bars, building deflecting dikes and closing incipient cut-offs, removing snags and sunken logs from the channel and overhanging trees from the banks of the stream, and revetting caving banks. The total estimated cost of the improvement is $129,000, provided funds are regularly and adequately supplied, besides from $3,000 to $5,000 for annual maintenance.

The amount expended on the work under the present project up to June 30, 1905, was $74,362.76 (of which $9,000 was for maintenance), which, added to the amount previously expended, gives a total expenditure for this work of $144,139.35.

This expenditure has resulted in the removal of one rock shoal, three sand bars, numerous snags, sunken logs, and overhanging trees. The greatest draft that can at present be carried at summer low water is about 2 feet by waiting for the tide at Coupers bar.

The additional work proposed is for the extension of benefits.

The commerce of the river before the improvement was begun was reported to have amounted to about 100,000 tons annually, valued at about $1,000,000. During the calendar year 1904 it is estimated to have amounted to about 4,500 tons, valued at about $200,000. There was also rafted down the river 109,255,356 feet B. M. of timber, valued at $1,348,986.

The various projects of improvement will be found printed in the following documents:

Original project, Annual Report of the Chief of Engineers for 1875, Part 2, page 670; modifications of original project, Annual Report of the Chief of Engineers for 1881, Part 2, page 1107, and for 1887, Part 2, page 1176; present project, Annual Report of the Chief of Engineers for 1890, Part 2, page 1372, and House Executive Document No. 283, Fifty-first Congress, second session.

A detailed history of the work of improvement may be obtained by consulting the Annual Reports of the Chief of Engineers, as follows: For 1888, Part 2, page 1038; for 1889, Part 2, page 1246; for 1892, Part 2, page 1261; for 1900, Part 3, page 1939.

Maps may be found in the following documents: Annual Report of the Chief of Engineers for 1884, Part 2, page 1116, and House Executive Document No. 283, Fifty-first Congress, second session.

July 1, 1904, balance unexpended	$2,831.87
Amount appropriated by river and harbor act approved March 3, 1905	10,000.00
	12,831.87
June 30, 1905, amount expended during fiscal year, for works of improvement	1,971.22
July 1, 1905, balance unexpended	10,860.65
July 1, 1905, outstanding liabilities	2,101.23
July 1, 1905, balance available	8,759.42
Amount (estimated) required for completion of existing project	104,000.00

(See Appendix O 5.)

6. Oconee River, Georgia.—The head of navigation on this river is Milledgeville, Ga., 147 miles from the mouth, though this point can only be reached during high stages of the river. At ordinary stages the river is at present only navigable to a point about 25 miles above Dublin, Ga., a distance of 104 miles from its mouth. In its

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original condition this river was used principally for navigation at high stages. At low water there were numerous shoals and snags, there probably being less than 2 feet on many sand bars and rock ledges.

The original project was submitted January 29, 1875, and provided for the removal of snags, overhanging trees, etc., cutting off points, and making cut-offs, at a cost of $10,150.

Under this project and its modifications there was expended, previous to the commencement of operations under the existing project, the sum of $44,822.18.

The existing project of improvement was adopted by Congress September 19, 1890. It provides for the establishment of a navigable channel 3 feet deep at ordinary summer low water from Milledgeville to the mouth. This is to be accomplished by removing rock shoals and sand bars, revetting caving banks, and closing incipient cut-offs, removing snags and logs from the channel and overhanging trees from the banks of the stream. The cost of the improvement is estimated at $171,000, besides from $3,000 to $5,000 for annual maintenance. The river and harbor act of March 3, 1905, authorizes the expenditure of $3,000 of the amount appropriated to be applied to cleaning out the river from the Georgia Railroad bridge to the northern boundary of Greene County, Ga.

The amount expended under the present project up to June 30, 1905, was $108,985.82 (of which $3,750 was for maintenance), which added to the amount previously expended, gives a total expenditure for this work of $153,808.

As the result of this expenditure, numerous snags and logs, bowlders, and overhanging trees have been removed, several cut-offs opened and others closed, and three training dikes built. The controlling depth at ordinary summer low water is 2½ feet between the Forks and a point 25 miles above Dublin and 1.5 feet between that point and Milledgeville. The river occasionally falls below this stage and frequently rises to 20 feet above it.

The additional work proposed is necessary to make the improvement available between Dublin and Milledgeville, and for extension of benefits between Dublin and the Forks.

No reliable statistics of the commerce of the river before the improvement was begun are available. In 1904 the amount of freight carried on the river amounted to 32,160 tons, valued at $443,225. Besides this, 60,237,440 feet B. M. of timber, valued at about $737,000, was rafted down the river.

The various projects of improvement will be found in the following documents: Original project, Annual Report of the Chief of Engineers for 1875, Part 2, page 41; present project, Annual Report of the Chief of Engineers for 1890, Part 2, page 1432, and House Executive Document No. 211, Fifty-first Congress, first session.

A detailed history of the work of improvement may be obtained by consulting Annual Reports of the Chief of Engineers for 1889, Part 2, page 1253, and for 1900, Part 2, page 1942.

Maps of the river will be found in House Executive Document No. 211, Fifty-first Congress, first session.

A report upon a preliminary examination of the river between Dublin and Skull shoals will be found printed in House Document

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No. 304, Fifty-eighth Congress, second session, and also on pages 1677–1679, Annual Report of the Chief of Engineers for 1904.

July 1, 1904, balance unexpended	$4,303.49
Amount appropriated by river and harbor act approved March 3, 1905	15,000.00
Amount received from proceeds of sale of Government property	15.00
	19,318.49
June 30, 1905, amount expended during fiscal year, for works of improvement	4,318.49
July 1, 1905, balance unexpended	15,000.00
July 1, 1905, outstanding liabilities	338.14
July 1, 1905, balance available	14,661.86
Amount (estimated) required for completion of existing project	111,842.00

(See Appendix O 6.)

7. Ocmulgee River, Georgia.—In its original condition this river was used for navigation chiefly at high stages. At low water there were numerous shoals and snags, there probably being less than 2 feet on many sand bars and rock ledges.

The head of navigation on this river is Macon, a distance of 202 miles, but the river during recent years has not been navigable above Hawkinsville, 133 miles from the mouth, except at high water, owing to heavy rock shoals just above Hawkinsville and long sand shoals below Macon. Between these two obstructions the river is also more or less obstructed with snags and logs. Between Hawkinsville and the Forks the river is, with few exceptions, in good condition, and while certain rock shoals are difficult to navigate, the controlling depth is nearly, if not quite, the project depth. The controlling depth between Hawkinsville and Macon is about 2 feet at ordinary summer low water.

The original project was submitted in 1875, and provided for a channel 80 feet wide and 4 feet deep at low water, to be accomplished by the removal of sand bars, rock shoals, snags, overhanging trees, etc., from Macon to Darien, at a cost of $162,000.

The amount expended under this project and its modifications prior to operations under the existing project was $79,390.73.

The existing project of improvement, adopted by Congress September 19, 1890, provides for the establishment of a navigable channel 3 feet deep at ordinary summer low water from Macon to the river's mouth. This is to be obtained by removing rock shoals and sand bars, closing incipient cut-offs, revetting caving banks, and removing snags and logs from the channel and overhanging trees from the banks of the stream.

The cost of the improvement as given in the project of 1890 is estimated at $210,000, provided funds are regularly and adequately provided, besides from $3,000 to $5,000 for annual maintenance.

Work was authorized to be done under continuing contracts.

The amount expended under the present project up to June 30, 1905, was $229,689.67 (of which $7,396.40 was for maintenance), which, added to the amount previously expended, gives a total of $309,080.40.

The work under the present project has resulted in marked improvement. Below Hawkinsville the project depth of 3 feet at ordinary summer low water has been obtained throughout the river.

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However, several rock and sand shoals give more or less trouble and require removal. Buttermilk shoal, Colliers Bluff shoal, Tar yard shoal, and Town shoal, a series of rock shoals above Hawkinsville, have been removed. At a series of sand bars just below Macon training dikes have been constructed and have resulted in rendering this portion of the river available for light-draft boats at ordinary low summer stages. These dikes have been damaged considerably by freshets, however, and are in need of repairs.

There are two rock shoals and several sand bars yet to be removed. The work near Macon has been only partially successful, as frequent freshets erode the banks and new shoals form at unexpected places.

The district officer reports that it has not been possible to complete all the work embraced in the project of 1890, and believes that certain work should be done at an early date to secure the results contemplated in the project. There has been prepared an estimate of cost of the work remaining to be done.

The additional work proposed is necessary to make the improvement available between Hawkinsville and Macon and for extension of benefits between Hawkinsville and the mouth of the river.

The work done for maintenance during the past fiscal year resulted in the removal of 669 snags, 7 logs, and 42 stumps, the cutting of 24 overhanging trees on the banks, and the removal of a portion of an old dam which obstructed navigation.

No reliable statistics of the commerce of the river before improvement was begun are available. In 1904 the amount of freight carried on the river amounted to 7,497 tons, valued at about $248,430. Besides this, 23,513,969 feet B. M. of timber, valued at about $261,123. was rafted down the river.

The various projects of improvement will be found printed in the following documents:

Original project: Annual Report of Chief of Engineers for 1875, Part 2, page 670.

Modifications of original project: Annual Reports of the Chief of Engineers for 1882, Part 2, page 1859; for 1885, Part 2, page 1297; for 1886, Part 2, page 1160, and for 1887, Part 2, page 1276.

Present project: Annual Report of the Chief of Engineers for 1890, Part 2, page 1458, and House Executive Document No. 215, Fifty-first Congress, first session.

A detailed history of the work of improvement may be obtained by consulting the Annual Reports of the Chief of Engineers for 1889, Part 2, page 1258, and for 1900, Part 2, page 1944.

Maps of the river will be found in House Executive Document No. 215, Fifty-first Congress, first session, and in Annual Report of the Chief of Engineers for 1902, Part 2, page 1192.

July 1, 1904, balance unexpended	$3,985.00
Amount appropriated by river and harbor act approved March 3, 1905	15,000.00
	18,985.00
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	2,396.40
July 1, 1905, balance unexpended	16,588.60
July 1, 1905, outstanding liabilities	802.90
July 1, 1905, balance available	15,785.70

(See Appendix O 7.)

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8. Brunswick Harbor, Georgia.—Previous to June 13, 1902, the projects under this title were for the inner harbor only, consisting principally of the removal of a shoal in East River, opposite the lower part of the city. The distance from the city of Brunswick to deep water beyond the bar is 13 miles.

The original project of improvement, dated April 29, 1876, provided for the construction of a jetty at the city front and dredging, at a total cost of $69,000.

Under this project and its modifications there was expended, prior to operations under the existing project, the sum of $190,000.

The project in force up to June 13, 1902, was adopted by Congress in 1894. It provided for the maintenance of a navigable channel 15 feet deep at mean low water by keeping the existing works in repair and by dredging. The act of June 3, 1896, provided for the improvement of Academy Creek. The cost of maintaining a channel depth of 15 feet at mean low water was estimated at $15,000 per annum.

There has been expended under this project up to June 30, 1902, $34,817.25, all of which has been for maintenance.

Including $10,000 spent in 1836 for dredging, the total amount expended up to June 30, 1902, on the inner harbor was $234,817.25.

The present project was adopted by act of Congress approved June 13, 1902, and provides for a navigable channel 21 feet deep at mean low water in Brunswick inner harbor, at a cost of $120,000, and for a channel across the outer bar 19.3 feet deep at mean low water (26 feet at mean high water), at a cost of $40,000. It also provides for dredging in Academy Creek at not to exceed $5,000.

The river and harbor act of March 3, 1905, authorizes the expenditure, from the the amount therein appropriated, of $5,000, or so much thereof as may be necessary, for maintaining in Academy Creek, immediately in front of and adjacent to the wharves thereof, to the Old Altamaha Canal, a depth equal to the controlling depth on the shoals at the lower end of the city in East River, provided that no money shall be expended inside harbor lines heretofore or hereafter established in said creek.

The act of 1905 also directed a survey to be made of Brunswick Harbor, with a view to securing a depth on the outer bar equal to the controlling depth in the inner harbor, and maintaining the depths over said bar and in said harbor. In addition to this survey, a preliminary examination of the inner and outer harbor was also authorized.

The amount expended under the present project to June 30, 1905, was $166,073.62, of which $8,044.15 was for maintenance. This, added to the amount previously expended, gives a total expenditure for the work of $400,890.87.

During the past fiscal year dredging on the outer bar was carried on with the U. S. dredge *Cumberland* for a period of nearly six months, and resulted in the removal of 393,482 cubic yards of material. On June 30, 1905, there remained only about ten days' work with the dredge to complete the project. The new channel dredged across the outer bar has a controlling depth of 20 feet at mean low water. The tide rises 6.7 feet. No work has yet been done on the inner shoal. This is to be done by United States seagoing dredge, and will be undertaken during the coming year. There were dredged from the inner harbor during the fiscal year 126,901.3 cubic yards

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of material. The present controlling depth in the inner harbor is 20 feet at mean low water, and in Academy Creek 16 feet at mean low water. The rise of tide is 7.5 feet.

The project depth of 21 feet at mean low water in the inner harbor was obtained in September, 1904, since which date the channel has shoaled about 1 foot at two or three places. This shoaling covers a very small area, however, and does not extend across the channel.

The controlling depth on June 30, 1905, between the city and deep water beyond the bar was 18 feet at mean low water on the inner shoal in St. Simon Sound, where the tide rises 6.7 feet.

The additional work proposed is for extension of benefits.

Before the improvement in 1880 the annual tonnage of the port of Brunswick was about 100,000, consisting chiefly of lumber, naval stores, wood, rice, and merchandise, valued at about $1,700,000. In 1904 the total tonnage of the port amounted to 1,417,157 tons, valued at $29,939,416.

The various projects of improvement will be found printed in the following documents:

First plan: Annual Report of the Chief of Engineers for 1876, Part 1, page 489. First project: Annual Report of the Chief of Engineers for 1880, Part 1, page 962. First revision of project: Annual Report of the Chief of Engineers for 1886, Part 2, page 1113, and for 1887, Part 2, page 1184. Second revision of project: Annual Report of the Chief of Engineers for 1895, Part 2, page 1494. Third revision of project: House Document No. 40, Fifty-sixth Congress, first session. Project for bar: Annual Report of the Chief of Engineers for 1892, Part 2, page 1327, and House Executive Document No. 34, Fifty-second Congress, first session. Revised project for bar: House Document No. 179, Fifty-sixth Congress, second session; House Document No. 355, Fifty-sixth Congress, second session, and Annual Report of the Chief of Engineers for 1901, Part 2, page 1663.

A detailed history of the work of improvement may be obtained by consulting the Annual Reports of the Chief of Engineers for 1888, Part 2, page 1047; for 1889, Part 2, page 1258; for 1890, Part 2, page 1407.

Maps showing the condition of the work at various dates may be found by consulting the following documents: Annual Reports of the Chief of Engineers for 1880, Part 1, page 962; for 1881, Part 2, page 1116; for 1883, Part 1, page 922; for 1885, Part 2, page 1228; for 1886, Part 2, page 1116; for 1887, Part 2, page 1196; for 1889, Part 2, page 1266; for 1892, Atlas, page 58, and for 1893, Part 2, page 1583; and House Executive Document No. 34, Fifty-second Congress, first session, and House Documents Nos. 40, Fifty-sixth Congress, first session, and 355, Fifty-sixth Congress, first session.

July 1, 1904, balance unexpended	$70,430.98
Amount appropriated by river and harbor act approved March 3, 1905	40,000.00
	110,430.98
June 30, 1905, amount expended during fiscal year, for works of improvement	71,321.85
July 1, 1905, balance unexpended	39,109.13
July 1, 1905, outstanding liabilities	5,506.09
July 1, 1905, balance available	33,603.04

(See Appendix O 8.)

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9. Inside water route between Savannah, Ga., and Fernandina, Fla.—This route consists of a series of bays and tidal sloughs, making a connecting waterway not exposed to rough water except at a few points in stormy weather. The waters forming the route are shown on Coast Survey charts Nos. 156 and 157. It is navigable from Savannah, Ga., to Fernandina, Fla., Brunswick, Ga., and Darien, Ga. The distance from Savannah to Fernandina is 160 miles. Touching at Darien en route increases this by about 20 miles and at Brunswick by about 12 miles.

The project of improvement was adopted in 1892 and provides for the establishment of a channel 7 feet deep at mean low water. This is to be accomplished by the improvement of Romerly Marsh, Mud River, Little Mud River, and Jekyl Creek. The estimated cost of the improvement is $105,000, provided the entire sum be made available at one time.

The total amount expended under this project up to June 30, 1905, was $63,719.60 (of which $19,857.22 was for maintenance), which, added to the amount expended for Jekyl Creek and Romerly Marsh, $71,108.77, makes a total of $134,828.37.

The total of the original estimate for the improvement of this route has been appropriated but the improvement is still uncompleted. The reasons for this are set forth in the accompanying report of the district officer, with estimate of cost of the work remaining to be done. He also states that the present project should be modified so as to provide for a channel 10 feet deep at mean low water, and that an estimate of the cost of doing this can be readily furnished if called for.

At present the controlling depth is 4.5 feet at mean low water in Mud River, at the southern end of the route. The mean rise and fall of tide over the route varies from 6.5 to 8 feet.

The additional work proposed is for the extension of benefits.

The value of the commerce passing through this route was estimated in 1890 at between $200,000 and $400,000 per annum. For 1904 it amounted to about 59,983 tons of freight, valued at about $1,183,754, and about 73,300,000 feet B. M. of timber, valued at $849,600. None of this commerce passed over the whole extent of the route.

The present project will be found in the Annual Report of the Chief of Engineers for 1892, Part 2, page 1309, and House Executive Document No. 41, Fifty-second Congress, first session.

A detailed history of the work of improvement will be obtained by consulting the Annual Reports of the Chief of Engineers, as follows: Report for 1892, Part 2, page 1309; for 1893, Part 2, page 1206, and for 1901, Part 2, page 1653.

A map of the route will be found in House Executive Document No. 41, Fifty-second Congress, first session.

A report upon a preliminary examination of Frederica River, Georgia, which forms a part of this route, will be found printed in House Document No. 220, Fifty-eighth Congress, second session, and in the Annual Report of the Chief of Engineers for 1904, pages 1674–1676.

A report upon the preliminary examination and survey of Club and Plantation creeks, Georgia, with a view to providing an inside route from the Altamaha River to Brunswick, Ga., will be found printed in House Document No. 159, Fifty-eighth Congress, second session, and

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in Annual Report of the Chief of Engineers for 1904, pages 1669–1674.

July 1, 1904, balance unexpended	$2,648.30
Amount appropriated by river and harbor act approved March 3, 1905	41,000.00
	43,648.30
June 30, 1905, amount expended during fiscal year, for works of improvement	2,367.90
July 1, 1905, balance unexpended	41,280.40
July 1, 1905, outstanding liabilities	466.93
July 1, 1905, balance available	40,813.47

(See Appendix O 9.)

10. Skidaway Narrows, Georgia.—The Narrows is a narrow, tortuous water course, and when improved will constitute an alternative or additional route for a portion of the inside waterway between Savannah, Ga., and Fernandina, Fla. In its present condition it is navigable only at high water for small sail boats and pleasure launches.

The approved project of improvement was adopted by the river and harbor act of March 3, 1905, and will be found printed in the Annual Report of the Chief of Engineers for 1904, pages 1680–1684. This project contemplates the establishment of a navigable channel 6 feet deep at mean low water and 75 feet wide at bottom, connecting Burnside River with Isle of Hope, or Skidaway, River, the route of such channel to be through the marsh and hammock land to the west of the Narrows. Subsequent developments made it necessary to abandon this route—principally on account of the difficulty in obtaining the desired right of way through private property. A new route, following practically the course of the Narrows, has been adopted. The estimated cost of the improvement by the new route is $55,000. No work has yet been done.

The amount expended up to June 30, 1905, was $5.50.

Amount appropriated by river and harbor act approved March 3, 1905	$20,000.00
June 30, 1905, amount expended during fiscal year, for works of improvement	5.50
July 1, 1905, balance unexpended	19,994.50
Amount (estimated) required for completion of existing project	35,000.00

(See Appendix O 10.)

11. Cumberland Sound, Georgia and Florida.—In its original condition the available depth at the entrance varied from 11 to 12.5 feet at mean low water. The point of crossing the bar was subject to very great changes in location, moving in a series of years as much as 1½ miles. The distance from the outer bar to the city of Fernandina, Fla., is about 6½ miles.

The project of improvement submitted in 1879 and revised by a Board of Engineers in 1891 provides for the construction of two low jetties from the shores on opposite sides of the entrance and extending seaward across the bar upon lines so directed that the ends will be parallel to each other and about 3,900 feet apart. These jetties were intended to establish a low-water channel across the bar not less than

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19 feet in depth. The cost of the improvement was originally estimated at $2,071,023, and as modified at $1,606,500, for the completion of low jetties, and at $2,079,500 if high jetties were found necessary. There was expended under this project $932,500.

The present project, which was adopted by act of Congress of June 3, 1896, provides for the establishment of a channel across the bar 19 feet deep at mean low water by the construction of two jetties of stone, resting on a foundation of brush mattresses, on the same lines as those in the previous project, the scour between the jetties to be aided by dredging, if necessary, the total cost of the improvement, at the time of this project, to be $2,350,000, exclusive of amounts previously appropriated.

The amount expended under this project up to June 30, 1905, was $2,241,572.07 (of which $137,743.54 was for maintenance), which, added to the amount previously expended, gives a total expenditure for this work of $3,174,072.07.

For maintenance of the dike on Cumberland Island there were placed during the fiscal year 13,286 cubic yards of brush fascines, 2,681 cubic yards of stone, 63,000 feet B. M. of lumber sheathing, 50 sand bags, and 80 cubic yards of oyster shells, and for maintenance of the inner end of the north jetty, 10 cubic yards of brush and 25 cubic yards of stone were placed.

The seagoing dredge *Cumberland* removed 59,412 cubic yards of material between October 22 and November 9, 1904, for maintenance of the jetty channel.

At the close of the fiscal year the project for this improvement was completed, so far as depth is concerned, the controlling depth being 22.5 feet at mean low water, an excess over the project depth of 3½ feet. The rise of tide is 6 feet. The channel between the jetties, however, required widening and straightening at one point. This work will be begun by the dredge *Cumberland* in July.

The north jetty is in good condition for its entire length, with the exception of some slight settlement at two or three places.

A wide gap exists in the shore end of the south jetty, and this jetty needs to be extended farther inshore. Other portions require raising.

A contract for repairing the two jetties has been made.

The north jetty channel is narrowing and shoaling at the inner end. A deep wide channel is rapidly forming along the south jetty, with a minimum depth of 24 feet at mean low water and a least width of 400 feet, which channel extends about 3,300 feet beyond the outer end of the jetty. Beyond this point to deep water there is a small shoal with a controlling depth of from 13 to 14 feet at mean low water. Between the 24-foot curve inside and the 24-foot curve outside the distance is about 1,200 feet. Two years ago there was a least depth of 9 feet on this line.

The breach on Cumberland Island is practically closed, and conditions there are very much improved.

The additional work proposed is for the extension of benefits.

Before improvement (in 1879) the annual in and out bound tonnage at Fernandina was about 300,000, and the value of imports and exports about $2,500,000, lumber, naval stores, and cotton being the principal articles. In 1904 the total tonnage of the port amounted to 754,982 tons, valued at $10,715,805.

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The project for this improvement will be found in the Annual Report of the Chief of Engineers for 1879, page 792, and the modifications in the Annual Report of the Chief of Engineers for 1891, Part 2, page 1566, and report for 1896, Part 2, page 1289.

A detailed history of the work of improvement may be obtained by consulting the following documents:

Annual Reports of Chief of Engineers for 1876, Part 1, page 459; for 1878, Part 1, page 580; for 1883, Part 1, page 934; for 1885, Part 2, page 1232; for 1888, Part 2, page 1054; for 1893, Part 2, page 1599; and for 1897, Part 2, page 1533; and Senate Executive Document No. 19, Fifty-second Congress, second session, and Senate Document No. 163, Fifty-fifth Congress, first session.

Maps showing the condition of the work at various dates may be found in the following documents:

Annual Reports of the Chief of Engineers for 1876, Part 1, page 482; for 1888, Part 2, page 1052; for 1889, Part 2, page 1276; for 1891, Part 2, page 1561; for 1892, Atlas, page 60; for 1893, Part 2, page 1596; for 1898, Part 2, page 1326; for 1899, Part 2, page 1597; for 1902, Part 2, page 1198, and in Senate Document No. 163, Fifty-fifth Congress, first session.

July 1, 1904, balance unexpended	$106,171.47
Amount deposited on account of dredge construction	3,941.80
Amount appropriated by river and harbor act approved March 3, 1905	30,000.00
Amount appropriated by sundry civil act approved March 3, 1905	40,000.00
	180,113.27
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	37,743.54
July 1, 1905, balance unexpended	142,369.73
July 1, 1905, outstanding liabilities	4,394.92
July 1, 1905, balance available	137,974.81
July 1, 1905, amount covered by uncompleted contracts	65,000.00

(See Appendix O 11.)

12. Removing sunken vessels or craft obstructing or endangering navigation.—The removal of the wrecks of the *City of Austin*, *Franconia*, and *Puntalunos* in Cumberland Sound, Georgia and Florida, begun during the last fiscal year, was completed. This work was done under emergency contract of August 8, 1903, at a total cost of $7,213.85. The balance remaining from the allotment of $9,570, viz, $2,356.15, was returned to the Treasurer of the United States.

The amount expended during the fiscal year, exclusive of amount returned to the Treasurer of the United States, was $5,934.

(See Appendix O 12.)

IMPROVEMENT OF CERTAIN RIVERS AND HARBORS IN FLORIDA.

This district was in the charge of Maj. Francis R. Shunk, Corps of Engineers. Division engineer, Lieut. Col. James B. Quinn, Corps of Engineers.

1. St. Johns River, Florida.—Before improvement the mean low-water channel depth across the bar varied from 5 to 7 feet, with a tidal range of 5.22 feet. The bar was dangerous, as the channel

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shifted through a range of about 1 mile. The least mean low-water depth in the river was about 11.5 feet. The tidal range varies from about 4.5 feet at the mouth to 1 foot at Jacksonville.

The first project, adopted in 1879, contemplated a channel 15 feet deep at mean low water from Jacksonville to the ocean, a distance of about 27.5 miles. This was to be obtained by dredging and building training walls in the river, and by building two converging jetties of riprap stone 1,600 feet apart between their outer ends.

The present project, adopted in 1896, and modified November 17, 1903, contemplates a channel 300 feet wide and 24 feet deep from Jacksonville to the ocean, except at Dames Point, where the width is to be 400 feet and the depth 25 feet. This channel is to be obtained by dredging through all shoals, building training walls in the river, and by raising and extending the jetties. Estimated cost, $2,109,750. The amount expended by the United States up to June 30, 1905, was $2,937,276.57, of which $1,520,276.57 was expended under the present project. Of this amount $34,948.16 was for work of maintenance and $169,684.44 for construction of a seagoing suction dredge.

The river and harbor act of June 13, 1902, appropriated $350,000 for this improvement, and authorized a continuing contract for the work to an additional amount not exceeding $950,000, and of said amounts an expenditure of $150,000 was authorized for the purchase or construction of a seagoing suction dredge.

The sundry civil act of March 3, 1903, appropriated $350,000 and the sundry civil act of April 28, 1904, appropriated $395,000 for continuing the work. The sundry civil act of March 3, 1905, appropriated $205,000, which completes the amount authorized in act of June 13, 1902. The river and harbor act of March 3, 1905, appropriated, for continuing improvement and for maintenance, $100,000, and authorized contract or contracts for such materials and work as may be necessary to complete the project, not to exceed in the aggregate $309,750 additional.

The work of constructing the seagoing suction dredge *St. Johns*, authorized in act of June 13, 1902, was completed in March, 1905. At the end of the fiscal year the dredge was making her thirty-day trial and had not been finally accepted. Details of construction are given in Appendix H 7, herewith.

Contract for construction of training walls was entered into June 30, 1903. The work was completed December 15, 1904.

A river dredge (the *Jacksonville*) with 30-inch hydraulic pump was completed in February, 1904. The work in the portion of the river above New Berlin and below Mayport is done by hired labor, using this dredge and the dredge *St. Johns*. Dredging in the lower part of the river above Mayport is done by contract. Contract for this portion was let August 24, 1904. Work began January 2, 1905, and was still in progress at the end of the fiscal year.

During the year the depth on the bar has increased from 19½ to 25 feet at mean low water. The maximum draft that can be carried at mean low water is 18 feet over Trout Creek shoal, which is the shoalest part of the locality under improvement.

The river is navigable from the mouth to Lake Washington, a distance of 276 miles.

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The commercial statistics furnished by the Jacksonville Board of Trade show a decrease of 51,760 tons for the year ending December 31, 1904. The estimated value of the commerce for 1904 is $28,000,000.

It is estimated that the improvement so far effected has resulted in maintaining a freight rate to northern points 100 per cent less than it otherwise would have been.

The amount estimated as profitable expenditure for the coming year will be applied to dredging and building up of jetties at the entrance.

No work in addition to the project is proposed.

Tonnage by years.

	Tons.		Tons.
1898	494,474	1902	903,191
1899	816,477	1903	1,052,076
1900	649,221	1904	1,000,316
1901	700,179		

More detailed information may be found in Reports of the Chief of Engineers for 1895, pages 1586–1604; 1896, pages 1305–1312; 1898, pages 1327–1330, and 1904, pages 1685–1690.

July 1, 1904, balance unexpended		$384,583.30
Amount appropriated by river and harbor act of March 3, 1905		100,000.00
Amount appropriated by sundry civil act approved March 3, 1905		205,000.00
Amount deposited, sale of old material	$445.96	
Amount deposited, unexpended balance river and harbor Board	89.16	
		535.12
		690,118.42
June 30, 1905, amount expended during fiscal year, for works of improvement		[a] 399,859.87
July 1, 1905, balance unexpended		290,258.55
July 1, 1905, outstanding liabilities		[b] 35,152.21
July 1, 1905, balance available		255,106.34
July 1, 1905, amount covered by uncompleted contracts		[c] 112,213.12
Amount (estimated) required for completion of existing project		309,750.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905. Submitted in compliance with requirements of sundry civil act of June 4, 1897.		309,750.00

(See Appendix P 1.)

2. St. Johns River at Orange Mills flats, Florida.—Before improvement the St. Johns River, between Jacksonville and Palatka, was obstructed by four shoals, all near Orange Mills, viz:

Forresters Point shoal, least depth 11.6 feet; Orange Mills flats, 9.8 feet; Racey Point shoal, 10.1 feet, and Tocoi shoal, 11.1 feet. The mean range of tide is 0.9 foot.

[a] Includes $48,182.69 on account of construction of dredge *St. Johns*.
[b] Includes $2,665.99 on account of construction of dredge *St. Johns*.
[c] Includes $4,500 on account of construction of dredge *St. Johns*.

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The project, adopted in 1898, is to dredge a channel 200 feet wide and 13 feet deep through the shoals between Jacksonville and Palatka, at an estimated cost of $120,000.

A channel was dredged through Orange Mills flats in 1900, from 120 to 160 feet wide, connecting the 13-foot contours across the shoal.

In 1903 the channel through Orange Mills flats was extended to a width of 160 feet throughout. A channel 13 feet deep and 120 feet wide was dredged through Racey Point shoal. Through Tocoi shoal a channel was dredged 13 feet deep and 40 to 80 feet wide.

The river and harbor act of March 3, 1905, appropriated $25,000 for this improvement. The work will be done by contract.

The amount expended on this improvement up to June 30, 1905, was $70,000.

The available channel depth is now limited by Forresters Point shoal to 11.6 feet at ordinary low-water stage, which is the maximum draft that can be carried through this channel.

The commerce on the upper St. Johns is chiefly in lumber, shingles, building material, and general merchandise. This improvement has had no appreciable effect upon freight rates.

Tonnage by years.

1898	25,866	1901	67,500
1899	122,074	1902	137,950
1900	171,500	1903	269,610

No commercial statistics for 1904 are available.

No work in addition to the project is proposed.

See Report of Chief of Engineers for 1904, pages 1690–1691.

Amount appropriated by river and harbor act approved March 3, 1905	$20,000.00
July 1, 1905, balance unexpended	20,000.00
Amount (estimated) required for completion of existing project	30,000.00

(See Appendix P 2.)

3. Volusia bar, Florida.—The bar is located at the south end or head of Lake George, in the St. Johns River, about 162 miles from the mouth.

Before improvement the channel over the bar was very crooked and had a least depth at low water varying from 3½ to 4½ feet.

The project of 1879 contemplated the construction of two jetties carried out beyond the bar, with their outer ends from 200 to 250 feet apart. Estimated cost, $15,000.

Two jetties have been built, starting from opposite sides of the river bank at the south edge of the lake and converging until upon the bar they are 230 feet apart. The east jetty is 3,400 feet long and the west jetty 2,200 feet. They are built to the level of mean low water throughout nearly their entire lengths. Two rows of piles with waling pieces confine boats to a 100-foot channel across the crest of the bar. This work was finished during 1899.

The act of March 3, 1905, appropriated $2,000 for this work, and there was an unexpended balance of $4,000 from former appropriations.

Operations began April 4, 1905, and were finished May 10, 1905, using the U. S. dredge and snag boat *Florida*. As a result, there is

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now a channel through Volusia bar 1,100 feet long, 100 feet wide, and 7 feet deep at mean low water, and through Lake Monroe bar a channel 1,050 feet long, 100 feet wide, and 6 to 7 feet deep.

The amount expended to June 30, 1905, was $37,000, of which $12,000 was for maintenance.

The maximum draft that can be carried through the improved channel is 6 feet at mean low water. The usual variation of level of water surface is about 2 feet.

The commerce of this portion of the river is chiefly in grain, fertilizers, ship stores, vegetables, and general merchandise. The estimated value of the commerce for 1904 is $3,620,820.

	Tons.		Tons.
1898	21,959	1902	53,678
1899	26,358	1903	55,922
1900	31,511	1904	60,347
1901	32,437		

It is estimated that the improvement so far effected has resulted in maintaining a freight rate to local points 100 per cent less than it otherwise would have been.

Work of maintenance will be required from time to time.

July 1, 1904, balance unexpended	[a] $4,000.00
Amount appropriated by river and harbor act approved March 3, 1905	2,000.00
	6,000.00
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	[b] 6,000.00

(See Appendix P 3.)

4. Oklawaha River, Florida.—This river is obstructed by snags, accumulations of drift, and overhanging trees. After removal, these obstructions recur in a few years.

The project adopted in 1891 is to clear the river of obstructions so as to give a navigable channel 4 feet deep at low stages from the mouth to Leesburg, a distance of 94 miles. Estimated cost, $26,000.

The act of March 3, 1905, appropriated $2,000 for this improvement, and there was an unexpended balance of $2,000 from a former appropriation.

Operations began June 1, 1905, and ceased June 28, 1905, owing to exhaustion of funds. As a result, the river has been cleared of snags and other obstructions for a distance of 21 miles above the mouth of the river. The river is navigable from the mouth to Leesburg, a distance of 94 miles.

The amount expended to June 30, 1905, was $21,249.42, of which $11,249.42 was for maintenance.

For more detailed description see Report of Chief of Engineers for 1896, pages 1314–1316.

The commerce concerned is small. The boats using the river are chiefly excursion steamers, which run during the winter months. This improvement has had no appreciable effect upon freight rates.

Tonnage, by years.

1898	4,481	1900	4,847
1899	4,291	1901	4,530

[a] Includes $2,000 from river and harbor act of April 28, 1904.
[b] Includes $600 allotted for construction of dredge *Florida*.

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Commercial statistics for 1904 are not available.

Work of maintenance will be required from time to time.

July 1, 1904, balance unexpended	$2,000.00
Amount appropriated by river and harbor act approved March 3, 1905	2,000.00
	4,000.00
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	1,249.42
July 1, 1905, balance unexpended	2,750.58
July 1, 1905, outstanding liabilities	1,784.60
July 1, 1905, balance available	965.98
Amount (estimated) required for completion of existing project	16,000.00

(See Appendix P 4.)

5. Indian River, Florida, between Goat Creek and Jupiter Inlet.—Before improvement the ruling depth in this portion of Indian River was 2½ feet; tide imperceptible.

The project of 1891 contemplates a continuous channel 5 feet deep at low water and at least 75 feet wide in the straight reaches, with as much greater width in the turns as may be required, at an estimated cost of $44,000. In 1895 the channel previously dredged by the Florida Coast Line Canal and Transportation Company was widened at Long Canal, High Bank Canal, Curved Canal, and Conch bar by dredging along one side of it a cut 50 feet wide and 6 feet deep.

The act of June 13, 1902, appropriated $2,000 for continuing the improvement. This amount not being sufficient to obtain noticeable results, it was proposed to defer the expenditure of the appropriation until more favorable conditions obtain or until additional funds might be provided.

The act of March 3, 1905, appropriated $20,000 for continuing this improvement and for maintenance, and provided for a survey of Sebastian Inlet. On May 5, 1905, the Chief of Engineers allotted $1,500 from this appropriation for survey of Sebastian Inlet, and on May 27, 1905, approved project for expenditure of the balance of $18,500. Dredging will be done opposite St. Lucie Inlet, in the vicinity of Jupiter Inlet, and elsewhere in this section of Indian River, the work to be done by hired labor, using the U. S. dredge and snag boat *Florida*.

The depths in this portion of the river are gradually decreasing. From Goat Creek to St. Lucie River a maximum draft of only 3 feet can now be carried at mean low water. Between St. Lucie River and Jupiter Inlet the ruling depth is only 2 feet at mean low water. This shoaling is due to sand brought in through an artificial opening.

The amount expended on this part of Indian River to June 30, 1905, was $16,410.79, of which $805.76 was applied to building and equipping the dredge *Florida*, and $605.03 to survey of Sebastian Inlet.

Indian River is at present chiefly used by small local steamers, launches, and small sailing vessels.

No commercial statistics are available for 1904. The commerce is believed to be small, and consists of fruits, vegetables, lumber and other building supplies, and general merchandise.

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Tonnage, by years.

1901	66,593	1902	91,875

July 1, 1904, balance unexpended	$2,014.62
Amount appropriated by river and harbor act approved March 3, 1905	20,000.00
	22,014.62
June 30, 1905, amount expended during fiscal year, for works of improvement	[a] 1,410.79
July 1, 1905, balance unexpended	20,603.83
July 1, 1905, outstanding liabilities	665.38
July 1, 1905, balance available	19,938.45
Amount (estimated) required for completion of existing project	7,000.00

(See Appendix P 5.)

6. Biscayne Bay, Florida.—Biscayne Bay in its original condition was navigable for boats drawing less than 3 feet of water. There is a channel about 12.5 miles long, with a least depth of 10.5 feet, from Miami to the Atlantic Ocean via Cape Florida. In about 4 miles of this channel the required depth was obtained by dredging. The tidal range in the bay is about 1 foot.

The project, adopted by the river and harbor act of June 13, 1902, is to excavate a channel 18 feet deep from the wharves at Miami to the sea by way of a line entering the sea at a point about 4,000 feet north of Norris Cut, and a basin of same depth, 1,600 feet long and 500 feet wide, adjacent to the said wharves. The act mentioned provides that, of the work contemplated, the Florida East Coast Railway Company shall construct, at its own expense, the basin adjacent to the wharves at Miami, and the channel from said basin to the east side of the proposed refuge basin on the east side of the bay; that the amounts appropriated and authorized shall be expended in constructing and protecting the portion of the channel extending to the sea from the terminus of the channel to be constructed by the railway company, of such approximately uniform depth and of such width as will best serve the interests of navigation and as can be constructed with the funds therein appropriated and authorized. The act further provides that before any part of the appropriation shall be expended the said railway company shall enter into contract with the United States for the performance of its part of the work. The act appropriated $50,000 and authorized a continuing contract for prosecuting the project for an additional amount, not exceeding $250,000. This latter amount was appropriated by the sundry civil act approved March 3, 1903.

A contract for the portion of the work to be done by the Florida East Coast Railway Company was executed by said company September 25, 1902. A project for the expenditure of the available and authorized funds was approved January 12, 1903. The project contemplates the construction of a basin 300 by 500 feet at the eastern side of the bay, and the excavation of a channel 18 feet deep and 100 feet wide, deepening to 20 feet at the ocean end, from the basin to the sea; also the construction of a breakwater extending from the present shore line seaward about 1,500 feet, 500 feet north of the proposed cut and parallel to it. The estimated cost of this work was $300,000.

[a] Includes $600 allotted for construction of dredge *Florida*.

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By subsequent arrangement with the Florida East Coast Railway Company, it was agreed that work by the United States should not begin until the Florida East Coast Railway Company should have excavated a preliminary channel 10 feet deep and 60 feet wide across the bay. Work on this preliminary channel was begun in March, 1903, and completed in November, 1903. Operations by the United States under contract with P. Sanford Ross (Incorporated), were commenced March 15, 1904.

On June 30, 1905, the foundation and hearting of the breakwater had been built to a distance of 1,400 feet from shore. The breakwater was capped with granite to a height of 5 feet above mean low water for a distance of 1,150 feet from shore.

The sides of the seaward end of the dredged cut are being rapidly eroded by wave action, forming a widely diverging shore line at the entrance. The sand removed by this erosion is being deposited seaward of the entrance, forming a shoal with only about 3 feet of water over it at mean low water, where a depth of as much as 8 feet had previously existed. It is believed that the shore line at the entrance will need to be revetted to prevent this erosion, and the southern breakwater, contemplated in the Board's report of April 9, 1900, will also be necessary to prevent injury from heavy wave action during southeasterly storms. The present breakwater should also be extended seaward 100 feet and the capping carried to the outer end. The channel should be made at least 150 feet wide at the entrance. This additional work is necessary to make the improvement available.

It is found that the actual proportion of rock is somewhat greater than was anticipated and that it will not be possible to complete the sea end of the channel to a width of more than 85 feet with funds available.

The channel is not yet available for purposes of navigation.

The amount expended on this work to June 30, 1905, was $98,767.03.

A description of the bay, with report and recommendations of a Board of officers, may be found in Report of the Chief of Engineers for 1900, pages 1986 to 2013.

The commerce of Biscayne Bay is in cattle, fertilizers, lumber, fruits, vegetables, grain, and general merchandise.

The estimated value of the commerce for the year 1904 is $514,710.00.

Tonnage, by years.

1899	18,089	1903	13,319
1902	8,390	1904	16,788

July 1, 1904, balance unexpended	[a] $288,358.01
June 30, 1905, amount expended during fiscal year, for works of improvement	87,125.04
July 1, 1905, balance unexpended	201,232.97
July 1, 1905, outstanding liabilities	40,120.36
July 1, 1905, balance available	161,112.61
July 1, 1905, amount covered by uncompleted contracts	142,753.29

(See Appendix P 6.)

[a] Reduced by $34.49, balance of appropriation for survey, which is not applicable to improvement work.

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7. Harbor at Key West, Fla., and entrance thereto.—The entrance referred to is the northwest channel. Key West Harbor accommodates vessels drawing about 27 feet. Before improvement the ruling depth over the northwest bar was 10.5 feet. The mean tidal range is 2.6 feet.

The project adopted in 1889 contemplates a channel 17 feet deep at mean low water. This was to be secured by building two stone jetties, one to the northeast and one to the west of the channel, converging toward the bar, and by dredging if necessary. Estimated cost of east jetty, $500,000. No estimate has been made of entire project.

The east jetty has been built to a length of 11,354 feet and the west jetty to a length of 6,452 feet. The east jetty for a distance of 3,950 feet is at the height of mean low water. The rest of the jetty is about 5 feet below mean low water. The crest of the west jetty is about at the level of mean low water.

In 1901 the channel was dredged to about 12.5 feet. Since that time shoaling has taken place, especially at the turn inside the bar, so that vessels frequently have difficulty in passing.

Authority was granted by the Secretary of War in April, 1903, to build a dredge for use on this work. This dredge (the *Key West*) was completed in December, 1904, and was accepted in January, 1905. Details of construction are given in Appendix H 7, herewith. Work of dredging began at Key West Harbor entrance on February 1, 1905. As a result of operations there is now a channel 15 feet deep and 100 feet wide over the shoal.

The maximum draft that can be carried through this entrance at mean low water is 15 feet.

The amount expended on this project to June 30, 1905, was $458,204.39.

For more detailed information see Reports of the Chief of Engineers for 1896, pages 1325–1327; 1898, page 1371, and 1900, page 1958.

The commerce is chiefly in cattle, fertilizers, tobacco, sponges, and general merchandise. The estimated value of the commerce for 1904 is $5,229,150.

Tonnage by years.

1898	72,968	1902	14,146
1899	130,713	1903	134,043
1900	30,594	1904	174,305
1901	18,863		

July 1, 1904, balance unexpended	$55,586.42
Amount appropriated by river and harbor act approved March 3, 1905	50,000.00
	105,586.42
June 30, 1905, amount expended during fiscal year, for works of improvement	[a]51,289.31
July 1, 1905, balance unexpended	54,297.11
July 1, 1905, outstanding liabilities	3,011.53
July 1, 1905, balance available	51,285.58
Amount (estimated) required for completion of existing project	50,000.00

(See Appendix P 7.)

[a] Includes $35,854.21 on account of construction of dredge.

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8. Kissimmee River, Florida.—The Kissimmee River rises in Lake Tohopekaliga and flows in a southerly direction through Cypress Lake, Lake Hatcheneha, and Lake Kissimmee, and empties into Lake Okechobee. The length of the waterway from the town of Kissimmee, situated on the northwest shore of Lake Tohopekaliga, to Lake Okechobee is 137 miles. The river is very tortuous, and a number of cuts avoiding the worst bends have been made by private parties.

Before improvement was undertaken by the Government the river and canals were narrow and shallow in places, and at ordinary stages of the water the minimum depth was less than 2 feet. Snags and overhanging trees impeded navigation. In years of drought steamboats ceased running for several months.

The project adopted June 13, 1902, provides for a channel 30 to 60 feet wide and 3 feet deep in the Kissimmee River (including the connecting canals and lakes) from the town of Kissimmee to Fort Bassinger, and for a channel 25 feet wide and 3 feet deep in Istokpoga Creek. Estimated cost of the improvement was $24,220.90.

The amount expended upon the work of existing project to June 30, 1905, was $8,920.41.

The channel in Southport Canal has been straightened and widened, its depth increased from 15 inches to 3 feet, and its permanence insured by the construction of bulkheads. At ordinary low stages of the river a maximum draft of 15 inches can be carried from the town of Kissimmee to Fort Bassinger. The annual variation of level is about 4 feet. Kissimmee is at the head of navigation. The entire route from Kissimmee to Fort Bassinger, 99½ miles, is navigable.

The commerce of Kissimmee River is in cattle, fruits, vegetables, fish, and general merchandise. The value of the commerce for the year 1904 was $283,365.

Tonnage by years.

1901	3,670	1903	10,652
1902	9,655	1904	2,863

For reference to examination and survey, see page 289, Report of the Chief of Engineers for 1904.

The project has lowered freight rates by enabling the steamboats to run more months in a year than they formerly did. Freight is hauled by wagons when steamboats are not running, there being no railroads down the valley.

July 1, 1904, balance unexpended	$116.70
Amount appropriated by river and harbor act approved March 3, 1905	7,000.00
	7,116.70
June 30, 1905, amount expended during fiscal year, for works of improvement	1,037.11
July 1, 1905, balance unexpended	6,079.59
July 1, 1905, outstanding liabilities	1,000.00
July 1, 1905, balance available	5,079.59
Amount (estimated) required for completion of existing project	9,220.90

(See Appendix P 8.)

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9. Orange River, Charlotte Harbor, and Caloosahatchee River, Florida.—These improvements were consolidated by the river and harbor act of June 13, 1902.

The river and harbor act of March 3, 1905, appropriated $3,000 for maintenance of these improvements. Allotments from the consolidated appropriation were made on April 26, 1905, as follows:

Orange River	$1,000
Caloosahatchee River	2,000
Total	3,000

(*a*) *Orange River.*—This stream empties into the Caloosahatchee River about 6 miles above the town of Fort Myers, and has a total length of 6 miles. Before improvement the limiting depth was about 2.5 feet at mean low water. Navigation was obstructed by shoals, snags, and overhanging trees.

The project, adopted June 13, 1902, provides for a channel 50 feet wide and 4 feet deep at mean low water from the mouth of the river to the head of navigation.

The amount expended upon the work of existing project to June 30, 1905, was $2,000.

The improvement has resulted in the formation of a navigable channel 4 feet deep at mean low water from the mouth of the river to the head of navigation. This channel is 50 feet wide from the river mouth for about half the distance to the head of navigation. For the remainder of the distance the river's banks limit the channel width to about 40 feet. A maximum draft of 4 feet at mean low water could be carried on June 30, 1905, from mouth of the river for a distance of 4 miles up the stream. Mean rise and fall of tide is 1 foot. During freshets the river level is about 2 feet above mean high water. The head of navigation is Middle Bridge, 4 miles from the mouth of the river.

The commerce of Orange River is in fruit, vegetables, fertilizers, lumber and general merchandise. The value of the commerce for the year 1904 was $112,388.

Tonnage, by years.

1896	1,250	1903	8,555
1902	7,155	1904	3,099

For reference to examination and survey see page 291, Report of Chief of Engineers for 1904.

The freight rates are practically the same as before the improvement was made.

(*b*) *Charlotte Harbor and Caloosahatchee River from Puntarasa to Punta Gorda.*—Before improvement this waterway was obstructed by two shoals in Pine Island Sound. The least depth across the shoals at mean low water was 5 feet.

The original project, adopted in 1890, for the improvement of Charlotte Harbor was to dredge a channel 200 feet wide and 12 feet deep at mean low water from the Gulf of Mexico to the steamship wharf at Punta Gorda. The project was modified in 1897 to include extension of the channel from the steamship wharf to a point in mid-channel in front of the railroad wharf at Punta Gorda, a distance of about 6,000 feet.

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The amount expended upon the work of the original project and the modified project of 1897 was $100,000.

The project adopted June 13, 1902, provided for a channel in Pine Island Sound 100 feet wide, 7 feet deep at mean low water, through the shoal northeastward of Patricio Island and through the shoal northeastward of Blind Pass. The estimated cost of the improvement was $6,000.

The amount expended upon work of existing project to June 30, 1905, was $6,000.

Result of the work of improvement is a channel 100 feet wide and 7 feet deep through both shoals in Pine Island Sound.

The maximum draft at mean low water that could be carried on June 30, 1905, was 7 feet. Mean rise and fall of tide is 1.7 feet. The head of navigation is Punta Gorda. The entire route from Puntarasa to Punta Gorda, 48½ miles, is navigable.

The commerce is in phosphate, coal, cattle, and general merchandise. The tonnage of Pine Island Sound in 1898 was 17,200; no later statistics are available.

The value of the commerce for 1904 was $1,514,563.

Tonnage, by years.

1897	112,172	1902	78,264
1898	106,346	1903	118,105
1899	102,048	1904	114,479
1900	85,475		

For reference to examinations and surveys see page 291 of Report of Chief of Engineers for 1904.

The project has not affected freight rates. The line of steamers that formerly used the route has been abandoned since the Atlantic Coast Line Railroad was extended from Punta Gorda to Fort Myers in May, 1904.

(*c*) *Caloosahatchee River between Puntarasa and Fort Thompson.*—Before improvement there was a navigable channel 5 feet deep at mean low water from Puntarasa to a point 4 miles above the town of Fort Myers. From that point to Fort Thompson the least depth was 3.5 feet across the shoal at Beautiful Island. There were oyster bars in the river near its mouth, and snags and overhanging trees obstructed the channel above Beautiful Island.

The original project, adopted in 1882, was to dredge a channel 100 feet wide and 7 feet deep at mean low water from the mouth of the river to the town of Fort Myers. The project was modified in 1886 to include improvement of the upper river by removal of snags and overhanging trees.

The amount expended upon the work of the original project and the modified project of 1886 was $14,000.

The project was again modified in 1888 to include straightening and deepening, to 4 feet at mean low water, the channel across the shoal at Beautiful Island.

The estimated cost of the improvement was $11,000.

The amount expended on the work of existing project to June 30, 1905, was $21,100, of which amount $10,100 was applied to maintenance of the improvement.

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The result of the improvement is a channel 100 feet wide and 7 feet deep at mean low water from the mouth of the river to the town of Fort Myers, and 4 feet deep from Fort Myers to Fort Thompson. The maximum draft that could be carried on June 30, 1905, was 7 feet from the river entrance to Fort Myers and thence 4 feet to Fort Thompson. The mean rise and fall of the tide at the river entrance is 1.6 feet. During freshets the water level in the upper reaches of the river rises considerably. The head of navigation is Fort Thompson. The navigable portion of the river from the mouth to Fort Thompson is 59.5 miles long.

The commerce of Caloosahatchee River is in fruits, vegetables, lumber, wood, and general merchandise. The value of commerce for the year 1904 was $214,910.

Tonnage, by years.

1899	33,101	1903	27,576
1900	22,737	1904	12,255
1902	27,895		

The freight rates are practically the same as before the improvement was made.

Amount appropriated by river and harbor act approved March 3, 1905	$3,000.00
July 1, 1905, balance unexpended	3,000.00

(See Appendix P 9.)

10. Sarasota Bay, Florida.—Before improvement there was a navigable channel with a least depth of 5 feet throughout the length of Big Sarasota Bay, excepting in two reaches, Palma Sola Pass and Long bar, which have a total length of 5,400 feet. In these reaches the least depth was 4.3 and 3.5 feet, respectively.

Between Sarasota and Caseys Pass, at the south end of the bay, the least channel depth was 1.2 feet at mean low water, except at the Mangroves, where there was no navigable water.

The original project, adopted in 1889, was to dredge a channel 100 feet wide and 5 feet deep at mean low water from Tampa Bay to the town of Sarasota. Estimated cost of the improvement was $17,500.

The amount expended under the original project was $10,000.

The original project was modified June 3, 1896, to include the improvement of Little Sarasota Bay by dredging a channel 75 feet wide and 3 feet deep at mean low water from the town of Sarasota to Caseys Pass. Estimated cost to complete the improvement was $45,000.

The amount expended on the work to June 30, 1905, was $22,500, of which amount $3,000 was applied to maintenance of the improvement.

Result of the work is a channel 50 feet wide and 5 feet deep at mean low water from Tampa Bay to the town of Sarasota, and thence 3 feet deep to a point on the southerly edge of White Beach shoal, near Osprey.

The maximum draft that could be carried on June 30, 1905, was 5 feet to Sarasota and 2 feet to the southerly end of the dredged cut near Osprey. Mean rise and fall of the tide is 1.5 feet. The head of navigation for 2-foot draft is the southerly end of the dredged cut near Osprey. The navigable portion of the bay, from the northerly entrance to Osprey, is 32 miles long.

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The commerce of Sarasota Bay is in fruits, vegetables, fish, naval stores, lumber, and general merchandise. The value of commerce for the year 1904 was $704,931.

Tonnage, by years.

1899	9,424	1903	4,755
1902	4,313	1904	25,479

For reference to examination and survey, see page 293 of Report of the Chief of Engineers for 1904.

The freight rates have been lowered 25 to 50 per cent, depending on freight classification, since the improvement was undertaken.

Amount appropriated by river and harbor act approved March 3, 1905	$5,000.00
July 1, 1905, balance unexpended	5,000.00
Amount (estimated) required for completion of existing project	27,500.00

(See Appendix P 10.)

11. Tampa Bay, Florida.—Before improvement the least depth in the bay channel between the Gulf of Mexico and Port Tampa was 13 feet.

The original project was adopted August 11, 1888, for a channel 200 feet wide and 20 feet deep at mean low water from Tampa Bay to Old Tampa Bay. The estimated cost of the improvement was $63,000.

The amount expended upon the improvement under the original project was $50,000.

A new project was adopted March 3, 1899. It contemplated a channel 27 feet deep from the Gulf of Mexico to Port Tampa, 500 feet wide across the bar and 300 feet wide in the bay. It was proposed first to secure a channel of full width and 24 feet depth and afterwards to increase the depth to 27 feet. The estimated cost of the improvement was $750,000.

Th amount expended upon the improvement under this project was $345,045.80.

The project of 1899 was modified by the river and harbor act of March 3, 1905. The project, as modified, contemplates securing a channel of 26 feet, with sufficient width, from the Gulf of Mexico to Port Tampa. The act authorizes the expenditure of the remaining balance to the credit of this appropriation on this project and provides "that no part of said balance on hand shall be expended unless the dock company or companies owning docks, wharves, or terminals at Tampa Bay shall, by valid contract, agree that the wharfage charges at such terminals shall be submitted to the Secretary of War and be subject to his approval."

No work has been done under the modified project because the Atlantic Land and Improvement Company, owning terminals at Tampa Bay, has not agreed, by valid contract, that the wharfage charges at such terminals shall be submitted to the Secretary of War and be subject to his approval, as is required by the river and harbor act of March 3, 1905.

The amount expended under the revised project to June 30, 1905, was, $2,170.69.

Result of the work of improvement under the project of 1899 is a channel 128 to 300 feet wide, with a least depth at mean low water of 24 feet, from the Gulf of Mexico to Port Tampa.

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The maximum draft that could be carried on June 30, 1905, was 24 feet. Mean rise and fall of tide at Tampa Bay entrance is 1.5 feet; at Port Tampa, 2 feet. The head of navigation for 24-foot draft is Port Tampa, 35 miles from deep water in the Gulf of Mexico.

The commerce is in phosphate, lumber, coal, crude petroleum, tobacco, grain, and general merchandise. The value of commerce for the year 1904 was $9,316,918.

Tonnage, by years.

1896	276,638	1901	416,503
1898	236,136	1902	462,703
1899	238,305	1903	435,867
1900	350,761	1904	591,181

For report on examination and survey of Tampa Bay, see Report of the Chief of Engineers for 1897, page 1596 et seq.

The freight rates have been lowered 20 per cent on phosphate shipments since the improvement was undertaken.

July 1, 1904, balance unexpended	$292,631.01
June 30, 1905, amount expended during fiscal year, for works of improvement	[a] 29,834.74
July 1, 1905, balance unexpended	262,796.27
July 1, 1905, outstanding liabilities	[b] 100.40
July 1, 1905, balance available	262,695.87
Amount (estimated) required for completion of existing project	139,987.24

(See Appendix P 11.)

12. Hillsboro Bay, Florida.—The city of Tampa is located at the head of Hillsboro Bay, at the mouth of Hillsboro River. It is separated from the 12-foot depth in the bay by a flat about 3 miles wide.

Before improvement there was a narrow and tortuous channel through the flat, with an average depth of about 5 feet at mean low water.

The original project was adopted in 1880, and had for its object the formation of a 9-foot channel, 150 feet wide in the bay and 200 feet wide in the river, from the 9-foot curve in the bay to the wharves at Tampa in the Hillsboro River. In 1888 the project was modified to provide for the formation and maintenance of a channel 8 feet deep in Hillsboro Bay and Hillsboro River to the city of Tampa, and a channel 20 feet deep and 200 feet wide from Tampa to Old Tampa Bay.

The amount expended upon the improvement of Hillsboro Bay under the original project and the revised project was $80,000.

A later project, adopted March 3, 1899, contemplated the formation of a channel in Hillsboro River from a point about 100 feet south of the bridge crossing the river at Lafayette street, in the city of Tampa, to the mouth of the river, and from there along the line of shortest distance to the 12-foot contour in Hillsboro Bay; this channel to be 12 feet deep at mean low water and 150 feet wide in the bay.

The estimated cost of the improvement was $300,000, and $1,000 annually for maintenance.

[a] Includes $22,918.91 on account of construction of dredge *Key West*.
[b] Includes $93.40 on account of construction of dredge *Key West*.

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The contractor, Edwin W. Preston, ceased operations on November 5, 1903. The contract was annulled on May 7, 1904, and the work was readvertised for completion on June 20, 1904. Bids for completion of the work were opened on July 21, 1904, and rejected on account of being too high. On August 5, 1904, the work was authorized to be done by hired labor, using the U. S. dredge *Suwanee*.

The amount expended under the 1899 project to June 30, 1905, was $275,000.

Result of the work is a channel 12 feet deep at mean low water, with a least width of 110 feet in the bay and 200 feet in the river.

A new project was adopted March 3, 1905. It contemplates the formation of a channel 20 feet deep at mean low water and 150 feet wide, from the lower bay to the mouth of Hillsboro River, with a turning basin at the inner end of the channel 450 feet wide and 1,050 feet long. Estimated cost of the improvement is $448,350.

Advertisements were published on June 1, 1905, inviting proposals for dredging the 20-foot channel.

An allotment of $10,000 from the available funds was made on April 3, 1905, for completing the 12-foot channel in Hillsboro Bay to its full width of 150 feet, the work to be done by hired labor, using a Government dredge.

The amount expended under the existing project to June 30, 1905, was $5,593.80.

A maximum draft of 12 feet could be carried at mean low water from Tampa Bay to the head of navigation on June 30, 1905. Mean rise and fall of tide is 2.2 feet. The head of navigation is the city of Tampa. The navigable channel from the city of Tampa to Tampa Bay is 10½ miles long; from Tampa to the Gulf of Mexico is 41 miles.

The commerce of Hillsboro Bay is in fruits, vegetables, lumber, coal, cattle, fish, naval stores, fertilizers, fuller's earth, and general merchandise. The value of the commerce for the year 1904 was $7,682,886.

Tonnage, by years.

1898	32,070	1902	169,844
1899	87,740	1903	228,252
1900	96,029	1904	274,399
1901	131,208		

For further information, see Report of Chief of Engineers for 1899, pages 1635–1637.

For reference to examination and survey see page 295 of Report of Chief of Engineers for 1904.

The freight rates by water have been lowered about 25 per cent since the improvement was undertaken.

The amount estimated as a profitable expenditure will be applied to completion of the channel by dredging. The work is necessary to make the improvement available.

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July 1, 1904, balance unexpended	$28,587.80
Amount appropriated by river and harbor act approved March 3, 1905	100,000.00
Amount deposited, sale of old material	9.30
	128,597.10
June 30, 1905, amount expended during fiscal year, for works of improvement	34,181.60
July 1, 1905, balance unexpended	94,415.50
July 1, 1905, outstanding liabilities	2,500.00
July 1, 1905, balance available	91,915.50
Amount (estimated) required for completion of existing project	348,350.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	348,350.00

(See Appendix P 12.)

13. Crystal, Anclote, Suwanee, and Withlacoochee rivers, Florida.—These improvements and the improvement of Manatee River were consolidated by the river and harbor act of June 13, 1902. The river and harbor act of March 3, 1905, made separate provision for Manatee River.

(*a*) *Crystal River.*—Crystal River is a small tidal estuary emptying into the Gulf of Mexico on the west coast of Florida about 25 miles southeast of Cedar Keys. It is navigable to the town of Crystal River, 6¼ miles from the mouth. The entrance is obstructed by reefs and sand bars.

Before improvement the channel was crooked and difficult to navigate, having a minimum depth of 2.7 feet at mean low water. There was also a shoal near the town of Crystal River, with a depth of 5 feet at mean low water.

The project, adopted June 13, 1902, was for a channel 60 feet wide and 6 feet deep at mean low water from the Gulf of Mexico to the town of Crystal River. Estimated cost of the work was $84,647.46.

The amount expended to June 30, 1905, was $10,000, of which $2,700 was expended toward completing the Government dredge *Florida.*

Result of the work is a channel, through shoals near the river entrance, 60 feet wide and from 5.5 to 6 feet deep at mean low water. Maximum draft that could be carried at mean low water from the Gulf of Mexico to the town of Crystal River on June 30, 1905, was 6 feet. Mean rise and fall of tide is 2.3 feet. Head of navigation is the town of Crystal River. The length of the navigable channel is 9 miles.

The commerce of Crystal River is in lumber, pencil cedar, oysters, fish, and general merchandise. The value of the commerce for the year 1904 was $352,720.

Tonnage, by years.

1902	1,785
1903	725
1904	6,875

For reference to examination and survey, see page 296 of Report of Chief of Engineers for 1904.

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The freight rates have been lowered 10 per cent since the improvement was undertaken.

(*b*) *Anclote River.*—Before improvement the river below Tarpon Springs was obstructed by shoals and bars, with depth varying from 2 to 14 feet at mean low water. The channel was narrow and tortuous.

The project was adopted March 3, 1899, and contemplates a channel 100 feet wide and 6 feet deep at mean low water from Anclote anchorage to Sponge Harbor, and thence 4 feet deep at mean low water to the county bridge at Tarpon Springs.

The estimated cost of the improvement was $51,500.

The amount expended to June 30, 1905, was $15,000.

Result of the work of improvement is a channel 50 feet wide and 6 feet deep at mean low water from Anclote anchorage to Sponge Harbor, and thence a channel 50 feet wide and 4 feet deep to a point about 1 mile below the county bridge at Tarpon Springs.

The mean rise and fall of tide at Anclote River entrance is 2 feet. Head of navigation is the county bridge at Tarpon Springs. Length of the navigable channel is 5 miles.

The commerce of Anclote River is in sponges, lumber, naval stores, and general merchandise. The value of the commerce for the year 1904 was $582,822.

Tonnage, by years.

1899	1,441	1903	2,138
1900	1,000	1904	8,310

For reference to examination and survey, see page 297 of Report of Chief of Engineers for 1904.

The freight rates have not been materially changed as a result of the improvement.

(*c*) *Suwanee River.*—Before improvement the river from its mouth to Ellaville, a distance of 135 miles, was obstructed by snags, overhanging trees, and shoals of soft, unstratified limestone. The channels across these shoals were narrow and crooked, with depths varying from 15 inches to 3 feet. At places in the channel there were large limestone bowlders.

The project adopted in 1879 is to deepen the bar at the entrance by dredging, to remove snags and overhanging trees along the river, and to deepen and improve the channel by removing rocks and snags and building wing dams. The channel is to be 150 feet wide and 5 feet deep from the mouth to Rollands Bluff (Branford), 75 miles; thence 60 feet wide and 4 feet deep to Ellaville, 60 miles.

The estimated cost of the work was $65,158. The amount expended on the work of improvement under the existing project to June 30, 1905, was $58,758.62.

The maximum draft that could be carried at mean low water on June 30, 1905, was 5 feet from the Gulf of Mexico to Branford (Rollands Bluff), and thence 4 feet to Beechams shoals, 2 miles below Ellaville. The mean rise and fall of tide at Suwanee River entrance is 2.4 feet. Head of navigation is Ellaville. Length of the navigable channel is 173 miles.

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The commerce of Suwanee River is in lumber, naval stores, and general merchandise. The value of the commerce for the year 1904 was $468,557.

Tonnage, by years.

1898	106,346
1899	76,878
1904	7,658

The improvement has had no effect on freight rates. Only one steamer now operates on the river regularly.

(*d*) *Withlacoochee River.*—Before improvement this river was obstructed by ledges of limestone rock, and sand bars, snags, and overhanging trees. The depths varied from 1 foot to 7.5 feet, the width from 75 to 180 feet. The obstructions prevented regular navigation, and the river was used only for rafting cedar logs.

The present project was adopted June 13, 1902. It provides for deepening the channel from the mouth of the Withlacoochee River to the loading pool in the Gulf of Mexico, being a distance of 11,780 feet, to 8 feet at mean low-water level, and straightening said channel where it is crooked, and for maintenance.

The amount expended under the present project to June 30, 1905, was $15,000.

Result of the work of improvement is three cuts 60 feet wide and 8 feet deep at mean low water, with an aggregate length of 2,046 feet, and one cut 30 feet wide, 8 feet deep, and 300 feet long.

Advertisements were published on June 12, 1905, inviting proposals for dredging, to continue the work of improvement with the appropriation made by the river and harbor act of March 3, 1905.

For improvement of the upper river see Report of Chief of Engineers for 1904, pages 298–299 and 1710–1711.

The maximum draft that could be carried at mean low water on June 30, 1905, was 5.8 feet from the Gulf of Mexico to Port Inglis, and 2 feet thence to Pembertons Ferry. Mean rise and fall of tide at Withlacoochee River entrance is 2.8 feet. Head of navigation is Pembertons Ferry.

Length of the navigable channel from the loading pool in the Gulf of Mexico to Port Inglis at mouth of the river is 9 miles; thence up the river to Inglis, 9 miles; thence to Pembertons Ferry, 68 miles.

The commerce of Withlacoochee River is in phosphate, lumber, coal, and general merchandise. Port Inglis, at mouth of the river, is a subport of entry. Vessels ply regularly from the anchorage basin off the river entrance to European ports with cargoes of phosphate.

The value of the commerce for 1904 was $1,802,976.

Tonnage, by years.

1899	4,941	1903	115,269
1900	2,550	1904	123,369
1902	74,047		

The freight rates have been reduced about 30 per cent since the improvement was undertaken by the Government and certain work done on the channel by the Port Inglis Terminal Company under authority granted by the Secretary of War.

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July 1, 1904, balance unexpended	$32,463.19
Amount appropriated by river and harbor act approved March 3, 1905	40,000.00
	72,463.19
June 30, 1905, amount expended during fiscal year, for works of improvement	28,484.91
July 1, 1905, balance unexpended	43,978.28
Amount (estimated) required for completion of existing project	91,147.46

(See Appendix P 13.)

14. Manatee River, Florida.—This river has an estuary 12 miles long. Before improvement the general depth of the river in the estuary varied from 7 to 20 feet. At the mouth there was a long shoal with a depth of 7 feet. Between Palmetto and Braidentown there was another shoal with least depth of 3 feet.

The original project, adopted in 1882, was for a channel 100 feet wide and 13 feet deep at mean low water from Tampa Bay to Shaw and McNeills points.

In 1886 the project was modified to provide for a channel 100 feet wide and 8 feet deep at mean low water from Tampa Bay to Manatee, Fla.

The amount expended under the original project and the project of 1886 was $34,000.

The project adopted August 13, 1892, was for a channel 100 feet wide and 13 feet deep at mean low water from Tampa Bay to Shaw and McNeills points. The estimated cost of the work of improvement was $39,000.

The amount expended upon the work of the existing project to June 30, 1905, was $12,000.

A project for forming a channel 100 feet wide and 6 feet deep at mean low water through Terraceia Cut-off was approved June 23, 1897. Terraceia Cut-off is the waterway joining Manatee River with Terraceia Bay. The estimated cost of the work was $20,000. Before improvement there was a crooked channel through the cut-off 1 foot deep at mean low water.

The amount expended upon the improvement of Terraceia Cut-off to June 30, 1905, was $13,342, of which $2,342 was applied to maintenance.

Result of the work is a channel in Manatee River 100 feet wide and 9 feet deep at mean low water from Tampa Bay to Braidentown, and thence 8 feet deep to the town of Manatee; in Terraceia Cut-off a channel 100 feet wide and 6 feet deep from Manatee River to Terraceia Bay.

A new project was adopted March 3, 1905. It contemplates forming a channel 9 feet deep at mean low water and 100 feet wide from McNeills Point to Rocky Bluff, and 4 feet deep and 75 feet wide from Rocky Bluff to Rye. Estimated cost of the improvement is $53,710.

A maximum draft of 9 feet at mean low water could be carried to Braidentown, 8 feet to Ellenton, 7 feet to Rocky Bluff, and 1.5 feet to Rye, on June 30, 1905, and 6 feet through Terraceia Cut-off. The mean rise and fall of tide at Manatee River entrance is 1.6 feet. Head of navigation is Rye. Length of the navigable channel is 20 miles.

The commerce of the river is in fruits, vegetables, fuller's earth, lumber, naval stores, and general merchandise. The value of the commerce for the year 1904 was $929,075.

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Tonange, by years.

1898	23,800	1902	34,41
1899	43,542	1903	44,36
1900	55,162	1904	46,51

For report of examination and survey made in 1902, see pages 1749–1756 of Report of the Chief of Engineers for 1904.

The freight rates have not been materially changed as a result of the improvement.

Amount appropriated by river and harbor act approved March 3, 1905	$10,000.00
July 1, 1905, balance unexpended	10,000.00
Amount (estimated) required for completion of existing project	70,709.60

(See Appendix P 14.)

15. Removing the water hyacinth from Florida waters.—Before this work was begun many of the Florida rivers, especially the upper St. Johns and its tributaries, were overgrown with water hyacinths to such an extent that navigation was impeded.

The river and harbor act of March 3, 1899, appropriated $25,000 for the construction of a boat for crushing the water hyacinths, $1,000 for log booms, and $10,000 for operating expenses. Before the boat was built experience in Louisiana showed that the crushing process was too slow and expensive to be practicable, and a chemical process was recommended instead.

The act of June 13, 1902, appropriated $50,000 for the removal of the water hyacinth from the navigable waters of the States of Florida, Texas, and Louisiana, and authorized the Secretary of War to use this amount and the unexpended balance of amounts theretofore appropriated for this purpose in the States of Florida and Louisiana in exterminating or removing the plant by any mechanical, chemical, or other means whatsoever.

On August 13, 1902, the Secretary of War authorized the adoption of a chemical process and the purchase of a steamer to be used for the work. The estimated annual expenditure was $50,000.

The sum of $25,000 was allotted for the work in the State of Florida from the appropriation made in the act of June 13, 1902. A steamer was purchased, and the work of spraying the water hyacinth with the Harvesta chemical compound was begun November 20, 1902, and suspended January 10, 1904. An allotment of $25,000 from the river and harbor appropriation of April 28, 1904, was made for this work. Operations under this allotment began July 27 and terminated November 26, 1904. As a result the river and its tributaries for 20 miles above and 15 miles below Palatka were practically freed from hyacinths. The amount expended to June 30, 1905, was $84,977.97.

The river and harbor act of March 3, 1905, appropriated $25,000 additional for continuing the work by the spraying method, provided that no chemical process injurious to cattle be used. No work has been done under this appropriation.

The commerce benefited is that of the upper St. Johns. (See improvement of Orange Mills flats, p. 290, herewith.)

Further information is to be found in the Reports of the Chief of Engineers for 1899, pages 1612–1623; 1901, pages 1746–1749; 1903, pages 1184–1186; 1904, pages 1712–1713.

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July 1, 1904, balance unexpended	[a] $27,032.65
Amount appropriated by river and harbor act approved March 3, 1905	25,000.00
	52,032.65
June 30, 1905, amount expended during fiscal year, for works of improvement	26,010.62
July 1, 1905, balance unexpended	26,022.03
July 1, 1905, outstanding liabilities	50.00
July 1, 1905, balance available	25,972.03

(See Appendix P 15.)

16. Dredge for river and harbor improvements in Florida.—The need for a light-draft self-propelling dredge and snag boat for operations on the harbors and streams in the State of Florida, for which small appropriations are made from time to time, and the special features required in such a boat are set forth in the Report of the Chief of Engineers for 1901, pages 1749 and 1750.

The river and harbor act of March 3, 1899, appropriated the sum of $35,000 for the purchase or construction of such a boat. The amount was inadequate, and the act of June 13, 1902, contained an item appropriating $35,000 in addition.

The purchase of refrigerating plant, electric-lighting plant, hydraulic dredging plant, and sundry equipment for the boat was authorized by the Chief of Engineeers November 6, 1903. The cost of these was defrayed from funds for various improvements in this district on which the boat is to work.

The work of construction was begun in July, 1903, under contract approved July 11, 1903, and was finished in March, 1905. The boat was finally accepted June 8, 1905.

Hydraulic and clam-shell dredging work, snagging work, and the work of removing a wreck were accomplished in a very satisfactory manner, and the boat appears to be well suited for the purpose designed.

The amount expended from this appropriation to June 30, 1905, was $70,000.

July 1, 1904, balance unexpended	$51,729.53
June 30, 1905, amount expended during fiscal year, for works of improvement	51,729.53

(See Appendix P 16.)

17. Removing sunken vessels or craft obstructing or endangering navigation.—On March 27, 1905, an allotment of $4,300 was made from the indefinite appropriation made by section 20 of the river and harbor act of March 3, 1899, for removal of wrecks of the schooner *Ridgewood* and the steam ferryboat *Commodore Barney* from the St. Johns River, Florida, the former near McGuires Mill and the latter at Jacksonville. On May 2, 1905, an allotment of $800 was made from the same appropriation for removal of wreck of steamer *Starlight* from Lake Monroe, Florida, near Sanford.

The work of removing the steamer *Starlight* was completed May 15 by the United States dredge and snag boat *Florida*. Proposals for removing wrecks of the *Ridgewood* and *Commodore Barney* were opened June 15. The lowest bid was $2,490. On June 29 contract was sent to the bidders for signature.

[a] Includes $25,000 from the river and harbor act of April 28, 1904.

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The expenditures during the year amounted to $813.07.
(See Appendix P 17.)

IMPROVEMENT OF RIVERS AND HARBORS IN WESTERN GEORGIA AND FLORIDA AND IN EASTERN ALABAMA.

This district was in the charge of Capt. J. B. Cavanaugh, Corps of Engineers. Division engineer, Lieut. Col. H. M. Adams, Corps of Engineers, until August 12, 1904, and Lieut. Col. Clinton B. Sears, Corps of Engineers, since that date.

1. East Pass and Carrabelle bar and harbor, Florida.—The town of Carrabelle is situated about 25 miles east of Apalachicola, at the mouth of the Carrabelle River, which empties into St. George Sound. The river forms the inner harbor, and along the water front its channel varies from 9 to 15 feet in depth, with a minimum width of about 100 feet.

Dog Island anchorage, a protected portion of St. George Sound, showing a 4-fathom depth over a considerable area, forms the outer harbor. Between the 10-foot contours in the inner and outer harbors there is a bar about 6,000 feet wide, which originally had a minimum low-water depth over it of 3½ feet to 4 feet.

Dog Island anchorage is connected with the Gulf of Mexico by East Pass, which had originally limiting low-water depths of about 17 feet on the outer bar and 16.5 feet on the inner bar.

The approved project for Carrabelle bar and harbor, Florida, adopted June 3, 1896, provides for dredging a channel 10 feet deep and 100 feet wide from Dog Island anchorage, St. George Sound, to the city of Carrabelle, at a cost estimated in 1900 at $47,300, in addition to appropriations already expended on the project amounting to $22,399.54. By act of Congress approved June 13, 1902, this project was extended to include the improvement of East Pass by dredging a channel across the bar 20½ feet deep and 150 feet wide, and closing an opening in Dog Island, at an estimated cost of $27,450.

The amount expended up to the close of the fiscal year ending June 30, 1905, was $54,094.51, of which $21,704.08 was expended prior to work on present estimate, and $12,500 was applied to maintenance of the channel at the mouth of the river during the fiscal year. With allotments of $7,500 from the emergency act of June 13, 1902, and $5,000 from the act approved April 28, 1904, the channel across the inner bar, which had shoaled to a minimum depth of about 5 feet, was redredged to a width of 80 feet and a minimum depth of about 9 feet.

Under contract with Rittenhouse Moore, dated October 1, 1903, 60,080 cubic yards was removed from the channel at East Pass, 21,600 yards from the inner bar, and 38,480 yards from the outer bar.

The maximum draft that could be carried through the channel to the inner harbor at mean low water on June 30, 1905, was 8 feet, this limiting depth being confined to the inner end, where no dredging has yet been done. This channel seems to be practically permanent under ordinary conditions, but should be protected by a bulkhead to the eastward to prevent shoaling due to storms. At the inner end beyond the dredged cut the channel is narrow and crooked and should be widened and straightened.

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Work done on the East Pass has deepened the channel across the outer bar from about 17 to 20 feet, and across the inner bar from about 16.5 to 17.5 feet, this limiting depth being confined to a short distance. As the crooked channel through the crossover and around the inner bar is about 1½ feet deeper than the dredged channel, the limiting depth through East Pass on June 30, 1905, was 19 feet at mean low water.

The ordinary range of the tide is about 2 feet.

With the completion of the project a substantial reduction in ocean rates may be expected, due to increased draft and improved facilities for lighterage.

The commerce of the port of Carrabelle, Fla., consists principally of timber, naval stores, dressed and kiln-dried lumber, shingles, and miscellaneous articles.

July 1, 1904, balance unexpended		$26,804.54
Amount appropriated by river and harbor act approved March 3, 1905		15,000.00
Amount allotted from appropriation for maintenance of river and harbor improvements, act of April 28, 1904		5,000.00
		46,804.54
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$18,000.00	
For maintenance of improvement	13,694.97	
		31,694.97
July 1, 1905, balance unexpended		15,109.57
July 1, 1905, outstanding liabilities		37.20
July 1, 1905, balance available		15,072.37
Amount (estimated) required for completion of existing project		45,000.00

(See Appendix Q 1.)

2. Harbor at Apalachicola Bay, Florida.—The town of Apalachicola lies at the mouth of the Apalachicola River, and the deep water along the river front forms the inner harbor.

At the mouth of the river, between the inner harbor and the 3-fathom anchorage area in Apalachicola Bay, there is a bar, of which the original width between 8-foot contours was 7,000 feet and the minimum depth of water 3.5 feet. Across this bar the lumber exported is lightered either to the 3-fathom anchorage in Apalachicola Bay or through Bulkhead shoals to the anchorage of Carrabelle, 25 miles distant. The 3-fathom anchorage area is entered via West Pass, where originally the depth was about 13 feet. The original depth over Bulkhead shoals was less than 4 feet.

The original project, approved June 14, 1880, provided for dredging a channel 100 feet wide and 11 feet deep through the bar at the mouth of the river, the width of cut to be increased to 200 feet if the results justified this enlargement.

This project was amended September 19, 1890, to include dredging a channel 9 feet deep and not less than 100 feet wide across the Bulkhead shoals.

Upon this project as amended has been expended $154,000, of which $100,000 has been applied to maintenance in repeated dredging of the cut across the bar at the mouth of the river. The channel through

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Bulkhead shoal, dredged in 1891–92, remains practically unchanged, with a minimum depth of 8 feet at mean low water.

Prior to the adoption of any project of record in this office $28,600 was expended on this improvement, 1833–39, but the object and results of such expenditures are unknown.

The existing project, approved by act of March 3, 1899, provides for a channel 100 feet wide, 18 feet deep at mean low water through the West Pass, along the northern shore of St. George Island, and across the bay to the water front of Apalachicola, estimated to cost $350,000, and $20,000 or $30,000 annually for maintenance of completed work. (See Annual Report of the Chief of Engineers for 1897, pages 1655–1659, giving report of survey, upon which the above project was based.)

Under an appropriation of $20,000, made by the act of March 3, 1899, a contract was entered into on December 16, 1899, for dredging a channel 18 feet deep at mean low water through the West Pass entrance and the Link channel, along the north shore of St. George Island to St. George anchorage. Work under this contract was commenced March 28, 1900, and suspended May 12, 1900, due to the expenditure of funds available. The dredging done secured a channel 17 feet deep, 150 feet wide, and 5,280 feet long over the bar at West Pass entrance, but no work was done on the Link channel. After the execution of this work West Pass shoaled rapidly, particularly at the outer crest of the bar, until the available depth on this crest at mean low water on June 30, 1904, did not exceed 13 feet.

Under an appropriation of $40,000, made available by the act of June 13, 1902, a contract was entered into with Rittenhouse Moore, October 1, 1903, and a channel across the bar at West Pass was redredged to a minimum depth of 16 feet, work being completed November 10, 1904. On June 30, 1905, the outer crest of the bar had shoaled to about 15 feet at mean low water.

An allotment of $20,000 was made from the appropriation of 1902 for dredging on the bar at the mouth of the river, which had been gradually shoaling since the last dredging was done, in 1897. Work was commenced November 13, 1902, and continued until February 17, 1903, when a channel 80 feet wide, with a minimum depth of 9 feet at mean low water, had been secured from a point 1,047 feet south of the red beacon to deep water in the river. With the balance of this allotment a channel 567 feet long was also dredged 80 feet wide and 9 feet deep through the "Oyster Lump," south of the red beacon, on the line marked by St. George Island light.

The channel across the bar at the mouth of the river shoaled after this dredging was completed in February, 1903, until on June 30, 1904, at many points the depth did not exceed 6 feet at mean low water.

With allotments of $12,500 and $5,000, made from the appropriation in river and harbor act of April 28, 1904, this channel was redredged to a width of 80 feet and a depth of about 9 feet, work being completed October 12, 1904. On June 30, 1905, the limiting depth at the outer end of the cut did not much exceed 7 feet, but the general depth is 1 to 2 feet greater.

The amount expended on the existing project up to the close of the fiscal year ending June 30, 1905, was $77,386.32, of which about $57,500 was for maintenance.

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The ordinary range of the tide is about 2 feet.

The opening of West Pass will reduce the freight on foreign and coastwise freight from Apalachicola about 50 cents per ton.

The commerce of this port is in timber, cotton, naval stores, staves, a large quantity of dressed and kiln-dried lumber, shingles, laths, and miscellaneous freight.

July 1, 1904, balance unexpended	$31,899.85
Amount appropriated by river and harbor act approved March 3, 1905	40,000.00
Amount allotted from appropriation for maintenance of river and harbor improvements, act of April 28, 1904	5,000.00
	76,899.85
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	36,786.17
July 1, 1905, balance unexpended	40,113.68
July 1, 1905, outstanding liabilities	43.30
July 1, 1905, balance available	40,070.38
Amount (estimated) required for completion of existing project	300,000.00

(See Appendix Q 2.)

3. Apalachicola River, the Cut-off, and Chipola River, Florida.—(a) Apalachicola River, the Cut-off, and lower Chipola River.—From the junction of the Chattahoochee and Flint rivers to the Gulf of Mexico (Apalachicola Bay), the Apalachicola River has a length of about 137 miles and a low-water slope of about 3 inches to the mile. The width varies from 150 to 300 yards, and the available depth was originally 6 feet at low water, except where obstructed by snags and sunken logs.

The Confederate authorities obstructed the channel at a point about 47 miles above the mouth, causing the river to break through by a channel known as Moccasin Slough into the River Styx, the latter a tributary entering the Apalachicola a few miles below the Confederate obstructions. Moccasin Slough was very narrow and tortuous and much obstructed by logs, snags, etc., and the former channel has gradually filled up.

About 55 miles above the mouth steamboats may leave the river, and after passing through the cut-off, lower Chipola River, and Lee Slough reenter it about 17 miles farther down, thus making many landings of much greater importance than those upon the corresponding part of the main river, which includes Moccasin Slough, above mentioned.

The original project, adopted by the act of June 23, 1874, contemplated securing a channel 100 feet wide and 6 feet deep at low water by the removal of snags and overhanging trees and widening and straightening Moccasin Slough and the Elbows, at an estimated cost of $80,333.

The act of September 19, 1890, adopted an addition to the project providing for the clearing of a channel 60 feet wide and 5 feet deep through the Cut-off, Lee Slough, and the lower Chipola River at a cost of $7,500.

The amount expended on work under this project since 1874 to the close of the fiscal year ending June 30, 1905, was $73,750. In addition there was expended between 1828 and 1831 $13,000 for which no project is of record. These expenditures have improved

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Moccasin Slough sufficiently for present purposes and maintained the river reasonably free from snags and other obstructions and enabled steamboats to make use of the cut-off, lower Chipola River, and Lee Slough either by day or night. An available depth of 6 feet had been secured in the Apalachicola River, except across the bar near Blountstown, over which about 3 feet can be carried, and in the Cut-off, lower Chipola River, and Lee Slough 5 feet has been secured. The Cut-off and Lee Slough have been widened also at the narrowest places so that steamboats can pass through readily going downstream and can pass upstream with little difficulty, but the channel is still very crooked, with some bends so sharp that in a few places lines are sometimes used going upstream, and the steamboats prefer the main river on the uptrip. It is estimated that the project is one-half completed.

The work was done with the plant belonging to the Chattahoochee and Flint River improvements, and comprised cutting overhanging timber, removing snags and logs, blasting out cypress stumps, and widening the slough and Cut-off by clearing the points of timber and dredging them off, depositing the dredged material in the deep holes or upon the banks.

During the fiscal year work has been confined to the maintenance of the improvement.

Variation of the water level is from 0 to 30 feet at Chattahoochee River bridge.

This river is navigable throughout its entire length of 137 miles.

As the country bordering on the Apalachicola River is almost entirely dependent upon the river for the transportation of its supplies and products, this improvement is essential to the development of this section, but in the absence of any basis of comparison the effect upon freight rates can not be determined.

The commerce of the river consists chiefly of cotton, naval stores, general merchandise, saw logs, and timber for export, and is so combined with that of the Chattahoochee, Flint, and upper Chipola rivers that a separation is impossible. The commerce of all these streams amounted to about $4,000,000 in 1899, about $4,777,000 in 1900, about $11,000,000 in 1901, about $11,500,000 in 1902, about $13,324,000 in 1903, about $10,990,000 in 1904, and about $11,065,500 in 1905. For detailed statistics, see reports on Flint and Chipola rivers.

By the terms of the river and harbor act approved March 3, 1905, the upper Chipola River from Marianna to its mouth was included in this improvement, and will hereafter be reported under this head; no expenditures were made upon this river during the fiscal year.

(*b*) *Upper Chipola River, Florida, from Marianna to its mouth.*—The river from Marianna to the head of the Dead Lakes has a general low-water depth of 5 feet and width varying from 60 to 200 feet, but is greatly obstructed by rock shoals, snags, and overhanging trees. Three bridges also form obstructions, their headways above low water being 17, 16, and 15 feet, respectively.

At Look and Tremble shoal, about 45 miles above the Dead Lakes, there is a fall of 5 feet in 40 over rock bottom. Between this shoal and the Dead Lakes there is a long, flat mud bar, at Sister Islands, over which but 2 feet can be carried at low water. The channel through the Dead Lakes, which is considered part of this improve-

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ment, has plenty of water, but is obstructed by snags and large cypress stumps and trees.

The approved project, adopted by act of March 3, 1899, provides for clearing a low-water channel 3 feet deep and 60 feet wide from Marianna to the foot of the Dead Lakes, estimated to cost $41,000, exclusive of necessary plant, which would comprise a snag boat, drilling barge, and dump scow. (See Annual Report of the Chief of Engineers for 1899, p. 1417.)

The amount expended to June 30, 1905, was $7,000, of which $5,000 was applied to the river above Sister Islands and $2,000 to the lower end of Dead Lakes. Snags, logs, and overhanging trees were removed, and a channel blasted through the rock reefs from Marianna to Look and Tremble shoal. Wing dams were built below some of the shoals to raise the water level on the shoals, and below Look and Tremble shoal, down as far as Sister Islands, snags, logs, and overhanging timber were removed as well as available funds permitted. From the lower end of the Dead Lakes, for a distance of 7 miles, a channel 60 feet wide was cleared of obstructions by removing logs, overhanging trees, cypress stumps, and knees. Very little benefit has been derived from the expenditure above Look and Tremble shoal, except to the timber industry, but the work done below the shoal and in the Dead Lakes has been of great benefit, as there are many turpentine stills below this shoal, giving a considerable commerce on this portion of the river, and in the Dead Lakes a large commerce in towing logs.

The variation of the water level is 0 to 14 feet.

Two feet is the maximum depth at low water over the shoalest part of the river below the shoal Look and Tremble. The actual head of navigation at low water is Sister Islands, 35 miles above the foot of the Dead Lakes.

The river is still obstructed by shoals at Sister Islands, Look and Tremble shoal, and at numerous points above, as well as by the bridges mentioned. The channel below Sister Islands is much obstructed by snags and logs, and this same condition exists in the channel through the Dead Lakes, except where improved at the lower end.

The commerce of this stream consists principally of naval stores, round and square timber, lumber, and other miscellaneous freights, the estimated value of which was, on June 30, 1905, $408,500.

The section of the country through which this stream flows is heavily timbered with long leaf yellow pine and cypress, which is now being rafted down this stream in large quantities. The total amount of this traffic is reported as 10,000,000 feet B. M., and is included in the valuation of timber and lumber exports for Apalachicola Bay and Carrabelle Harbor, Florida.

July 1, 1904, balance unexpended	$3,750.00
Amount appropriated by river and harbor act approved March 3, 1905	12,000.00
	15,750.00
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	3,750.00
July 1, 1905, balance unexpended	12,000.00
Amount (estimated) required for completion of existing project	42,000.00

(See Appendix Q 3.)

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4. Flint River, Georgia.—Originally this river was navigable at low water from its mouth to Bainbridge, a distance of 36 miles, for boats drawing 3 feet, but the channel was narrow, crooked, and greatly obstructed by logs, snags, and overhanging trees. Above Bainbridge the channel was so obstructed by rock shoals, loose rock, and bowlders that there was no navigation except on a rise of 5 feet, when steamboats could run to Albany, 105 miles above the mouth. Above Albany to Montezuma, 182 miles from the mouth, the channel was so obstructed by sand and rock shoals, bowlders, snags, logs, and overhanging trees that the river was not navigable at a low-water stage.

The original project called for a channel 100 feet wide and 3 feet deep at extreme low water from the mouth of the river to Albany, Ga., at an estimated cost of $184,862.

This project was extended in 1870 to give a channel for light-draft steamers at moderate stages of water from Albany to Montezuma by the removal of logs, snags, and overhanging trees, cutting through rock reefs, and deepening sand bars by contraction works, at an additional cost of $15,000.

The amount expended up to the close of the fiscal year ending June 30, 1905, was $234.710.99. As a result of the work done the river is now navigable throughout the year from Albany down to Newton, 33¼ miles, and from Bainbridge to the mouth, 36 miles, there being a good channel, with 3 feet available at low water, throughout these sections.

Between Bainbridge and Newton, 35¾ miles, the river is navigable for light-draft boats only, and the channel is narrow and still much obstructed by bowlders and rock reefs. Considerable work has been done between these points, and operations for the next few years will be confined to this portion of the river. When the improvement of this section has been completed the river will be open to navigation at low water from its mouth to Albany, Ga.

The section between Albany and Montezuma, 77 miles, is still much obstructed, although it has been repeatedly cleared of snags and similar obstructions, in accordance with the project. As there is no navigation on this part of the river, it is recommended that no further work be done on this section until the improvement of the section between Bainbridge and Newton renders work already done fully available.

A large amount of work was done on the river during the past fiscal year between Albany and Newton, completing this part of the channel to a width of 60 feet and an available depth of 3 feet.

The water level varies from 0 to 40 feet.

During ordinary low water Albany, Ga., is the head of navigation, but in periods of extreme low water, such as occurred during the fall of 1904, interruptions occur in the section between Bainbridge and Newton.

The commerce consists principally of cotton, naval stores, provisions, general merchandise, saw logs, and timber for export. Several very large sawmills are located at Bainbridge, but no record of the amount of lumber manufactured is kept, as shipments are made by rail. A large part of the saw logs used by these mills comes down the river.

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To make the improvement below Albany fully available it will be necessary to widen the channel in many places between Bainbridge and Newton and to remove many obstructions to secure the width of 60 feet and the depth of 3 feet now available in the section above. This work is largely permanent rock work, and its completion will greatly benefit the section of country between Albany and the mouth of the river. There are many turpentine stills in operation on the river which depend upon the water transportation for their products and supplies.

The commerce of the lower part of this stream is so combined with that of the Chattahoochee and Apalachicola rivers that it is impossible to give a statement in regard to it. The commerce of that part below Albany down as far as the improvement has been carried is estimated to be 30,792 tons, valued at $1,539,600, for the past fiscal year.

July 1, 1904, balance unexpended		$6,558.66
Amount appropriated by river and harbor act approved March 3, 1905		20,000.00
		26,558.66
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$4,000.00	
For maintenance of improvement	1,269.65	
		5,269.65
July 1, 1905, balance unexpended		21,289.01
July 1, 1905, outstanding liabilities		1,195.47
July 1, 1905, balance available		20,093.54
Amount (estimated) required for completion of existing project		73,000.00

(See Appendix Q 4.)

5. Chattahoochee River, Georgia and Alabama, below Columbus.—Columbus, Ga., is 223 miles above the junction of this river with the Flint and 360 miles above the mouth of the Apalachicola River, formed by the confluence of the Chattahoochee and Flint. Originally boats were always able to reach Columbus; but navigation was difficult and dangerous by day and impossible by night, owing to the large accumulation of logs, snags, and overhanging trees and to sand, rock, and marl shoals obstructing the channel.

The project for improvement, adopted in 1873, provided for a low-water channel 100 feet wide and 4 feet deep from Columbus, Ga., to Chattahoochee, Fla., at the junction of the Flint, which was to be obtained by the removal of logs, snags, and overhanging trees, cutting through the rock and marl shoals, and scouring out sand bars by works of contraction and shore protection. The estimated cost of this work from Chattahoochee, Fla., to Eufaula, Ala., 139 miles, was $145,247; but no estimate of cost for that part between Eufaula, Ala., and Columbus, Ga., was ever made.

The amount expended on this work to the close of the fiscal year ending June 30, 1905, was $493,066.42, largely expended in maintenance, removing the annual influx of obstructions brought in from caving banks.

No increased depth as a whole has been gained; but by removing the logs, snags, and overhanging trees and removing the sand, gravel, marl, and rock reefs the river has been kept open to navigation. As nearly all the land along the banks of the river and its tributaries

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has been gradually cleared, each rainy season has brought increasing quantities of sand into the river, filling the original river bed with shifting sand and gravel bars and greatly changing its regimen. In fact, this stream has now a changeable bed, and it is practically impossible to say one year exactly where work will be needed the next. Four feet draft can be carried at ordinary low water, but at extreme low water scant 3 feet is the maximum draft that can be counted upon.

Below Eufaula, Ala., the river is now in a fair condition, with an available low-water depth of 3½ feet; but between Eufaula and Columbus there are a number of bars and isolated obstructions which cause trouble, particularly at extreme low water. The most serious of these obstructions was a series of sand bars formed in the river from the wharves at Columbus, Ga., down to Mary Freemans bar, 3 miles below, which made it impossible for steamboats to reach Columbus, and the head of navigation during the period of extreme low water was therefore Mary Freemans bar.

During the past fiscal year snags and other obstructions were removed from the river throughout its length, the system of jetties immediately below Columbus was extended down the river to the Indian Mound, 7 miles below Columbus, and channels were dredged at the wharf at Columbus, at Jennys Island, Abercrombies, Woolfolks, and just above, Broken Arrow, Indian Mound, Snake shoals, and Chambers Landing. As a result of this work Columbus has become the head of navigation, and boats have been able to reach there at all times, except in the fall of 1904, when the unusual drought and unprecedented low water put a stop to all navigation.

A large number of other sand bars and shoals between Columbus, Ga., and Eufaula, Ala., still need improvement, and the wing dams and training walls already built require repairs and maintenance. In addition, the annual accumulations of snags and other obstructions must be removed from the river throughout its length.

The variation of the water level is from 0 to 47 feet at Columbus.

The commerce of this stream consists of cotton, cotton seed, fertilizers, grain, naval stores, provisions, hardware, and general merchandise, and is so combined with that of the Flint and Apalachicola rivers that a separation is impossible. It is given under the report of the Flint River as 117,757 tons, valued at $10,657,000.

The effect of the improvement has been to give to Columbus and all other points on the river water rates, or a material reduction over rates to all rail points, but the exact amount of reduction can not be stated.

July 1, 1904, balance unexpended		$40,720.46
Amount appropriated by river and harbor act approved March 3, 1905		75,000.00
		115,720.46
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$10,000.00	
For maintenance of improvement	35,856.10	
		45,856.10
July 1, 1905, balance unexpended		69,864.36
July 1, 1905, outstanding liabilities		9,259.72
July 1, 1905, balance available		60,604.64
July 1, 1905, amount covered by uncompleted contracts		947.03

(See Appendix Q 5.)

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6. Choctawhatchee River, Florida and Alabama.—The Choctawhatchee River is 162 miles long from Newton, Ala., to its mouth, in Choctawhatchee Bay, an arm of the Gulf of Mexico.

Originally the river was impassable during low water for about 10 miles below Newton, due to marl reefs and fish-trap dams, and for the remaining 152 miles to the mouth it was much obstructed by snags, logs, overhanging trees, and sand and gravel bars.

The project for the improvement, as amended in 1890, contemplates the creation of a low-water navigable channel throughout, by removing logs, snags, and overhanging trees, by excavating rock and marl shoals, and by contraction works and shore protection, at an estimated cost of $112,832.

The amount expended on this river under the existing project (i. e., since 1874) up to the close of the fiscal year ending June 30, 1905, was $166,690.02, of which the greater part has been expended in maintenance.

The following results have been accomplished:

A channel 40 feet wide and 3 feet deep has been blasted through the marl shoals for a distance of about 3 miles from a point about 8 miles below Newton to the lower end of these shoals above Pates Landing. The river has been partially cleared of snags and other obstructions from Pates Landing to Geneva. A fairly navigable channel 3½ feet deep at low water was secured by snagging and works of regulation from Geneva to Caryville, but is again much obstructed. The remainder of the lower river has repeatedly been cleared of obstructions, but is at present much obstructed, except the section below the mouth of the Holmes River, which was thoroughly cleaned out during the fiscal year. A channel 60 feet wide and 5½ feet deep at mean low water was dredged through the bar at the mouth of the river (Cypress Top).

The actual head of navigation at low water on June 30, 1905, was the mouth of the Holmes River, 33 miles above the mouth of the river. The minimum draft that could be carried to this point was about 2½ feet, but the draft is at least 1 foot greater, except at Cow Ford bar, where trouble has recently developed.

There is no commerce on the river above Geneva, with the possible exception of a small movement of logs. Below Geneva there is a large commerce in logs and hewn timber, and four steamers ply between Pensacola and Vernon on the Holmes River.

Below Geneva the channel should be kept free from obstructions, Cow Ford bar should be improved, and the channel across the bar at the mouth of the river (Cypress Top) should be further deepened to enable tugs to handle the timber brought down, and future appropriations should be applied to this work.

The commerce on this stream is mainly saw logs, timber, naval stores, and general merchandise.

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July 1, 1904, balance unexpended	$3,270.70
Amount appropriated by river and harbor act approved March 3, 1905	10,000.00
	13,270.70
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	3,960.72
July 1, 1905, balance unexpended	9,309.98
July 1, 1905, outstanding liabilities	559.52
July 1, 1905, balance available	8,750.46

(See Appendix Q 6.)

7. Holmes River, Florida, from Vernon to its mouth.—Holmes River empties into the Choctawhatchee River about 40 miles above the mouth of the latter. It is a wide and deep stream to the town of Vernon, 25 miles above its mouth, but was originally obstructed by sunken logs, fallen timber, and overhanging trees, and was only available for navigation by small sailing craft and barges, which occasionally made trips up to Vernon.

The present project for the improvement of the stream provides for making a navigable channel by removing logs and snags from the river and overhanging trees from its banks from the mouth up to the town of Vernon.

The total amount expended on this improvement up to the close of the fiscal year ending June 30, 1905, was $12,468.82, of which $10,308.02 was upon Holmes River and $2,160.80 upon Lagrange Bayou.

Prior to June 30, 1902, the channel was cleared of all obstructions that were then found and made available for the small craft that then used the stream. A considerable trade having sprung up on this river, work was resumed during the fall of 1903 and the river cleared of obstructions from Vernon to its mouth.

During the fiscal year an allotment of $2,000 was made from the appropriation in river and harbor act of April 28, 1904, and with these funds the river was again thoroughly cleared of all obstructions from Vernon to its mouth.

The importance of this improvement has increased greatly in the last few years, and four steamers are now engaged in the large and growing trade between Vernon and Pensacola.

The commerce of the stream consists of cotton, turpentine, rosin, molasses, honey, and miscellaneous articles, the value of which has grown from practically nothing in 1902 to $500,000 in 1905.

Amount appropriated by river and harbor act approved March 3, 1905	$2,000.00
Amount allotted from appropriation for maintenance of river and harbor improvements, act of April 28, 1904	2,000.00
	4,000.00
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	2,468.82
July 1, 1905, balance unexpended	1,531.18
July 1, 1905, outstanding liabilities	664.02
July 1, 1905, balance available	867.16

(See Appendix Q 7.)

8. Blackwater River, Florida.—The original project for this improvement was adopted March 3, 1899, and provided for securing a

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channel 9 feet deep from Milton, Fla., to Pensacola, at an estimated cost of $20,000. Under this project $5,000 was expended, and a channel of the required depth secured in the river proper.

The river and harbor act of March 3, 1905, contains the following provision:

Improving Blackwater and Upper East bays and Blackwater River, Florida, from Milton to the mouth, in accordance with the report submitted in House Document Numbered One hundred and ninety-three, Fifty-eighth Congress, second session, ten thousand dollars.

This in effect provides for the completion of the original project, fixing the width of the channel at 100 feet. No work has yet been done under this appropriation.

The maximum draft that could be carried over the improvement at mean low water on June 30, 1905, was 7 feet. The usual variation of water surface is 2 feet. The head of navigation is at Milton, about 4 miles above the mouth of the river proper.

The commerce of this stream consists of timber, lumber, sash and doors, wool, and other products, having an estimated value of $800,000 per annum. The dry dock at Bagdad and marine railway at Milton both do a large business, which would be materially increased by the completion of the project.

Amount appropriated by river and harbor act approved March 3, 1905	$10,000.00
July 1, 1905, balance unexpended	10,000.00
Amount (estimated) required for completion of existing project	5,000.00

(See Appendix Q 8.)

9. Harbor at Pensacola, Fla.—The available depth across the inner bar at the entrance to this harbor in 1879, previous to any work of improvement, was 19.5 feet, the width of the channel being contracted by the encroachment of the Middle Ground shoal to the southward. The harbor entrance and channel way were also obstructed by wrecks, and the western shore line in the vicinity of Fort McRee was cutting away rapidly, almost the whole of the old Fort McRee washing away before the erosion was stopped.

The project of 1877 considered only the removal of the wrecks; that of 1878 called for the removal of these wrecks and for making a survey to determine further recommendations for improvement. The project of 1881 provided for dredging a channel 300 feet wide and 24 feet deep at mean low water for the temporary relief of navigation, and also for protecting the shore line near Fort McRee with a view to preventing further injurious changes. Dredging under this project was carried on at various times between 1881 and 1893, and at the close of the dredging operations in August, 1893, the available channel was 225 feet wide and 24 feet deep at mean low water. Two groins, one 360 feet and the other 220 feet long, were completed in 1890 and still serve to hold the shore line near Fort McRee.

In 1891 a special Board of Engineers presented a project for opening a new channel across the Caucus shoal, following the direction of the ebb current, by means of two jetties, assisted by dredging, if necessary. In 1895 a second special Board of Engineers recommended that no change be made in the project of 1891, but that dredging be tried, using one of the hydraulic dredges belonging to the

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United States to open up a channel 26 feet deep at mean low water and as wide as practicable on the line of deepest water across the Caucus shoal and approximately on the line of the axis of the jettied channel proposed by the Board of Engineers in 1891. In December, 1895, this channel was opened by the U. S. dredge *Gedney* to a width of 120 feet and depth of 24 feet at mean low water. It has a length of about 10,000 feet across Caucus shoal and is now known as the Caucus channel.

In 1896 the same Board that recommended the first amendment to the project of 1891 submitted a second amendment providing for the expenditure of all funds available in continuing the work of dredging across the Caucus shoal and for building a dredge and opening the channel across the Caucus shoal 30 feet deep at mean low water to a width of at least 300 feet, with such side slopes as the material would assume, if sufficient funds were made available by Congress. Until a channel should be opened by dredging across the Caucus shoal, as above proposed, the Board recommended that the construction of the jetties for its maintenance be not considered.

The river and harbor act of March 3, 1899, extended this project to "securing a channel depth of 30 feet at mean low water from the Gulf of Mexico to the dock line at the east end of the city of Pensacola."

With balance of funds left from the appropriation of March 3, 1899, and an allotment of $5,000 from the emergency act of June 6, 1900, 184,753.8 cubic yards of material was removed during the fiscal year ending June 30, 1902, by the U. S. dredge *Comstock*, loaned from the Galveston district. This work restored the 30-foot depth for a width of 100 feet throughout the center of the channel, and for an additional width of 100 feet a depth of 28 feet was obtained.

The amount expended on these projects to June 30, 1905, was $725,956.94. The work done comprises the removal of the wrecks obstructing the channel, dredging a large amount of material from the inner bar, opening and redredging a 30-foot channel across the Caucus shoal, and the protection of the shore line, by the construction of two groins near old Fort McRee, from erosion, which are still in good condition.

The river and harbor act approved June 13, 1902, appropriated $220,000, of which $150,000 might be used in constructing a seagoing suction dredge. This dredge is now building under the direction of Maj. J. C. Sanford, Corps of Engineers, and details of operation are given in Appendix H 7, herewith. The same act modified the project, which now involves dredging a channel 30 feet deep and 500 feet wide from the Gulf of Mexico to the dock line at the east end of the city of Pensacola. There is no approved estimate of the cost of this project. Under this amended project there has been expended for maintenance of improvement $27,764.41 and for dredge construction $140,691.17.

After dredging was suspended in 1902 the channel shoaled gradually until the available depth at mean low water was about 26.5 feet, with an available width of less than 100 feet. As relief was urgently needed, the U. S. dredge *Winyah Bay* was borrowed from the Charleston district, and worked upon the channel from August 10, 1904, to February 14, 1905. She removed a total of 200,108 cubic yards, restoring the channel to a depth of 30 feet at mean low water

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for a width of 150 feet. The maximum draft that could be carried over the improvement at mean low water June 30, 1905, was 29.2 feet, this limiting depth being confined to a short shoal at the outer end. In general the channel is in excellent condition, and no further work will be required until the dredge *Caucus*, now nearing completion, is available.

The commerce of this port is very large. For the fiscal year ending June 30, 1903, the foreign exports were reported as $13,741,540, no record of the coastwise exports being available; in 1904, as $15,893,456, and in 1905 exports as $15,295,067 and imports as $985,840.

The completion of the project will give greatly increased facilities to the large commerce of Pensacola, but will not materially affect freight rates.

July 1, 1904, balance unexpended		$127,337.49
Amount appropriated by river and harbor act approved March 3, 1905		100,000.00
		227,337.49
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$50,182.28	
For maintenance of improvement	25,610.79	
		[a] 75,793.07
July 1, 1905, balance unexpended		151,544.42
July 1, 1905, outstanding liabilities		[b] 20,438.71
July 1, 1905, balance available		131,105.71
July 1, 1905, amount covered by uncompleted contracts		[c] 15,000.00

(See Appendix Q 9.)

10. Escambia and Conecuh rivers, Florida and Alabama.—These two names apply to one and the same stream, which flows through a heavily timbered country in southern Alabama and western Florida into Escambia Bay, an arm of Pensacola Bay. The timber from this district is brought down the river and forms a large part of all that is exported from Pensacola. Originally the river was much obstructed by snag, marl reefs, and sand bars, and a bar prevented the entrance of tugs to the mouth of the river, where the rafts are made ready to be towed to Pensacola, and seriously interfered with navigation.

The first appropriation for the improvement of this river was made in 1833, and prior to the adoption of the present project $5,000 was expended in removing obstructions. A subsequent appropriation of $5,500, made in 1836, was returned to the surplus fund in 1838. No further appropriations were made until 1880.

The present project, adopted June 14, 1880, is based upon reports of the examinations and surveys printed in the Annual Report of the Chief of Engineers for 1879, pages 843–852, and provides for the improvement of the river from its mouth to Indian Creek, Alabama, an estimated distance of 293 miles, by the removal of snags, logs, and overhanging trees, by excavating rock shoals, by works of contraction and shore protection, and by dredging a channel 150 feet wide and 5½ feet deep at mean low water through the bar at the mouth, all at an estimated cost of $87,430.

[a] Includes $50,182.28 on account of construction of dredge *Caucus*.
[b] Includes $15,104.16 on account of construction of dredge *Caucus*.
[c] On account of construction of dredge *Caucus*.

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The amount expended to June 30, 1905, was $104,884.51, largely for maintenance. These expenditures kept the river fairly free from snags and opened the channel across the bar at the mouth from time to time, and has greatly facilitated the rafting and towing of timber; but, due to lack of funds in recent years, the river, which in 1900 was practically free from obstructions, has again become so much obstructed as to seriously interfere with the rafting of timber at low-water stages. The channel across the bar has shoaled also, interfering with the movements of the towboats for the rafts. Snagging operations were resumed April 4, 1905, at Pine Barren, and will be continued throughout the coming season. Funds should be provided for operating the snag boat continuously throughout the low-water season and for redredging the channel across the bar at the mouth of the river.

The commerce of this stream is mainly in timber, lumber, and saw logs.

July 1, 1904, balance unexpended	$759.30
Amount appropriated by river and harbor act approved March 3, 1905	10,000.00
	10,759.30
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	1,643.81
July 1, 1905, balance unexpended	9,115.49
July 1, 1905, outstanding liabilities	812.00
July 1, 1905, balance available	8,303.49

(See Appendix Q 10.)

11. Alabama River, Alabama.—This river is formed by the junction of the Coosa and the Tallapoosa, 11 miles below Wetumka, on the Coosa River, and from this junction to its junction with the Tombigbee to form the Mobile it constitutes a 312-mile link in a waterway 815 miles long, from the Oostenaula and Coosawattee rivers, Georgia, to the Gulf of Mexico.

The river was originally so obstructed by logs, snags, and overhanging trees, and shoals, many with depths of but 2.5 feet, that during the low-water season navigation was practically by day only. Long detentions were frequent at many of the shoals below Selma, and when the water was unusually low traffic was suspended between Selma and Montgomery for three or four months in the year.

The original project, adopted in 1878, for the improvement of this stream (see Report of the Chief of Engineers for 1876, Part 1, p. 498) provided for securing a low-water channel 4 feet deep and 200 feet wide by removing snags, logs, and overhanging trees, by constructing works of regulation, and by dredging, all at an estimated cost of $229,741. On this project $185,000 was expended, principally in snagging operations and the construction of works of contraction. These expenditures greatly improved the condition of the channel, freeing it from obstructions, and secured a low-water depth of 4½ feet to 5 feet.

In 1891 the original project was amended to provide for a low-water channel 6 feet deep, which was to be secured in the same general way as contemplated in the original project, and the estimated cost was placed at $386,251, provided that at least $100,000 should be appropriation annually, and $10,000 a year thereafter for maintenance.

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Upon this project there has been expended to June 30, 1905, $234,400.10, but at no time since the adoption of the project have the appropriations been sufficient to do much more than maintain the channel, and in the last few years the channel has been deteriorating, as the funds available have been insufficient to maintain the contraction works already constructed, and work on the river has been confined to the operation of the snag boat.

On June 30, 1904, the maximum draft that could be carried to Montgomery was less than 3 feet. The actual head of navigation is Wetumka, on the Coosa River.

The river and harbor act approved March 3, 1905, contemplates securing a continuous channel not less than 4 feet deep in the Alabama River by open-channel work, and calls for a preliminary examination with a view of securing this channel from the mouth to Montgomery and from Montgomery to Wetumka.

As the benefits to be derived from the improvement of the Alabama River are very great, funds should be provided for the vigorous prosecution of work whether a new project is adopted or not, and as the most important work under the project to secure a channel 6 feet deep will be the dredging, the small dipper dredge belonging to the improvement should be kept at work and a suitable hydraulic dredge should be constructed. Works of regulation should be maintained and new works constructed in connection with the dredged channel.

Variation of the water level is from 0 to 59 feet at Montgomery, Ala.

The commerce of this stream is important, consisting principally of cotton, cotton seed, fertilizer, grain, lumber, shingles, naval stores, staves, and a large quantity of miscellaneous freight of all descriptions, estimated for the past fiscal year as 127,250 tons, valued at $12,907,500. This, however, is but a small part of the freight movement that is affected by the improvement, for the actual shipments by water have been relatively small. The rates quoted on the first six classes of through freight from the east to Montgomery, via sea and river, average 12 cents per hundred lower than the corresponding all-rail rates; therefore, with the river improved for continuous navigation, it is estimated that 100,000 tons of the present freight movement would either go by river, or at river rates, and the resulting saving would be enormous. In addition, improved facilities would render possible an actual reduction in rates on freight now carried by river.

July 1, 1904, balance unexpended	$8,447.33
Amount appropriated by river and harbor act approved March 3, 1905	100,000.00
	108,447.33
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	8,847.43
July 1, 1905, balance unexpended	99,599.90
July 1, 1905, outstanding liabilities	16,032.71
July 1, 1905, balance available	83,567.19
July 1, 1905, amount covered by uncompleted contracts	13,777.69

(See Appendix Q 11.)

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12. Coosa, Oostenaula, and Coosawattee rivers, Georgia and Alabama.—The Coosa is formed at Rome, Ga., by the junction of the Oostenaula and Etowah rivers, which have their sources in northern Georgia. The Oostenaula is formed by the junction of the Coosawattee and Connesauga rivers, 56 miles northwest of Rome. The Oostenaula above Rome, Ga., and its tributary, the Coosawattee, are navigable for light-draft boats during nine months of the year for a distance of about 105 miles, but the Etowah and the Connesauga are not navigable.

The Coosa River has always been navigable for light-draft boats from Rome, Ga., to Greenport, Ala., an estimated distance of 162 miles, and this part of the river is of such a character as to make its improvement by works of contraction and channel excavation entirely practicable.

From Greenport, Ala., to Wetumka, Ala., a distance of 142 miles, locks and dams are required in conjunction with works of contraction and channel excavation to provide for navigation.

From Wetumka to the junction of the Tallapoosa River the river is navigable at all seasons.

The ordinary variation of the water surface is, at Rome, Ga., 0 to 30 feet; at Greenport, Ala., 0 to 15 feet; at Wetumka, Ala., 0 to 50 feet.

In compliance with the river and harbor act approved June 13, 1902, a survey was made of the Coosa River from Lock 4 to Wetumka, Ala., and an examination of the Coosa and Alabama rivers from Wetumka, Ala., to the mouth of the Alabama River, and a report has been submitted upon the feasibility, advisability, and probable cost of securing a 6-foot navigation in these rivers from Gadsden, Ala., to the mouth of the Alabama River. This report was submitted to Congress and printed as House Document No. 219, Fifty-eighth Congress, third session.

As existing data in reference to discharges, slopes, and character of lock and dam foundations are very meager, additional investigation covering these and other points should be carried on to determine the details of any extensive improvements undertaken in future.

(*a*) *Coosa River between Rome, Ga., and East Tennessee, Virginia and Georgia Railroad bridge.*—The original project for the improvement of the Coosa River contemplated the opening of a continuous water route of transportation from the Mississippi River to the Atlantic Ocean by way of the Ohio, Tennessee, Coosa, Etowah, Ocmulgee, and Altamaha rivers, with canals from the Tennessee to the Coosa and from the Etowah to the Ocmulgee. This was designated as the "southern route." The low-water depth and width of the channel proposed can not be stated from the records at hand.

Various examinations and estimates for the improvement of parts of this section of river have been made from time to time up to the adoption of the existing project, September 19, 1890. This project, as modified by act of Congress of July 13, 1892, formed a part of a plan submitted in 1875 for a proposed waterway from the Mississippi to the Atlantic via the Tennessee River, and provides for a crib and timber lock 200 by 32 feet and a 3-foot lift, with excavation for a 4-foot channel between Rome, Ga., and Wills Creek in Alabama, at a total estimated cost of $180,000; for three locks between Greenport and Lock 4 (Whisenant and Ten Island shoals), 210 feet long, 40

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feet wide, and an extreme low-water depth of 4 feet on miter sills, together with a 3-foot channel between Locks 1 and 3, at a total estimated cost, including accessory dams and dikes, of $155,616.23; for five locks and dams from and including Lock 4 to the East Tennessee, Virginia and Georgia Railroad bridge, the locks to have an available length of 280 feet, width of 52 feet, and an extreme low-water depth of 6 feet over the miter sills, together with a connecting channel 100 feet wide and 4 feet deep at extreme low water, at a total estimated cost of $1,160,491, or at a total cost for the entire improvement of $1,496,107.23.

To June 30, 1905, there has been expended on this section of the Coosa $1,027,826.09, of which $504,126.09 has been expended upon the existing project, and $523,700 prior to its adoption. The work accomplished is as follows, of which expenditures about 10 per cent has been for maintenance:

Locks 1, 2, and 3, Coosa River, commenced prior to 1890, have been completed. They are situated, respectively, 0.68 mile, 3.86 miles, and 5.24 miles below Greenport, Ala., and have available lengths of 175 feet and widths of 40 feet.

Lock 4 (25.89 miles below Greenport), commenced since the adoption of larger dimensions above mentioned, has, together with its appurtenances, been under construction, with desultory appropriations, since 1886, but is still incomplete.

Channel improvement has been extended as far down as Lock 4, and navigation is now possible to this point except at extreme low water, when interruptions occur a short distance above Lock 4.

During the past fiscal year work was confined to maintenance of the channel between Rome, Ga., and Gadsden, Ala., and to care of the large amount of plant on hand.

Even if it be decided to abandon the improvement of the river between Wetumka and the East Tennessee, Virginia and Georgia Railroad bridge for the present, Lock 4 should be completed, as the old cofferdam now acting as the west abutment of Dam 4 is in bad condition and extensive repairs will be required in the near future to preserve the dam. The completion of the lock will afford a passage to the rafts which must at present be run over the dam, frequently injuring it seriously, and will also extend navigation to the railroad at Riverside during the greater part of the year.

On June 30, 1905, the maximum draft that could be carried at ordinary low water between Rome, Ga., and Lock 4 was 3 feet, except at Horseleg shoals, 1½ miles below Rome, over which but 2 feet can be carried until a lock is constructed at this point.

The commerce of this portion of the Coosa consists principally of cotton, cotton seed, fertilizer, timber, lumber, staves, grain, and miscellaneous articles.

(*b*) *Coosa River between Wetumka and East Tennessee, Virginia and Georgia Railroad bridge.*—On account of the numerous rapids this part of the river has never been navigable.

The original project for the improvement of this section of the river, adopted September 19, 1890, as the result of a survey made in 1889 and modified by Congress July 13, 1892, contemplates slack-water navigation and provides for the construction of 23 locks and dams of varying lifts, of an available length of 280 feet and width of 52 feet, with 6 feet over the miter sills, no lift of lock to exceed 15

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feet. In addition, the channel is to be cleared of various rock reef and points, so as to give a least depth of 4 feet, all at an estimated cost of $5,106,422. There has been expended on this project to June 30, 1905, $399,966.15, of which about 2½ per cent has been for maintenance, which has resulted in the construction of the lowest lock of the series, known as No. 1, excepting the dam and gates, the excavation of the channel between this lock and the one next above, and the preparation of data and plans for additionl locks and dam, but these data are still incomplete. As yet no benefit has been derived from this improvement, and its value is entirely dependent on the completion of the entire system.

(*c*) *Oostenaula and Coosawattee rivers, Georgia.*—The Oostenaula and Coosawattee rivers have their sources in the mountains of northeastern Georgia and are tributaries of the Coosa.

From Rome to Carters Mill these rivers were originally obstructed by gravel bars, rock reefs, snags, and overhanging trees. Examinations were made in 1872 and 1874, and the original project, based upon them, was to secure 3-foot depth of channel on the Oostenaula and 24 inches of water on the Coosawattee to Carters Mill during nine months of the year, at an estimated cost of $28,208.50.

There was expended on this project $25,500.61, which in 1881 had practically completed it as intended and no work had been done upon either river since that time until 1903.

The existing project is that part of the river and harbor act approved June 13, 1902, applying to these rivers, as follows:

> Improving Coosa River, Georgia and Alabama, and the Oostenaula and Coosawattee rivers, Georgia, thirty-five thousand dollars, of which amount ten thousand dollars, or so much thereof as may be necessary, shall be expended upon the last-named rivers.

No estimate of cost other than that quoted from the river and harbor act above was made.

When this project was adopted the rivers were obstructed at high water by numerous closed bridges and at ordinary stages by sunken logs, trees, and snags; by overhanging trees; by various fish traps, erected under the laws of the State of Georgia, which require an opening of but 40 feet to permit the passage of boats; by the remains of two or three old milldams, which had been only partially removed, and by detached masses of rock lying in the channel, which were especially dangerous in the short turns.

The navigation during the low-water season was still further obstructed by a number of gravel bars and two or three rock bars or reefs.

There has been expended under this project $7,155.80, with which a channel has been cleared from Rome to Carters mill, having a minimum width of 30 feet and a depth of 2 feet, but on June 30, 1905, it had again become much obstructed by drift and overhanging trees.

No work was done during the fiscal year, and as the commercial benefits to be derived from the improvement are very small, no further appropriations are recommended at present.

Carters, on the Coosawattee, about 105 miles above Rome, is the head of navigation on this system of rivers, and small steamboats can reach this point with a draft of 2 feet at ordinary low water.

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July 1, 1904, balance unexpended	$18,790.47
Amount appropriated by river and harbor act approved March 3, 1905	25,000.00
	43,790.47
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	15,667.14
July 1, 1905, balance unexpended	28,123.33
July 1, 1905, outstanding liabilities	3,167.29
July 1, 1905, balance available	24,956.04
Amount (estimated) required for completion of existing project	6,059,913.00

(See Appendix Q 12.)

13. Operating and care of canals and other works of navigation on Coosa River, Georgia and Alabama.—Locks 1, 2, and 3 were opened to navigation June 30, 1890, and have been operated continuously ever since except during such periods as it was necessary to close them for repairs, and for a period of ten days in February, 1895, when the canal between Locks 2 and 3 was frozen over.

The amount expended to the end of the fiscal year ending June 30, 1905, was $143,298.99.

The expenses of operating and care of Locks 1, 2, and 3, and the improved channel as far down as Dam 4, during the fiscal year have been paid from the permanent indefinite appropriation provided by section 4 of the act of July 5, 1884. These expenses amounted to $8,442.57, exclusive of liabilities outstanding on June 30, 1905, of $173.09.

(See Appendix Q 13.)

14. Removing sunken vessels or craft obstructing or endangering navigation.—The schooner *Grace Andrews* and the tug *Bishop*, sunk near the mouth of Carrabelle River, Florida, having been reported as obstructions to navigation, were removed under contract after advertisement, as provided by law. Amount expended during the year upon this work, $1,750.20.

(See Appendix Q 14.)

SURVEY OF COOSA AND ALABAMA RIVERS, GEORGIA AND ALABAMA, MADE IN COMPLIANCE WITH THE RIVER AND HARBOR ACT APPROVED JUNE 13, 1902.

Capt. J. B. Cavanaugh, Corps of Engineers, submitted reports dated June 30 and November 22, 1904, on survey of *Coosa and Alabama rivers, with a view of determining the advisability of securing 6-foot navigation in said rivers and the probable expense thereof*, required by the river and harbor act approved June 13, 1902, and they were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law. Improvement of these streams in the manner indicated is not deemed advisable. The reports were transmitted to Congress and printed in House Document No. 219, Fifty-eighth Congress, third session. (See also Appendix Q 15.)

IMPROVEMENT OF RIVERS AND HARBORS IN WESTERN ALABAMA AND EASTERN MISSISSIPPI.

This district was in the charge of Maj. W. E. Craighill, Corps of Engineers. Division engineer, Lieut. Col. H. M. Adams, Corps of

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Engineers, until August 12, 1904, and Lieut. Col. Clinton B. Sears, Corps of Engineers, since that date.

1. Mobile Harbor, Alabama.—This channel originally had minimum depths of 5½ feet through Choctaw Pass and 8 feet through Dog River bar, the available draft to Mobile, via Spanish River, being limited to the latter depth.

The improvement of the channel of Mobile Harbor has been progressive. Between 1826, the date of the first appropriation for this work, and 1857 a channel 10 feet deep was dredged through the shoals in Mobile Bay up to the city of Mobile. Between 1870 and 1876 this depth was increased to 13 feet, the channel being dredged to a width of 300 feet through Choctaw Pass and 200 feet through Dog River bar.

In 1880 a project for a channel 17 feet deep and 200 feet wide was adopted, and appropriations between 1878 and 1886 were applied to the formation of a channel of these dimensions.

In the river and harbor act of August 11, 1888, a project for securing a channel 23 feet deep was adopted, this project being modified by the river and harbor act of September 19, 1890, so as to provide for the formation of a channel 23 feet deep and with a top width of 280 feet from the Gulf of Mexico to the mouth of Chickasaw Creek, above the city of Mobile. This channel was completed in 1896, subsequent appropriations, up to and including that made by the sundry civil act of July 1, 1898, having been applied to its maintenance.

The total amount expended on these projects was $3,648,630.60, of which about $115,000 is estimated to have been applied to maintenance.

The existing project for the improvement of Mobile Harbor provides for the formation of a channel 23 feet deep and 100 feet wide at bottom, with appropriate slopes, from the entrance of the bay to the mouth of Chickasaw Creek, at an estimated cost of $1,640,000, and the removal of sunken obstructions from Mobile Harbor at such times as the latter work may be authorized. This project was adopted by the river and harbor act approved March 3, 1899, and was modified by the acts of June 13, 1902, and March 3, 1905.

The amount expended on work under the existing project up to the close of the fiscal year ending June 30, 1905, was $1,098,559.94, of which amount the sum of $60,197.48 was allotted to work of maintenance.

The work of forming a 23-foot channel in Mobile River and Bay under the existing project has been in progress since 1899, under two continuing contracts, during the progress of which 12,402,956 cubic yards of material, scow measurement, has been removed from the channel. At the close of operations under the latter of these contracts, on November 11, 1903, an uninterrupted channel of the projected depth, 23 feet, and with a width varying from 55 to 150 feet, existed within the limits of the project. Portions of this channel have subsequently shoaled. The work of removing sunken trees, logs, timbers, and other dangerous obstructions from the channel of Mobile Harbor has also been prosecuted at various times under the existing project when such operations were necessary.

On June 7, 1904, an allotment of $50,000 was made from the appro-

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priation carried by the river and harbor act of April 28, 1904, for the purpose of maintaining the 23-foot channel in Mobile Harbor.

During the past fiscal year the following work has been accomplished:

(*a*) Under a contract dated November 12, 1904, the work of maintaining the Mobile Harbor channel with the funds allotted from the act of April 28, 1904, was commenced January 6, 1905. Dredging operations under this contract were in progress until June 6, 1905, when work was completed. In this interval 498,739 cubic yards of material, scow measurement, was removed from the channel of Mobile River and Bay, principally below the Mobile Bay light-house, and cuts with a least depth of 23 feet, a width of about 55 feet, and an aggregate length of 43,798 feet were formed through shoal stretches of the channel.

(*b*) By use of United States plant and hired labor, various obstructions in the ship channel, such as sunken trees, logs, and timbers, were removed between December, 1904, and June, 1905, thus maintaining the channel in a safe condition for navigation. This work was prosecuted under the funds allotted for maintenance work in Mobile Harbor from the act of April 28, 1904, and from the general appropriation of March 3, 1905.

Expenditures during the past fiscal year have resulted in increasing the depth of the channel in Mobile Bay about 1½ feet through stretches of the dredged cut which had recently shoaled and in maintaining the channel in a safe condition by the removal of sunken logs and timber.

On June 30, 1905, the minimum low-water depth within the limits of the 23-foot project was about 22 feet, the present low-water draft, the average range of the tide being 1½ feet.

The river and harbor act approved March 3, 1905, appropriated $200,000 for the improvement and maintenance of Mobile Harbor, and authorized the work of undertaking a survey of the Mobile Harbor channel for the purpose of submitting an estimate of the cost of "dredging and deepening the said channel to a depth of twenty-seven feet, the said channel to have a clear bottom width throughout of one hundred feet, with appropriate side slopes."

Under the approved project for the expenditure of the appropriation of March 3, 1905, the sum of $40,000 will be applied to works of improvement, while the balance will be held for application to maintenance work as the latter becomes necessary. The survey of the channel with a view to estimating the cost of a 27-foot project was commenced in April, 1905, and is still in progress.

The Mobile River is navigable for vessels of about 14 feet draft up as far as its head, which is about 45 miles above the city of Mobile.

Detailed information with reference to the work accomplished under the existing project is contained in the Annual Reports of the Chief of Engineers for 1901, page 1810, and 1904, page 1803. A reference to the report of the survey upon which the project for Mobile Harbor is based is printed in the Annual Report of the Chief of Engineers for 1904, page 324.

The imports and exports, foreign and domestic, for 1904, aggregated 1,781,008 tons; value, $49,517,047. Cotton, lumber, timber,

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breadstuffs, and hog products are the principal articles of export, and bananas and sisal grass the most important of the imports.

The effect of this project is to give Mobile an average reduction of about 20 per cent on rail freight rates from Atlantic seaport cities and to afford direct water freight rates from Mobile to foreign ports.

July 1, 1904, balance unexpended		$64,789.64
Amount appropriated by river and harbor act approved March 3, 1905		200,000.00
Received from sales of Government property		8.50
		264,798.14
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$10,766.79	
For maintenance of improvement	51,565.79	
		62,332.58
July 1, 1905, balance unexpended		202,465.56
July 1, 1905, outstanding liabilities		1,700.00
July 1, 1905, balance available		200,765.56
Amount (estimated) required for completion of existing project		560,000.00

(See Appendix R 1.)

2. Mobile bar, Alabama.—The channel across Mobile bar, which is located in the Gulf of Mexico off the entrance to Mobile Bay, had a depth of 23 feet at low water over ample width before any work of improvement was commenced. This depth accommodated all the traffic of the Mobile Bay ship channel, but it was not sufficient to permit of the utilization of the deep anchorage in lower Mobile Bay beyond the southern limit of the dredged cut leading to the city of Mobile.

The original and existing project for this improvement was adopted in the river and harbor act of June 13, 1902, and provides for the formation of a channel 30 feet deep at low water and 300 feet wide across Mobile bar, at an estimated cost of $91,250. This work of improvement formed a part of the Mobile Harbor project until March 3, 1905, when by the river and harbor act of that date it was made a separate project. By the latter act the limit of cost was also increased to $100,000.

Up to June 30, 1905, the sum of $46,993.40 was expended on this improvement, no portion of this amount having been applied to maintenance.

Between October 2, 1903, and July 20, 1904, under the allotment of $50,000 from the Mobile Harbor appropriation of June 13, 1902, a channel from 27 to 29 feet deep and about 225 feet wide was dredged at this locality. This channel has subsequently shoaled to some extent, and on June 30, 1905, there was a least depth of about 25½ feet on the light-house range through the dredged cut. As the bottom at this locality is hard the available low-water draft is limited to about 25 feet. The average range of the tide is 1.1 feet. The available death was increased during the early part of the fiscal year 1905 about 2 feet, but owing to subsequent shoaling the net increase has been reduced during the year to about one-half foot.

Available funds will be applied to the work of maintaining the existing cut and deepening the channel to the projected depth of 30 feet over a portion of its width during the coming year.

For commercial statistics see report on Mobile Harbor.

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A reference to the report of the survey on which the existing project is based can be found in the Annual Report of the Chief of Engineers for 1904, page 324.

July 1, 1904, balance unexpended	$26,592.09
Amount appropriated by river and harbor act approved March 3, 1905	50,000.00
	76,592.09
June 30, 1905, amount expended during fiscal year, for works of improvement	23,585.49
July 1, 1905, balance unexpended	53,006.60
July 1, 1905, outstanding liabilities	50.00
July 1, 1905, balance available	52,956.60
Amount (estimated) required for completion of existing project	25,000.00

(See Appendix R 2.)

3. Black Warrior, Warrior, and Tombigbee rivers, Alabama.—(*a*) *Black Warrior River.*—This name refers to that portion of the Warrior River above Tuscaloosa. Originally this part of the river was practically closed to navigation on account of shoals at and above Tuscaloosa..

The original project for the improvement was adopted in 1887, the object being to obtain a channel for barges of 6 feet draft at low water all the year round between Tuscaloosa and Daniels Creek, 14½ miles above, by means of five locks and dams, at an estimated cost of $741,670.

The river and harbor act of March 3, 1899, provided for the construction of Lock 4 (now known as Lock 13), at a cost not to exceed $190,500. As it was subsequently found that the lock could not be completed for the amount appropriated, the river and harbor act approved June 13, 1902, authorized the transfer of $14,000 from the unexpended balance of the Warrior River appropriations for the completion of this lock. The same act extends the upper limit of the improvement to the junction of the Mulberry and Locust forks of the river, 46½ miles above Tuscaloosa, and provides for making a survey for the location of Locks 5 and 6 (now known as 14 and 15) next above Lock 4. This survey was completed in 1903 at a cost of $2,413.50. Report thereon is printed in the Annual Report of the Chief of Engineers for 1904, page 1840.

Work so far done has been the completion of Locks 10, 11, and 12 (formerly known as 1, 2, and 3). Six feet of navigation can be carried 9 miles above Tuscaloosa to Lock No. 13 (formerly known as Lock 4). Lock No. 13 is now ready for navigation, though some minor parts of the work remain unfinished. This will give 3 miles additional navigation to the site of Lock 14. Beyond this there has been no improvement.

The total amount expended on the improvement to June 30, 1905, including the survey mentioned, was $798,159.03, none of which was applied to maintenance.

The improvement of the Black Warrior River between Tuscaloosa and Daniels Creek is based upon the report of a Board of Engineers, dated April 2, 1887, and published in the Annual Report of the Chief of Engineers for 1887, page 1302.

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For commercial statistics see report on operating and care of locks and dams on Black Warrior River, Alabama.

(*b*) *Warrior River.*—This name refers to that portion of the Warrior River below Tuscaloosa. Originally logs, snags, and overhanging trees rendered navigation impossible at low water and dangerous at boating stages. The minimum depth of channel was about 1 foot and the minimum width about 60 feet.

The original project for the improvement, adopted by the river and harbor act approved March 3, 1875, contemplated deepening the channel by jetty construction and the removal of snags and overhanging trees. The amount expended on this project from 1880 until the adoption of the present project was $319,372. Prior to 1880 appropriations were made for the Warrior and Tombigbee rivers jointly, and the amount expended on the Warrior River up to that time is not known. An account of this work may be found in the Annual Report of the Chief of Engineers for 1897, page 1679.

The present project, adopted by the river and harbor act of March 3, 1899, is for the construction of six locks and dams, with a total lift of 60 feet, and is to afford a channel for barges of 6-foot draft at low water all the year round. The estimated cost of this work is $1,628,466. This work was commenced under continuing contract, but the completion of three of the locks by hired labor has been authorized.

The act last mentioned provided for the construction of three of these locks and dams at a cost not exceeding $660,000. These three locks were completed at a cost of $640,500 and are now being operated and cared for by the Government as Locks Nos. 7, 8, and 9, Black Warrior River. This improvement has resulted in opening up the river from Tuscaloosa to Lock 7, a distance of 79 miles, for navigation all the year round, though some dredging will be necessary to obtain a channel depth of 6 feet at the upper end of each pool. Towboats and barges of 4 feet draft were operated on this section of the river during the past low-water season.

From the emergency appropriation of June 6, 1900, an allotment of $3,691.24 was applied to maintaining the improvement of Warrior River by the removal of logs, trees, and slip-ins left in the channel after the floods of the spring of 1900, since which time no such work has been done.

The river and harbor act approved June 13, 1902, provided for the construction of Locks and Dams 1, 2, and 3 on this river, at a cost not to exceed $874,000; also that $10,000 of this amount might be applied to the work of maintenance of the improvement between Tuscaloosa and Demopolis, and up to the close of the past fiscal year $9,052.15 of this $10,000 had been so applied. Work on these locks was commenced under contract in May, 1903, and continued until December 31, 1904, when contractors abandoned the work.

During February, 1905, the completion of these locks by hired labor was authorized. Since that time a large amount of plant and material has been delivered. Excavation and erection of plant are in progress at all three locks. About 30 per cent of the entire work had been completed on June 30, 1905.

The river and harbor act approved March 3, 1905, provided for the completion of Locks 1, 2, and 3 at a cost of $94,466, in addition to

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amounts previously appropriated or authorized, $40,000 for a dredge, and $30,000 for building lock houses.

The amount expended on improvement of Warrior River under the existing project to June 30, 1905, $1,032,666.46, of which $11,947.14 was applied to maintenance.

For commercial statistics see report on operating and care of locks and dams, Black Warrior River. The report of the survey upon which the present project is based is printed in the Annual Report of the Chief of Engineers for 1890, page 1719.

A revised estimate by the local engineer officer of the cost of building Locks and Dams 1, 2, and 3 is printed in House Document No. 165, Fifty-seventh Congress, first session, and in the Annual Report of the Chief of Engineers for 1902, page 1293. See also Annual Report of the Chief of Engineers for 1904, page 1845.

(*c*) *Tombigbee River from the mouth to Demopolis* (*construction of locks and dams*).—The original condition of the navigable channel of this section of the river was such as to permit of steamboat navigation during high stages of water only, lasting about six or eight months of the year. The minimum width of the channel was about 100 feet and the minimum depth about 2 feet.

For project, amount expended, etc., see report on maintenance of channel Tombigbee River from the mouth to Demopolis.

The amount expended on work of lock and dam construction under the existing project to June 30, 1905, was $200,240. A survey of this section of Tombigbee River, to determine the cost of completing Lock 1 and the location and cost of Locks 2 and 3, was made during 1902 and 1903. The report of this survey is printed in the Annual Report of the Chief of Engineers for 1904, page 1842. During the past fiscal year additional survey was made for the purpose of securing more economical locations for Locks 2 and 3. The survey was authorized by the act of June 13, 1902, and the allotment was made from funds appropriated for building Locks 1, 2, and 3, Warrior River.

The cost of these surveys was $11,854.53, the amount allotted for the work being $13,000.

Lock No. 1, at McGrews shoals, Alabama, has been about two-thirds completed; the lock walls are built, but the gates are yet to be erected, the dam and abutment built, and the banks graded and riprapped.

Detailed accounts of this improvement are contained in the Annual Reports of the Chief of Engineers for 1896, page 1437; 1897, page 1685, and 1900, page 2202.

The river and harbor act approved March 3, 1905, provides for the completion of Lock and Dam No. 1, and the construction of Lock and Dam No. 2 at a cost not to exceed $717,000. Plans and specifications for dam, abutment, and guard cribs at Lock 1 have been prepared and approved, and proposals invited for their construction.

For commerce on the river in 1904, see report on maintenance of channel of Tombigbee River from mouth to Demopolis.

The project for all the year round 6-foot navigation from the Mulberry and Locust forks of the Black Warrior River to Mobile, Ala., has not yet progressed sufficiently to have much if any effect on freight rates. When completed, however, it is expected to cause a great reduction in freight rates from the mining section of Alabama to the Gulf of Mexico.

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July 1, 1904, balance unexpended		$632,227.47
Received from sales of Government property		268.29
Amount appropriated by river and harbor act approved March 3, 1905		100,000.00
Amount appropriated by sundry civil act approved March 3, 1905		15,000.00
		747,495.76
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$216,693.16	
For maintenance of improvement	947.85	
		217,641.01
July 1, 1905, balance unexpended		529,854.75
July 1, 1905, outstanding liabilities		77,135.00
July 1, 1905, balance available		452,719.75
July 1, 1905, amount covered by uncompleted contracts		55,700.00
Amount (estimated) required for completion of existing project		[a]841,466.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905		[b]603,466.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.		

(*d*) *Tombigbee River from the mouth to Demopolis* (*maintenance of channel*).—The original condition of the channel of this portion of the river was such as to permit of steamboat navigation during high-water stages only, lasting about six or eight months of the year. The minimum width of the channel was about 100 feet and the minimum depth 2 feet.

The original project for the improvement of this stream, as adopted in 1871, contemplated the removal of snags and other obstructions in the channel of the river and the widening and deepening of the existing channel through various shoals, at an estimated cost of $21,500. The project adopted in 1879 was to afford a channel of navigable width and 4 feet deep at ordinary low water from the mouth to Demopolis, a distance of 185 miles, by the removal of snags, logs, and overhanging trees and the improvement of the worst bars by dredging.

The amount expended on the improvement of this section of Tombigbee River under previous projects can not be given, as joint appropriations for the Warrior and Tombigbee rivers were made from 1875 to 1879, while between 1880 and 1888 the lower division of the river, for which appropriations were made, extended from Vienna to the mouth.

The earlier projects for the improvement of this section of Tombigbee River were superseded by the project adopted in the river and harbor act of September 19, 1890. The project adopted at that time provided for securing a channel 6 feet deep at low water between the mouth and Demopolis by the construction of locks and dams, bank

[a] The estimate for completion has reference only to lock and dam construction under continuing-contract authorization.

[b] For continuing-contract work authorized by the river and harbor act of—

June 13, 1902	$60,000.00
March 3, 1905	543,466.00
Total	603,466.00

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revetments, and by the removal of logs, snags, and other obstructions. The cost of this project was originally estimated at $508,808.98, but in 1897, after $330,000 had been appropriated for the work, the estimate was increased, the additional cost of completion being then placed at $600,000.

By the river and harbor act of June 13, 1902, the formation of a 6-foot channel below Demopolis by constructing locks and dams was made a part of the project for securing 6-foot navigation in the Black Warrior, Warrior, and Tombigbee rivers, Alabama. Information in regard to work accomplished on the Tombigbee River under this project and the expenditures made in connection therewith will be found in the section of this report immediately preceding.

Under previous projects this section of the Tombigbee River has been repeatedly cleared of snags, dikes have been constructed, dredging has been done at the worst bars, and the channel made navigable for steamboats at low stages of the river. The existing project for maintenance of the improvement of the Tombigbee River from the mouth to Demopolis was adopted by the river and harbor act of June 13, 1902, and contemplates the maintenance of the existing channel by the removal of logs, snags, and other obstructions from the stream, and by the repair of dikes.

The amount expended on work under the existing project up to the close of the fiscal year ending June 30, 1905, was $19,654.76, all of which was applied to maintenance. Under this project all work has been performed by United States plant and hired labor, and the channel of the stream has been maintained in a navigable condition.

Under date of May 31, 1904, an allotment of $4,000 from the contingent appropriation for emergencies in river and harbor works, act of June 13, 1902, was made for the Tombigbee River, mouth to Demopolis. With these funds, during the past fiscal year, a new shore connection for the Osage bar dike was constructed and various obstructions were removed from the channel of the river between Osage bar and the mouth of the stream, a distance of about 95 miles. On June 30, 1905, as a result of these operations, the channel was available for steamboat navigation on a slight rise above low water.

It is proposed to apply available and future appropriations to the work of maintaining the existing channel in its improved condition.

The Tombigbee River is navigable for steamboats as far as Columbus, Miss., a distance of 341 miles above its mouth, and for rafts as far as Walkers Bridge, Miss., a farther distance of 169 miles. This stream is nontidal, except in its lower reaches. Floods at Demopolis rise at times to a stage of 60 feet above low water.

Detailed accounts of this improvement are contained in the Annual Reports of the Chief of Engineers for 1896, page 1437; 1897, page 1685, and 1900, page 2202.

Commerce on this section of the river in the calendar year 1904 aggregated 250,000 tons, valued at $4,750,000.

This project results in affording cheap water rates between Mobile and points along the lower Tombigbee River.

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July 1, 1904, balance unexpended		$4,305.85
Amount appropriated by river and harbor act approved March 3, 1905		15,000.00
		19,305.85
June 30, 1905:		
Amount expended during fiscal year, for maintenance of improvement	$3,887.92	
Amount turned back into Treasury	223.69	
		4,111.61
July 1, 1905, balance unexpended		15,194.24

(*e*) *Tombigbee River from Demopolis, Ala., to Columbus, Miss.*—The original condition of this section of the river was such as to admit of navigation only during high-water stages. The channel was obstructed by shoals, logs, and overhanging trees, the minimum depth of water being 1 foot and the minimum width of channel 70 feet. The improvement of the Tombigbee River between Demopolis and Columbus was commenced under the project of 1871, which contemplated the improvement of this stream by the removal of snags and other obstructions in the river and the widening and deepening of existing channels through various bars. In 1879 this project was modified so as to provide for the formation of a channel of navigable width and 3 feet deep at low water from Demopolis to Columbus, this section forming a part of two different improvements.

The earlier appropriations being made for the Warrior and Tombigbee rivers jointly, the exact amount expended on the original project for this improvement can not be stated.

The present project for the improvement of this section of the Tombigbee River, adopted in 1890, provides for securing a channel 6 feet deep at low water from Demopolis to Columbus, a distance of 156 miles, by snagging, tree cutting, bank revetment, bar improvement, and the construction of locks and dams, at a cost originally estimated at $779,400. In 1897 the construction of locks and dams was estimated to cost $2,000,000. This project was adopted by the river and harbor act of September 19, 1890, but no provision has yet been made by Congress for commencing the work of lock and dam construction. The fall of the river from Columbus to Demopolis is about 108 feet.

The total amount expended on work under the existing project up to the close of the fiscal year ending June 30, 1905, was $160,431.98, of which about $59,975.09 was applied to maintenance. These expenditures have resulted in the formation of a clear channel within the limits of the project available for light-draft boats on a 2-foot rise above low water and in the partial maintenance of this improvement. Work has been prosecuted by means of United States plant and hired labor.

During the fiscal year ending June 30, 1904, snagging operations were in progress from July 1 to December 26, 1903, this entire section of the river having been worked over, and on the latter date, as a result of this work, the channel between Demopolis and Columbus was in a safe condition for light-draft steamboat navigation on a rise of about 2½ feet above low water.

During the past fiscal year no work of improvement was in progress until June, 1905, owing to the lack of funds. Repairs were made to

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plant, the snag boat *Vienna* was towed from Mobile to Demopolis, Ala., a working party was organized, and snagging operations were commenced on June 26, 1905. During the balance of the month a distance of 3½ miles of river from Demopolis upstream was worked over.

On June 30, 1905, owing to deterioration of the channel during the period of suspension of work, a rise of 5 or 6 feet was necessary for navigation purposes.

With available and future appropriations it is proposed to maintain this improvement by the removal of trees, snags, and other obstructions which are brought into the channel by freshets. The maximum heights of the latter are 40 feet at Columbus, Miss., and about 60 feet at Demopolis.

The commerce on this section of the river for the calendar year 1904 amounted to 20,000 tons, valued at $600,000.

This project has no effect on freight rates.

It is expected that the report of the examination authorized by the river and harbor act approved March 3, 1905, will be submitted to Congress at its next regular session.

July 1, 1904, balance unexpended	$123.59
Amount allotted from appropriation made by river and harbor act approved March 3, 1905	10,000.00
	10,123.59
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	555.57
July 1, 1905, balance unexpended	9,568.02
July 1, 1905, outstanding liabilities	680.00
July 1, 1905, balance available	8,888.02

(*f*) *Tombigbee River from Columbus to Walkers Bridge, Miss.*—Prior to 1902 this improvement was divided into two sections, one from Columbus to Fulton, 144 miles, and the other from Fulton to Walkers Bridge, 25 miles, for which appropriations were made separately.

The original condition of the river was such that navigation was impossible except at high water, and difficult even at the latter stage, owing to the logs, snags, and overhanging trees which obstructed the channel. The minimum depth in the channel was about 1 foot, and the minimum width was 50 feet.

The original and existing project for the improvement of the river above Columbus was adopted in 1873, and provided for obtaining a good high-water channel by the removal of obstructions at an estimated cost of $35,000. This project was completed in 1882, at a cost of $27,293.65, since which time operations have been directed toward maintaining the improvement. The first specific appropriation for the portion of the river between Fulton and Columbus was made in 1892, this money, together with subsequent appropriations, being applied to the maintenance of a high-water channel. This portion of the river has been freed of snags and overhanging trees and has been placed in a condition to permit of the passage of large rafts of logs and timber during high water.

The original and existing project for improvement of the river from Fulton to Walkers Bridge was adopted in 1888, and provides for securing a good high-water channel by removal of logs, snags,

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and overhanging trees at an estimated cost of $11,000, and for the maintenance of the same at an annual cost of $1,500. This project was adopted by the river and harbor act of August 11, 1888, and was completed in 1891 at a cost of $6,517.19.

The total amount expended on these projects up to the close of the fiscal year ending June 30, 1905, was $72,862.93, of which amount $39,052.09 had been applied to maintenance. United States plant and hired labor have been employed on this work.

During the fiscal year ending June 30, 1904, this work of improvement was in progress between July 1 and December 5, 1903. During this period a stretch of 74 miles of river above Aberdeen, Miss., was worked over and placed in good condition.

During the past fiscal year no work of improvement was in progress until June, 1905, owing to the lack of funds. A party for the prosecution of snagging operations was organized on June 1, working property was purchased, and actual work commenced at Bigbee, Miss., on June 16, 1905. During the balance of the month a distance of 2 miles of river was worked over and placed in good condition. This work will be continued during the coming fiscal year.

It is proposed to apply available and future appropriations to the work of maintaining a clear high-water channel in this section of the river.

On June 30, 1905, the condition of this improvement was such as to permit of its use on a rise of several feet above low water. This portion of the river is at present used principally for rafting purposes. The improvement is not permanent, as obstructions are lodged in the stream after each freshet. This section of the Tombigbee River is nontidal, freshet stages varying from 20 to 40 feet.

Reports on surveys upon which a portion of this project is based are printed in the Annual Reports of the Chief of Engineers for 1882, page 1312, and 1888, page 1226.

The commerce on this section of the river during the calendar year ending December 31, 1904, amounted to 135,000 tons of logs; value, $300,000.

Funds for work on this section of the river were allotted from appropriation for Tombigbee River, Demopolis to Columbus.

This improvement has no effect on freight rates.

July 1, 1904, balance unexpended	$327.98
Amount allotted from appropriation made by river and harbor act approved March 3, 1905	2,000.00
	2,327.98
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	523.86
July 1, 1905, balance unexpended	1,804.12
July 1, 1905, outstanding liabilities	520.00
July 1, 1905, balance available	1,284.12

(See Appendix R 3.)

4. Operating and care of locks and dams on Black Warrior River, Alabama.—(*a*) *Lock 7 (formerly Lock 4, Warrior River).*—This lock is about 79 miles by river below Tuscaloosa. Contract work was completed and the lock turned over to the United States November 7, 1903. At that time its operation and care became a charge under the general law of July 5, 1884.

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The lock was opened for traffic November 27, 1903, and has been used regularly since. In addition to its operation, the riprap bank protection has been repaired, stone filling has been placed below dam and along outside of river wall to check erosion, flood deposit has been removed from lock chamber, some dredging has been done in lower approach to lock, and other minor repairs made.

(*b*) *Lock 8* (*formerly Lock 5, Warrior River*).—This lock is about 63 miles by river below Tuscaloosa. Contract work was completed and this lock turned over to the United States in December, 1902. On January 1, 1903, its operation and care became a charge under the general law of July 5, 1884.

On account of failure to complete gates before winter floods set in, damage to timber floor by upthrust, and a large leak which developed under abutment, this lock was not opened to traffic until October 13, 1903. Since that time it has been used regularly, except 26 days during November, 1904, when it was closed to traffic on account of leakage through floor. Floor was repaired, gravel and dredged material filled in deep holes that had been eroded below dam and along river wall and covered with several feet of quarry waste, stone filling, and derrick stones.

(*c*) *Lock 9* (*formerly Lock 6, Warrior River*).—This lock is about 46 miles by river below Tuscaloosa. Contract work was completed and the lock turned over to the United States in December, 1902. On January 1, 1903, its operation and care became a charge under the general law of July 5, 1884.

This lock was opened for traffic in October, 1902, and has been used regularly since. During the past year the area below dam showed considerable erosion. The deeper holes were filled with gravel filling with a heavy covering of stone and quarry waste. Riprap slopes were repaired and some dredging done in lower approach to lock and channel below it.

(*d*) *Locks 10, 11, and 12* (*formerly Locks 1, 2, and 3*).—These locks and dams are near Tuscaloosa, Ala., and overcome the Tuscaloosa Falls with their combined lift of 29 feet. They were finished and opened to commerce in November, 1895, and on July 1, 1896, their operation and care became a charge under the general law of July 5, 1884.

In addition to their operation, some repair work has been done and some dredging done below Lock 10. The areas between wing walls at these three locks have been graded and covered with concrete paving. Riprap bank protection has been extended.

Minor repairs have been made to the plant. Total expense during the year for operating, repairs, etc., for the six locks was $49,712.48. The commerce passing through the locks during the fiscal year ending June 30, 1905, amounted to 3,047 tons coal, 18,276 tons stone, 1,132 tons sand and gravel, 2,306 tons logs, 381 tons lumber, 649 tons general merchandise.

(See Appendix R 4.)

5. Pascagoula River, Mississippi.—Before this improvement was commenced the channel through the bar at the mouth of the river had a least depth of 3 feet at low water, while inside the mouth for a distance of 10 miles upstream the river was navigable for vessels of 6½ feet draft. Appropriations for this work of improvement were

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made in 1827, 1828, and 1852, but there is no record of the work accomplished in those years.

The first extended project for the improvement of this stream was adopted in 1880 and contemplated securing a channel 7 feet deep and 200 feet wide across the bar at the mouth of the river. This project also included some snagging work on the river above Moss Point, which is described in the report on the improvement of the Pascagoula River and its tributaries, the Chickasahay and Leaf rivers, Mississippi. The project for a 7-foot channel was practically completed in 1884, the total amount expended in securing such a channel, including the appropriations made between 1827 and 1852, amounting to $74,500.

In 1886 a new project was adopted which provided for securing a channel 12 feet deep at low water with a navigable width, between Mississippi Sound and Moss Point. Under this project a depth of 9 feet across the entrance bar was first obtained, while subsequently a channel 12 feet deep and 80 feet wide was dredged from Moss Point to the mouth of the river, and a 12-foot channel across the bar at the mouth was partially completed. These operations required the expenditure of $95,000, including the expenditure of about $8,000 applied to dredging work in Horn Island Pass in 1897, or a total of $169,500 under both projects. The present project for the improvement of Pascagoula River was adopted in the river and harbor act of March 3, 1899, and provided for the formation of a 12-foot channel from a point in Dog River 3 miles above its mouth down the Pascagoula River to the 12-foot contour in Mississippi Sound, at an estimated cost of $317,600, including the formation of a 20-foot channel through certain shoal spots in the Horn Island anchorage.

Work under this project was in progress between September, 1899, and February, 1902, during which time an uninterrupted 12-foot channel was obtained within the limits of the project in Pascagoula River, while a 20-foot channel was formed through the shoal areas in Horn Island anchorage.

The river and harbor act of June 13, 1902, modified and extended the existing project so as to provide for a channel 17 feet deep instead of 12 feet, from 3 miles above the mouth of Dog River to Mississippi Sound, at a total cost of $1,050,222, exclusive of the Horn Island improvement, and authorized the expenditure of $150,000 for the commencement of operations under the modified project.

The total amount expended on the existing project up to the close of the fiscal year ending June 30, 1905, was $372,184.82, excluding the expenditure of about $88,000 on the work performed at Horn Island. No part of this amount was applied to maintenance.

During the fiscal year ending June 30, 1903, a continuing contract for dredging the channel to a depth of 15 feet over as great a width as might be possible, not exceeding the limits of the project, was entered into. Under this contract operations were in progress from July 7, 1903, to June 16, 1904, and as a result an uninterrupted 15-foot channel with a width varying from 75 to 100 feet and with an aggregate length of about 49,827 feet was dredged within the limits of the project, except over one 14-foot shoal at the upper end of the improvement. This work required the removal of 364,391 cubic yards of material, place measurement, from the upper section of the work,

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comprising the channels of Pascagoula and Dog rivers, and 376,249 cubic yards, scow measurement, and 31,655, place measurement, from the lower section, the channel of approach in Mississippi Sound.

No dredging work was in progress on this stream during the past fiscal year owing to the lack of funds. Under the appropriation of March 3, 1905, contracts for deepening the existing 15-foot channel to the projected depth of 17 feet were entered into on June 16, 1905, and it is expected that dredging operations under these contracts will be commenced during the early part of the coming fiscal year.

Owing to shoaling, the available low-water depth in the dredged cut has become reduced from 14.8 feet to about 13 feet, but owing to soft bottom, a 14-foot low-water draft is possible. The average range of the tide is about 1.75 feet.

The head of continuous navigation on the Pascagoula River is at Cedar Creek, about 55 miles above the mouth, to which point a draft of 6 feet can be carried.

Available funds will be applied to the work of obtaining a 17-foot channel within the limits of the project under contracts already entered into.

A reference to the report of the survey of the Pascagoula River upon which the existing project is based is printed in the Annual Report of the Chief of Engineers for 1904, page 334. An account of this improvement is contained in the Annual Reports of the Chief of Engineers for 1902, page 2211, and 1904, page 1828.

The commerce of the river for the calendar year 1904 amounted to 735,875 tons, principally logs, lumber, and naval stores, valued at $4,629,000.

This project results in effecting a reduction in rail freight rates between Scranton, Miss., and seaboard cities of the Atlantic coast, and also in affording direct water freight rates on lumber from Moss Point and Scranton to foreign ports.

July 1, 1904, balance unexpended	$29,214.06
Amount appropriated by river and harbor act approved March 3, 1905	150,000.00
	179,214.06
June 30, 1905, amount expended during fiscal year, for works of improvement	21,798.88
July 1, 1905, balance unexpended	157,415.18
July 1, 1905, outstanding liabilities	850.00
July 1, 1905, balance available	156,565.18
July 1, 1905, amount covered by uncompleted contracts	120,000.00
Amount (estimated) required for completion of existing project	520,622.00

(See Appendix R 5.)

6. Pascagoula, Leaf, and Chickasahay rivers, Mississippi.—(*a*) *Pascagoula River* (*above the mouth of Dog River*).—Before this improvement was commenced navigation was impossible on this section of Pascagoula River, except during periods of high water. The minimum width of the channel was 60 feet and the minimum depth was 1 foot, the stream being very much obstructed by snags and logs. The first project for this improvement, which was adopted in 1880, in addition to providing for dredging work at the mouth of the stream, described in the report on the improvement of the Pascagoula River,

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Mississippi, contemplated the improvement of the river by the removal of snags and overhanging trees. Under this project the river was cleared of obstructions, between 1882 and 1884, at a cost of $15,000. In 1886 the existing project for this improvement was adopted. This project provides for the maintenance of the channel above the mouth of the river by removal of obstructions from the stream from time to time. This project was modified in 1899, the extent of the improvement being limited at that time to the section of the river above Dog River. The total amount which has been expended on the existing project to June 30, 1905, was $20,314.60, all of which was applied to maintenance.

From the combined appropriation of $8,500 carried by the river and harbor act of June 13, 1902, for the improvement of Pascagoula River and its tributaries, the Chickasahay and Leaf rivers, Mississippi, the sum of $4,000 was allotted to the Pascagoula River and $2,250 each to the other two streams. With these funds snagging operations were in progress from October 1 to December 20, 1902, and from June 1 to 30, 1903, on the Pascagoula River. During this time the entire stream above the mouth of Dog River, a distance of about 100 miles, was worked over and placed in fair condition for rafting and steamboat navigation.

Owing to the lack of funds, snagging work on the river was suspended between June, 1903, and June, 1905. The river and harbor act of March 3, 1905, appropriated $12,000 for the Pascagoula and Leaf rivers, Mississippi, including the Chickasahay River. Of this amount, $6,750 has been allotted to the Pascagoula River.

With the above allotment, repairs have been made to plant, working property purchased, a party organized, and snagging operations were commenced at Moss Point, Miss., on June 19, 1905. During the balance of the month a distance of 40 miles of river from Moss Point upstream was worked over and restored to its improved condition. This work will be continued during the coming fiscal year with funds now available. Future appropriations will be applied to the work of maintaining the improvement.

On June 30, 1905, the Pascagoula River was navigable at low water for vessels of 6 feet draft as far up as Cedar Creek, a distance of 55 miles, while above this point to the head of the river light-draft navigation and rafting were possible on a slight rise above low water.

The Pascagoula River is nontidal, except in its lower reaches.

The commerce originating on Pascagoula River above the mouth of Dog River during the calendar year 1904 amounted to 180,250 tons, principally logs and naval stores, valued at $1,194,500. In addition to this, the combined commerce of Chickasahay and Leaf rivers passed down this stream.

This project has no effect on freight rates.

(*b*) *Leaf River.*—Originally it was impracticable to navigate this river on account of snags, logs, and overhanging trees obstructing the channel. The minimum width of the stream was 100 feet and the minimum depth 2½ feet. The original project for this improvement was adopted in 1890, its purpose being to afford a channel for high-water navigation from Bowie Creek to the mouth of the river, a distance of 75 miles, by the removal of obstructions and overhanging trees. This project was completed in 1897, at a cost of $11,019.04,

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since which time expenditures have been in the direction of maintaining the improvement.

The sum of $2,250 was allotted for the improvement of Leaf River from the combined appropriation of $8,500 carried by the river and harbor act of June 13, 1902, for the Pascagoula, Chickasahay, and Leaf rivers, Mississippi. During the fiscal year ending June 30, 1903, with these funds the river between Beaumont, Miss., and the upper limit of the project at Bowie Creek, a distance of 45 miles, was worked over and placed in good condition for rafting and light-draft navigation on a slight rise above low water.

During the past fiscal year no general work has been in progress owing to the lack of funds. Expenditures have been in payment for the preservation and care of working property.

From the appropriation of March 3, 1905, for the Pascagoula and Leaf rivers, Mississippi, the sum of $3,250 was allotted for the improvement of the Leaf River. With these funds it is expected to resume snagging operations on the stream during the coming fiscal year.

It is proposed to apply future appropriations to the work of maintaining the existing channel by the removal of obstructions which are carried into the stream during the annual freshets. The stream is nontidal.

The total amount expended on work under this project up to the close of the fiscal year ending June 30, 1905, was $19,750, of which the sum of $8,730.96 was applied to maintenance.

On June 30, 1905, the river within the limits of the project was available for rafting purposes on a fair rise above low water. The river is used to a very limited extent for any other form of navigation.

For references to the report on which this project is based and to descriptions of this improvement, see the Annual Report of the Chief of Engineers for 1904, page 337.

The commerce of the Leaf River during the calendar year 1904 amounted to 196,300 tons, principally logs and naval stores, valued at $600,500.

This project has no effect on freight rates.

(*c*) *Chickasahay River.*—The original condition of this river was such that it was navigable only for small rafts during high water, and even navigation of this character was troublesome and dangerous. The minimum width of the channel was 50 feet and the minimum depth 6 inches, the river being badly obstructed with logs and snags. The original project for this improvement was adopted by the river and harbor act of September 19, 1890, and provided for obtaining a high-water channel from the mouth of the river up to Shubuta, Miss., a distance of 130 miles, by the removal of obstructions and overhanging trees. The river and harbor act of June 3, 1896, modified this project by limiting the improvement to that part of the river between the mouth and Bucatunna, Miss., about 75 miles. The project further provided for the maintenance of the improved channel. The project as modified was completed in the latter part of 1896, at a cost of $12,399.73, subsequent operations being for the maintenance of the improvement.

The sum of $2,250 was allotted for the improvement of Chickasahay River from the appropriation of $8,500 for the Pascagoula,

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Chickasahay, and Leaf Rivers, Mississippi, carried by the river and harbor act of June 13, 1902.

During the fiscal year 1903 the necessary working outfit was purchased, but active operations were not undertaken until July 1, 1903.

During the fiscal year of 1904 snagging work was in progress from July 1 to October 19, 1903. In this period the entire river within the limits of the project was worked over and placed in fair condition for rafting and flatboats on a rise of 3 or 4 feet above low water.

No work was in progress during the past fiscal year. Expenditures have been for the preservation and care of public property. On June 30, 1905, the condition of the stream had deteriorated somewhat, but rafting was still possible on a slight rise.

The total amount expended on the original project up to the close of the fiscal year ending June 30, 1905, was $21,750, of which $9,350.27 had been applied to maintenance.

The existing project for this improvement is based on a report printed in the Annual Report of the Chief of Engineers for 1904, page 1854, and provides for the maintenance of the channel in the Chickasahay River from the mouth to Bucatunna, Miss., a distance of about 75 miles, by the removal of logs, snags, trees, etc., from the waterway, in order to keep the river in navigable condition for rafting at high-water stages, at an annual cost of $2,500. This project was adopted in the river and harbor act of March 3, 1905. From the appropriaton of $12,000 carried by the river and harbor act of March 3, 1905, for the Pascagoula and Leaf rivers, Mississippi, including the Chickasahay River, the sum of $2,000 was allotted to the improvement of the Chickasahay River. With these funds it is expected to resume snagging operations during the coming fiscal year.

It is proposed to apply future appropriations to the maintenance of the existing channel in the Chickasahay River within the limits of the project. This improvement is not permanent, as each high water causes new obstructions to lodge in the stream. This stream is nontidal, and is used only for rafting purposes and flatboats. For this class of navigation the stream can be used from the mouth up to Shubuta, Miss., 130 miles, on a 6 or 8 foot rise.

The commerce of the Chickasahay River during the calendar year 1904 amounted to 66,875 tons, principally logs and naval stores, valued at $238,000.

This project has no effect on freight rates.

July 1, 1904, balance unexpended	$735.08
Amount appropriated by river and harbor act approved March 3, 1905	12,000.00
	12,735.08
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	1,049.68
July 1, 1905, balance unexpended	11,685.40
July 1, 1905, outstanding liabilities	410.00
July 1, 1905, balance available	11,275.40

(See Appendix R 6.)

7. Horn Island Pass, Mississippi.—The channel through this bar had, before improvement, a depth which increased through natural causes from 14 or 15 feet in 1853 to about 18 feet in 1886, and has been available at low water since the latter date for vessels up to a draft of slightly less than 18 feet.

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Under the appropriations for improving Pascagoula River, Mississippi, carried by the river and harbor acts of August 18, 1894, and June 3, 1896, provision was made for the removal of the bar in Horn Island Pass, and in conformity with this provision a channel with a least depth of 20.5 feet (19.5 feet referred to the existing datum), and with a width of 200 feet, was dredged through the Horn Island bar. The total cost of this work was $7,682.40, but the benefit of the improvement was soon lost through shoaling.

Under the appropriations for Pascagoula River and Horn Island Harbor, carried by the river and harbor act of March 3, 1899, and the sundry civil act of June 6, 1900, an amount estimated at about $88,000 was applied to dredging a 20-foot (19 feet present datum) channel at certain shoal areas in the Horn Island anchorage basin, the work being in progress between 1899 and 1901.

The existing project for the improvement of Horn Island Pass provides for the formation of a channel 21 feet deep at low water, 300 feet wide through the outer bar, and 200 feet wide elsewhere in the pass, at an estimated cost of $40,480 and $9,000 annually to maintain the improvement. The project was adopted by the river and harbor act of March 3, 1905, which carried an appropriation of $40,480 for the work, subject to the condition "that a contract or contracts can be made at a sum not to exceed the unit price of 11 cents per cubic yard, or such work can be performed by Government dredge." No expenditures have been made in connection with this improvement.

The proposed dredging work was advertised under date of May 16, 1905, but no bids for its execution were received in response to this advertisement.

During the coming fiscal year arrangements for the performance of this work by United States plant will be made, if it is found that a Government dredge can be spared from some other district for this purpose.

Commerce using the Horn Island Pass channel during the calendar year 1904 consisted of 110,000 tons of lumber and timber, valued at $1,052,000.

This improvement has as yet no effect on freight rates.

The report on which this project is based is printed in the Annual Report of the Chief of Engineers for 1904, page 1863.

Amount appropriated by river and harbor act approved March 3, 1905 $40,480.00
July 1, 1905, balance unexpended 40,480.00

(See Appendix R 7.)

8. Harbor at Biloxi, Miss.—This channel originally had a minimum depth of 4 feet. The original project for its improvement was adopted in 1882 and contemplated the formation of a channel through Deer Island flats to connect Biloxi Bay with the Back Bay of Biloxi, at an estimated cost of $35,000. The channel thus proposed was to have a depth of 8 feet at low water, with a width sufficient for navigation.

In 1884 this project was changed so as to provide for deepening the channel from Mississippi Sound to the wharves at Biloxi from the existing depth of 4 to 4½ feet to 8 feet over a width of 150 feet, the estimated cost of this work being $55,000. The work of dredging under the project was commenced in September, 1887, and the project was completed in 1892, at a cost of $34,148.64. The balance of funds available, to the extent of $10,233.63, was subsequently applied to

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the work of removing shoals which had formed in the lower part of the dredged cut and to widening the channel to a slight extent. From an examination made in August, 1893, the channel was found to have a minimum width of 160 feet and a minimum depth of 9 feet. Work on this improvement was then suspended until provision for its resumption was made by the river and harbor act of June 13, 1902, which carried an appropriation of $10,000 for this improvement.

During the fiscal year 1903 a portion of this appropriation was applied to the work of making a survey of the harbor and to necessary preparations for the performance of dredging work at this locality under contract. The survey indicated general shoaling within the limits of the earlier improvement.

In this year a contract was also entered into for restoring the benefits of the original improvement by dredging a channel 8 feet deep at mean low water from the 8-foot contour in Mississippi Sound to the wharves at Biloxi, with as great a width, not exceeding 150 feet, as available funds would permit. The date of this contract was May 21, 1903.

During the fiscal year 1904 dredging operations under the contract above referred to were in progress between December 26, 1903, and January 28, 1904, work being completed at the latter date. These operations resulted in the formation of a channel with a least depth of 8 feet at mean low water and with a width of from 70 to 100 feet within the limits of the project. As a result of this contract about one-half the work necessary to fully restore the channel to its improved condition has been completed.

The total amount expended on work in connection with the existing project to the close of the fiscal year ending June 30, 1905, was $54,382.27. Of this amount $10,000 has been applied to maintenance. In January, 1896, a balance of $617.73 was redeposited in the United States Treasury.

On June 30, 1905, the maximum low-water draft that could be carried through the dredged channel of Biloxi Harbor was 7 feet, shoaling having occurred since the suspension of recent dredging operations. The average range of tide at this locality is 1¾ feet.

The river and harbor act of March 3, 1905, carried an appropriation of $9,000 for maintaining the channel in Biloxi Harbor. With these funds it is proposed to enter into a dredging contract during the coming year for the restoration of the dredged cut to its projected dimensions as far as may be practicable.

A reference to the report on which the present project for improving harbor at Biloxi, Miss., is based can be found in the Annual Report of the Chief of Engineers for 1904, page 337.

During the calendar year 1904 the commerce of Biloxi Harbor amounted to 254,000 tons, valued at $2,535,555.

This project has no effect on freight rates.

July 1, 1904, balance unexpended		$165.64
Amount appropriated by river and harbor act approved March 3, 1905		9,000.00
		9,165.64
June 30, 1905, amount expended during fiscal year, for maintenance of improvement		165.64
July 1, 1905, balance unexpended		9,000.00

(See Appendix R 8.)

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9. Channel from Gulfport to Ship Island Harbor, Mississippi.—Originally no channel existed between Ship Island Harbor and Gulfport, Miss. The depths on the site of the channel now in progress of formation ranged from 19 to 8½ feet, and the depths over the site of the proposed anchorage basin varied from 8½ to 2½ feet.

The existing project for this improvement was adopted by the river and harbor act of March 3, 1899, which authorized the Secretary of War to enter into a contract or contracts to dredge a channel 300 feet wide and 19 feet deep at mean low water from the anchorage basin at Ship Island Harbor, on the Gulf of Mexico, to Gulfport, Miss., and to construct at the end of this channel next to the shore an anchorage basin of similar depth and not less than 2,640 feet by 1,320 feet in area. This act also authorized the Secretary of War to contract for the maintenance of this channel and anchorage basin for a term of five years after their completion for the sum of $10,000 annually.

This work was first advertised in 1899, but no bids for its performance were then received. It was again advertised in January, 1901, and one bid was received, which was accepted. Under this proposal a contract was entered into, by the terms of which it was agreed by the contractor to dredge the channel and anchorage basin as called for by the project for the sum of $150,000, work to be completed within two years from the date of commencement. Under the terms of this contract the maintenance of the channel and basin was required for the term of five years from the date of their completion for the sum of $10,000 annually.

Work under this contract was commenced on April 16, 1901, and has been continuously in progress since that time.

The work of dredging the channel from Ship Island Harbor to Gulfport was completed in August, 1903. On the latter date only about one-half the area of the anchorage basin had been dredged over, and recent operations have therefore been directed principally toward the enlargement of the basin, although some redredging work in the channel has been necessary. On June 30, 1905, practically the entire area of the basin had been dredged to the specified depth, but the sides of the channel were shoal, thereby requiring redredging. The latter work is now in progress. The maximum low-water draft available in the channel and basin was about 19½ feet. The range of tide at this locality is about 1¾ feet.

The sundry civil act approved June 28, 1902, appropriated $150,000 for the payment of contract work at Gulfport in accordance with the provision in the river and harbor act approved March 3, 1899, authorizing the execution of the work. These funds will be held until the completion of the channel and anchorage basin to the projected dimensions.

The sundry civil act of April 28, 1904, appropriated $10,000 for the maintenance of the Gulfport channel and basin in accordance with the terms of the existing contract. It is proposed to hold these funds until the channel and basin shall have been maintained to their full dimensions for the period of one year from the date of the acceptance of the work by the United States.

Since the commencement of operations at Gulfport allotments amounting to $21,194.04 have been made from the permanent indefinite appropriation carried by section 4 of the river and harbor act

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of July 5, 1884, for the purpose of superintending and inspecting operations on this work of improvement. Under these allotments the work of improvement has been surveyed and laid out, and the dumping of the material dredged under the contract has been supervised by Government inspectors. The expenditure to June 30, 1905, has amounted to $12,720.60, all of which has been applied to inspection, superintendence, and surveys.

A reference to the report on which the present project is based can be found in the Annual Report of the Chief of Engineers for 1904, page 338.

The commerce at Gulfport Harbor during the calendar year 1904 amounted to 445,300 tons, principally lumber and timber, valued at $3,731.400.

It is expected that the report of the examination authorized by the river and harbor act approved March 3, 1905, will be submitted to Congress at its next regular session.

This project results in effecting a reduction in rail freight rates between Gulfport, Miss., and seaboard cities of the Atlantic coast, and also in affording direct water freight rates on lumber from Gulfport to foreign ports.

July 1, 1904, balance unexpended	$169,013.20
June 30, 1905, amount allotted during fiscal year	712.00
	169,725.20
June 30, 1905, amount expended during fiscal year, for works of improvement	1,251.76
July 1, 1905, balance unexpended	168,473.44
July 1, 1905, amount covered by uncompleted contracts	160,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	10,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix R 9.)

10. Pearl River below Rockport, Miss.—The limits of this improvement originally extended from the mouth of the river to Jackson, a distance of 313 miles. By act of Congress of April 21, 1900, the construction of a fixed highway bridge across Pearl River at Rockport was legalized, and this point thereby became the head of navigation for this section of Pearl River and the upper limit of the project. The distance from Jackson to Rockport is 67 miles.

Prior to improvement the condition of the river was such that it was not navigable except during high-water stages, and even then navigation was difficult and dangerous.

The original project for this improvement was adopted in 1880 and provided for a channel of navigable width and 5 feet depth at low water by the removal of snags and sunken trees from the river bed and overhanging trees from the banks, at an estimated cost of $95,940. This project having been found to be impracticable, a modified project was adopted in 1885, which provided for a 2-foot channel at low water throughout this section of the river, at an estimated cost of $145,940.

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The total amount expended under this project and its modifications up to the close of the fiscal year ending June 30, 1905, was $163,460.33, of which about $58,335.33 was applied to maintenance.

During the fiscal year 1903 a snag boat was constructed and placed in commission on June 1, 1903. Up to the close of that fiscal year about 15¾ miles of river had been worked over.

During the fiscal year 1904 snagging operations were continued until November 23, 1903, when funds were exhausted. In this interval a distance of 31 miles of river was worked over and placed in good condition for navigation.

Under date of May 31, 1904, an allotment of $2,000 from the contingent appropriation of the act of June 13, 1902, for emergencies in river and harbor works was made for the Pearl River below Rockport. With these funds a pile revetment protected by earth filling was constructed by hired labor across the head of Moores Bayou to prevent a cut-off at this locality. This work was commenced on October 3, 1904, and was completed January 6, 1905, at a total cost of $1,286.39. The balance of the allotment, to the extent of $713.61, was turned back into the United States Treasury.

With the funds appropriated in the river and harbor act of March 3, 1905, repairs were made to plant, property was purchased, the snag boat *Pearl* was towed from Mobile to Indian Village, West Pearl River, and snagging operations were commenced at that locality on June 21, 1905. During the balance of the month a distance of 17 miles of river from Indian Village upstream was worked over and maintained.

This work and work of improvement will be continued during the coming fiscal year with funds now available.

Recent appropriations have been sufficient to maintain the channel in the lower 100 miles of the river, and on June 30, 1905, this portion of the stream was available for light-draft navigation on a fair rise.

Many obstructions still exist in the upper portions of the stream not recently worked over, and a rise of 7 or 8 feet is necessary for navigation purposes in the latter localities.

With future appropriations it is proposed to continue maintenance operations and to improve the sections of the river which are at the present time obstructed to the greatest extent by snags and fallen trees. This stream is nontidal except in its lower reaches.

*An account of the improvement is contained in the Annual Reports of the Chief of Engineers for 1897, page 1698, and 1900, page 2218.

No reliable figures as to the commerce of this stream could be obtained.

This project has no effect on freight rates.

It is expected that the report of examination authorized by the river and harbor act approved March 3, 1905, will be submitted to Congress at its next regular session.

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July 1, 1904, balance unexpended		$2,225.98
Amount appropriated by river and harbor act approved March 3, 1905		7,000.00
		9,225.98
June 30, 1905:		
Amount expended during fiscal year for maintenance of improvement	1,561.31	
Amount turned back into Treasury	713.61	
		2,274.92
July 1, 1905, balance unexpended		6,951.06
July 1, 1905, outstanding liabilities		870.00
July 1, 1905, balance available		6,081.06
Amount (estimated) required for completion of existing project		31,000.00

(See Appendix R 10.)

11. Pearl River between Edinburg and Jackson, Miss.—The original condition of this section of Pearl River was such that navigation was impossible except during high water, and even at high stages it was difficult and dangerous. The minimum width and depth of the channel were 40 feet and 1 foot, respectively, between Carthage and Jackson, while above Carthage the channel had a minimum width of 30 feet and a minimum depth of 3 inches. This portion of Pearl River was formerly divided into two sections, for which appropriations were made separately. The original project for the improvement of the lower section from Carthage to Jackson, 105 miles, as adopted in 1879, contemplated obtaining a clear channel of navigable width and 5 feet depth at low water, at an estimated cost of $21,000. In 1886 this project was modified so as to reduce the proposed depth of the channel to 2 feet, this being considered sufficient for the needs of navigation, and at the same time the estimate of cost was increased to $50,000. Work under this project was completed in 1893, at a total cost of $26,014.98, since which time funds have been applied to maintenance.

The original project for the section of the stream between Edinburg and Carthage, a distance of 25 miles, was adopted in 1884, and provided for the formation of a high-water channel for use during six or eight months of the year, at an estimated cost of $13,464, and for the maintenance of this channel at an annual cost of $500. Work under this project was completed in 1890, at a cost of $5,857.08, subsequent appropriations having been applied to the work of maintenance.

Up to June 30, 1905, the total amount expended on the existing project for the Pearl River between Edinburg and Jackson was $58,721.82, of which about $26,849.76 had been applied to maintenance.

During the fiscal years 1903 and 1904 the river from Edinburg to Jackson, the lower limit of the project, was worked over and placed in fair condition. On September 10, 1903, work was suspended, owing to the exhaustion of available funds.

On account of the high water which prevailed during a portion of the working season of 1902 many obstructions still exist in the low-water channel, so that on June 30, 1905, a rise of several feet above low water was necessary for navigation purposes.

With funds appropriated in the river and harbor act of March 3, 1905, it is proposed to commence snagging operations on this section

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of the Pearl River during the coming fiscal year. Expenditures during the past year have been for the preservation and care of public property.

It is proposed to apply future appropriations to the continuation of the work of removing obstructions from this section of the Pearl River. This portion of the river is nontidal, and Edinburg is the head of navigation.

Accounts of this work are contained in the Annual Reports of the Chief of Engineers for 1897, pages 1700–1702, and 1900, pages 2220–2221.

No commercial statistics could be obtained on this improvement.

This project has no effect on freight rates.

July 1, 1904, balance unexpended	[a]$261.91
Amount appropriated by river and harbor act approved March 3, 1905	4,000.00
	4,261.91
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	183.73
July 1, 1905, balance unexpended	4,078.18

(See Appendix R 11.)

12. Removing sunken vessels or craft obstructing or endangering navigation.—On March 15, 1904, an allotment of $350 was made from the indefinite appropriation for removing sunken vessels or craft obstructing or endangering navigation, for the purpose of defraying the cost of shifting the wreck of the Russian bark *Hilja* so as to prevent the vessel from sinking in the channel of Horn Island Harbor, Mississippi, and to effect the removal of the wreckage of iron masts and yards from this vessel which had fallen overboard in the anchorage area. The latter work had been performed under emergency, on March 4, 1904. The work of removing the wreckage of the masts and yards was undertaken by the owners of the wreck in June, 1904, after notice had been given them as to the requirements of the law, and this work was reported completed in July, 1904. Subsequent examination showed the wreckage to have been removed satisfactorily. The total cost of this work was $133.40, and the balance of the allotment, amounting to $216.60, was turned back into the Treasury on January 18, 1905.

On May 17, 1905, an allotment of $600 was made from the indefinite wreck appropriation, for the purpose of removing the wreck of the gravel barge *Goodwin*, which had sunk in Mobile Bay, off Cedar Point. Arrangements for prosecuting the work of removing this wreck are now in progress.

(See Appendix R 12.)

IMPROVEMENT OF THE PASSES OF THE MISSISSIPPI RIVER, OF BAYOU LAFOURCHE, OF BAYOU PLAQUEMINE, GRAND RIVER, AND PIGEON BAYOUS, AND OF BAYOU TECHE, LOUISIANA.

This district was in the charge of Lieut. Col. H. M. Adams, Corps of Engineers, until August 12, 1904, and of Lieut Col. Clinton B. Sears, Corps of Engineers, since that date.

[a] Erroneously reported last year as $261.88.

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1. Closing crevasse in Pass a Loutre, Mississippi River.—Pass a Loutre is one of the three outlets of the Mississippi River. The crevasse forms an outlet from Pass a Loutre into an arm of the Gulf, known as Garden Island Bay, and was caused by the wearing away of the south bank of that pass at a locality 1¾ miles below Head of Passes.

The ditch where the crevasse first broke was 3 feet wide in 1872, and gradually increased from year to year. In January, 1891, the crevasse began to widen rapidly, but could not be checked on account of high water in the river. In July, 1891, it was 860 feet wide and 25 feet deep. Several attempts were made about this time by the estate of James B. Eads to close the crevasse, but it seemed a hopeless task, and was abandoned. On November 18, 1896, the crevasse was 2,230 feet wide, and on February 26, 1897, Congress appropriated $250,000 for the closure.

The project approved July 10, 1897, provided for building a dam 6,650 feet long, in two sections, 1,900 and 4,750 feet long, respectively, forming an angle of 112°, at a distance of 3,000 feet below the mouth of the crevasse, the dam to be constructed of Wakefield sheet piling, backed with a double row of piles securely braced and bolted to stringers and the sheet piling, using a third row of brace piles where the depth of water exceeded 20 feet.

Under this project a contract for the work was approved December 10, 1897. Work was carried on from December 14, 1897, to January 27, 1898, and from August 5, 1898, to November 13, 1898. On the last-named date the work was considered completed and was accepted. At that time it seemed that the closure would prove a permanent success, notwithstanding the high stage of the river. A severe storm arose that night, and on November 14 the dam gave way in two localities and 170 feet of it washed out. Portions of the ends of the dam have washed away at intervals since then, and on June 30, 1905, the width of the break was 934.5 feet.

On February 17, 1898, Congress allotted $10,000 from this appropriation for the expenses of a survey and report by a Board of Engineer officers upon the practicability of securing a channel of adequate width and of 35 feet depth at mean low water of the Gulf of Mexico throughout the Southwest Pass, Mississippi River. The survey was completed in 1898 and report submitted on January 7, 1899. This report is printed in the Annual Report of the Chief of Engineers for 1899 as Appendix U 19.

The amount expended from this appropriation up to June 30, 1905, was $228,995.08, of which $6,727.36 was for the survey of Southwest Pass, and $1,000, reserved March 6, 1902, for expenses of the Office of the Chief of Engineers.

No work toward closing the crevasse was attempted during the past year, the amount available being insufficient for the purpose.

July 1, 1904, balance unexpended	$21,004.92
February 2, 1905, amount received from proceeds of sale of Government property	25.00
July 1, 1905, balance unexpended	21,029.92

(See Appendix S 1.)

2. Outlet of the Mississippi River.—The river and harbor act of March 3, 1899, as amended by the act of June 6, 1900, appropriated

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$200,000 for constructing a sill across Pass a Loutre and for constructing and operating one or more dredges for improving the outlet of the Mississippi River, and authorized continuing contracts to be made for these purposes not exceeding $300,000 additional. The sundry civil act of June 6, 1900, appropriated $300,000 additional to cover the authorized continuing contracts.

On September 23, 1899, and July 2, 1900, the Secretary of War approved projects allotting, of the total of $500,000 appropriated, aggregate amounts of $175,000 for sill construction and $325,000 for construction and operation of one dredge.

A contract for the construction of a mattress sill, weighted with stone, across the head of Pass a Loutre was entered into March 31, 1900. Work on the sill was commenced July 1, 1900, and completed December 31, 1900, at a total cost of $174,914.06. This sill has prevented the enlargement of Pass a Loutre and has increased the current across head of South Pass.

Under allotments made from this appropriation and that for improving Southwest Pass, Mississippi River, the dredge *Benyaurd* was constructed for use at the passes of the Mississippi River. The construction of the dredge was originally provided for by contract, but the contractors having failed, the boat was completed by the Navy Department. The dredge was turned over by Major Sanford to the New Orleans district on December 17, 1904. Details of construction are given in Appendix H 7, herewith.

The sum of $500,000 had been expended to June 30, 1905, of which $178,776.73 was expended by the New Orleans (La.) office on improvement work and $321,223.27 in construction of the dredge *Benyaurd*, under direction of Major Sanford.

July 1, 1904, balance unexpended, in hand, under the New Orleans (La.) office	$158,183.82
June 30, 1905, amount expended during fiscal year on construction of dredge	158,183.82

(See Appendix S 2.)

3. Southwest Pass, Mississippi River.—On February 17, 1898, Congress allotted $10,000 from the appropriation for closing crevasse in Pass a Loutre, Mississippi River, for the purposes of a survey and report of a Board of Engineer officers upon the practicability of securing a channel of adequate width and 35 feet depth at mean low water of the Gulf of Mexico throughout Southwest Pass, Mississippi River. The survey was completed in 1898 and report submitted on January 7, 1899. This report is printed in the Annual Report of the Chief of Engineers for 1899, page 1863. The Board presented a tentative project and stated that, in its opinion, the project presented would, if executed with vigor, secure a navigable channel of adequate width and of 35 feet depth at mean low water of the Gulf of Mexico throughout Southwest Pass at a cost not excessive, considering the vast commercial interests involved.

The item in the river and harbor act approved March 3, 1899, making appropriation for improving outlet of the Mississippi River, provided for the appointment of a Board of Engineers to prepare a project for a channel 35 feet in depth throughout Southwest Pass, and appropriated $20,000 for expenses of the Board. The Board of Engineers appointed under provisions of this act submitted a report and

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project on January 11, 1900. The report is printed on pages 2287–2302, Annual Report for 1900.

The project of the Board contemplated securing a channel 1,000 feet wide and 35 feet deep at mean low water throughout the Southwest Pass, by dredging; the construction of two jetties to maintain the channel; the construction of sills across Cubits Gap, The Jump, and Baptiste Collets Canal; the closing of all minor outlets below the forts; the construction of a dredge in addition to the one provided for by the river and harbor act of March 3, 1899, and the sundry civil act of June 6, 1900, under appropriation for improving outlet of the Mississippi River; other necessary plant, such as tugboats, barges, tracks, buildings, etc., and the purchase of land at the shore ends of the jetties; the whole estimated to cost $6,000,000, and $150,000 additional per annum for maintenance.

In accordance with the report of this Board the river and harbor act of June 13, 1902, appropriated $750,000, and authorized continuing contracts to be made to the amount of $2,750,000 additional toward the prosecution of the project, at the same time authorizing the Secretary of War, in his discretion, to modify the plans described in the report of the Board. The sundry civil act of March 3, 1903, appropriated $1,000,000 additional to be applied to this work, and $1,250,000 was appropriated by act of March 3, 1905.

A project for the expenditure of the amounts appropriated and for which contracts were authorized by the act of June 13, 1902, containing proposed modifications of the project contained in House Document No. 329, Fifty-sixth Congress, first session, was approved by the Secretary of War April 6, 1903. This project contemplates the construction of a dredge, dredging, purchase of land, and construction of two jetties to be built of willow mattresses, stone, and concrete.

The dredge provided for by the river and harbor act of June 13, 1902, was constructed under the supervision of Maj. J. C. Sanford, Corps of Engineers. The trial of the dredge took place in Southwest Pass from April 21 to May 31, 1905. For details of the construction of the dredge see Appendix H 7, herewith.

All of the land below or south of Pilottown, on the east bank, and all that below the United States reservation on the west bank of Southwest Pass, containing about 1,275 acres, was acquired on July 10, 1903, for use in connection with the work.

Contract was entered into July 16, approved July 31, 1903, for construction of the two jetties. The laying of foundation mats in the east jetty was commenced on December 31, 1903, and in the west jetty on August 30, 1904. To June 30, 1905, the east jetty had been extended 22,100 feet from the beginning or shore end, and the termination of foundation mats in the west jetty was about opposite that of the east jetty and a distance of 16,148 feet from the shore end of the west jetty. In the east jetty 110 foundation mats, 42 second-tier, 20 third-tier, and 5 fourth-tier mats had been placed and secured by the required amount of stone. In the west jetty 81 foundation mats had been placed and secured. In addition to the stone required to hold the mattresses in place, 15,441.91 tons had been placed in the east jetty and 7,360.78 tons in the west jetty for foundation under concrete superstructure.

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The amount expended on this improvement to June 30, 1905, was $1,357,177.44.

On account of the advance of the crest of the bar at Southwest Pass since the date of the survey, in 1898, on which the estimates for this improvement were based, it has become necessary to make provision for increasing the lengths of the jetties to correspond with this advance. This will necessarily increase the cost of the jetties. This extension is absolutely necessary to insure the ultimate success of the project.

In order to provide the funds required for prosecuting the work to the greatest advantage, to insure against the possible loss of portions of the jetties by storms, or of accident to the valuable plant engaged on this work, to provide for increasing the floating and other plant required on a work of this magnitude, and in general to insure the efficient and successful prosecution of the project and the early attainment of the projected depth of water through Southwest Pass, an early appropriation of $500,000, in addition to the amount authorized by the act of June 13, 1902, is earnestly recommended for the favorable consideration of Congress.

July 1, 1904, balance unexpended	$1,362,081.50
Amount appropriated by river and harbor act approved March 3, 1905	1,250,000.00
	2,612,081.50
June 30, 1905, amount expended during fiscal year, for works of improvement	[a] 969,258.94
July 1, 1905, balance unexpended	1,642,822.56
July 1, 1905, outstanding liabilities	[b] 209,436.48
July 1, 1905, balance available	1,433,386.08
July 1, 1905, amount covered by uncompleted contracts	1,079,444.56
Amount (estimated) required for completion of existing project	3,000,000.00
Amount that can be profitably expended in fiscal year erding June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	500,000.00

(See Appendix S 3.)

4. Examinations and surveys at South Pass, Mississippi River.—The act of Congress approved March 3, 1875, required examinations and surveys to be made at South Pass, Mississippi River, and reports upon the depth of water and width of channel secured and maintained from time to time in said channel, together with such other information as the Secretary of War might direct. The act of August 11, 1888, made an annual appropriation of $10,000 for this work. The river and harbor act approved June 13, 1902, contains the following:

The provisions of the Act of March third, eighteen hundred and seventy-five, and of the Act of August eleventh, eighteen hundred and eighty-eight, with regard to examinations and surveys at South Pass, mouth of the Mississippi River, shall

[a] Includes $81,379.15 for construction of dredge *Benyaurd* and $69,234.82 for the dredge *Barnard*.

[b] Includes $1,536.77 for construction of dredge *Benyaurd* and $22,494.67 for the dredge *Barnard*.

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remain in force as fully as though they were herein reenacted in express terms, notwithstanding the termination of the contract with the late James B. Eads and associates.

Up to January 29, 1901, the work of making examinations and surveys at South Pass was carried on under the provisions of the acts of March 3, 1875, and August 11, 1888. From January 29, 1901, to June 30, 1902, examinations and surveys were made with funds appropriated by the act of June 6, 1900, for maintenance of South Pass channel.

Since June 30, 1902, under the act of June 13, 1902, repeated surveys have been made of the shoaler localities in South Pass. Complete surveys of the jetty channel and of the channel beyond the ends of the jetties to deeper water in the Gulf were made each month during the fiscal year. A detailed annual survey was made of the 14 miles of channel from the main river to deep water in the Gulf. Discharge measurements were made of each of the three passes during high water.

The amount expended upon this work from the appropriation for the past fiscal year was $8,482.98, exclusive of outstanding liabilities amounting to $1,517.02.

(See Appendix S 4.)

5. Maintenance and improvement of South Pass channel, Mississippi River.—The act of Congress of March 3, 1875, amended by acts of June 19, 1878, and March 3, 1879, made provision for the construction by James B. Eads, or his representatives, of jetties and other works in South Pass to secure and maintain a channel 26 feet in depth through the pass, and through the jetties at the mouth of the pass a channel "26 feet in depth, not less than 200 feet in width at the bottom, and having through it a central depth of 30 feet without regard to width." A contract was made for the maintenance of such a channel for a period of twenty years.

On January 28, 1901, this contract expired, and the work of maintenance is being continued under the provisions of the emergency river and harbor act of June 6, 1900, which provides that at the termination of the contract with the representatives of the estate of James B. Eads, deceased, the Secretary of War shall take charge of and maintain the channel, jetties, and auxiliary works at South Pass, for which a sum not to exceed $100,000 per year is appropriated until otherwise provided by law.

The river and harbor act of June 13, 1902, appropriated an additional sum of $75,000 for the purchase of land at South Pass, for dredging, and for other necessary expenses to maintain the channel with the utmost efficiency. The act of March 3, 1905, authorized contracts to be entered into for materials and work for the improvement of this channel not to exceed in the aggregate $50,000, exclusive of the amounts heretofore provided by law.

From January 29 to June 30, 1901; from May 26 to October 4, 1902, and from February 15 to August 24, 1903, the channel was maintained by dredging with the U. S. dredge *Beta*, belonging to the Mississippi River Commission.

From July 2 to 25, and from October 5 to 26, 1901, dredging was done by the U. S. dredge *Sabine*. No dredging in the channel through South Pass was done from October 26, 1901, to May 26, 1902;

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from October 17, 1902, to March 23, 1903, and from August 24, 1903, to October 24, 1904.

From September 18 to October 17, 1902; from April 5 to August 17, 1903; from January 30 to March 16, and from July 15 to August 19, 1904, the dredge *Sabine* was employed in dredging the channel beyond the ends of the jetties.

The dredge *Benyaurd*, built under the appropriations for improving passes of the Mississippi River and improving Southwest Pass, Mississippi River, arrived in New Orleans on October 12, 1904, and began dredging in the channel beyond the ends of the jetties on October 24, 1904. Since that date she has been operated in South Pass and the channel beyond the ends of the jetties, except for periods when she was undergoing repairs or coaling.

Repair work on jetties and auxiliary works was commenced August 5, 1901. These works have been maintained in good condition since that time by the addition, from time to time, as required, of willows, stone, piles, and waling timber.

Portions of the plant and materials of the Eads estate have been purchased at various times since the termination of their contract with the United States, at a total cost of $27,636.94, for use in maintaining the jetties and auxiliary works. Of this amount, $21,263.32 was expended for the purchase of plant and $6,373.62 for materials.

The lands along both sides of South Pass, from Head of Passes to the Gulf, containing about 6,994 acres, together with the buildings thereon, were acquired by purchase July 8, 1903, the price paid being $35,000.

The sum of $498,876.57 was expended on this work from January 29, 1901, to June 30, 1905, of which $86,258.16 was expended during the past fiscal year.

Comparative statement of receipts and shipments for six years for the port of New Orleans, La.

Year ending December 31—	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
1899	3,176,740		
1900	2,773,645		403,095
1901	4,213,869	1,440,224	
1902	3,385,686		828,183
1903	3,062,506		323,180
1904	2,853,926		208,580

Amount (estimated) required for completion of existing project---- $50,000.00

Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905---------- 50,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix S 5.)

6. Bayou Lafourche, Louisiana.—Bayou Lafourche is an outlet of the Mississippi River, forming a junction 70 miles above New Orleans. It is about 105 miles long and flows into the Gulf of Mexico. In its original condition it was obstructed by logs, snags, and overhanging

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trees. The project of 1879 provided for the removal of such obstructions to improve low-water navigation. Work under this project was carried on until 1885, with appropriations aggregating $30,000.

The project of June 11, 1886, provided for the construction of a lock to connect the bayou with the Mississippi River and for dredging a channel 75 feet wide and 5 feet deep at mean low water of the Gulf, at an estimated cost of $450,000, and $8,000 annually thereafter for maintenance. Work under this project was confined to dredging to maintain low-water navigation, the appropriations at any one time being insufficient to warrant the commencement of the lock, and the exigencies of commerce not permitting a suspension of the dredging.

The project of 1886 was modified on September 23, 1896, and held in abeyance the construction of the lock, restricting operations to dredging to maintain low-water navigation, at an estimated cost of $25,000 per annum.

The project of July 11, 1895, for the expenditure of $40,000, appropriated August 18, 1894, recommended that $30,000 be reserved for the purchase of a dredge whenever it should become advisable to make such purchase.

Dredging operations under the modified project of 1896 were carried on in 1897 and 1898 from the head of the bayou to about 3 miles below Thibodeaux, improving about 38 miles of channel. This improvement is not permanent, as sand bars form each year after the subsidence of floods in the Mississippi River.

The project of July 11, 1895, so far as the reservation of $30,000 for purchase of a dredge is concerned, was modified on December 7, 1899, to allow the expenditure of $9,000 of this amount in dredging to maintain flatboat navigation during low water. With these funds and the $7,500 appropriated March 3, 1899, dredging was carried on from August 9, 1899, to January 22, 1900, and a depth of 3 feet during low water was secured from the head of the bayou at Donaldsonville to a point 8 miles below.

The project of July 11, 1895, was further modified on May 11, 1900, to allow the expenditure of funds remaining to the credit of this appropriation in dredging during the low-water season. Dredging was carried on from July 25 to December 8, 1900, from June 25 to December 30, 1901, and from September 5 to December 13, 1902, to maintain channel during low-water seasons of 1900, 1901, and 1902, respectively.

The amount expended on this work up to June 30, 1905, was $257,990.74.

The navigation of Bayou Lafourche is at present obstructed by a dam placed across the head of the bayou at its junction with the Mississippi River by levee boards of the State of Louisiana, under authority of the act of Congress approved June 13, 1902. The time for the removal of this dam has been extended to December 13, 1907, by joint resolution of Congress approved April 13, 1904.

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Comparative statement of receipts and shipments for ten years.

Date.	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
Year ending May 31—			
1896	229,891		33,716
1897	217,292		12,599
1898	269,398	52,106	
1899	206,516		62,882
Calendar year—			
1899	157,258		49,258
1900	210,315	53,057	
1901	137,357		72,958
1902	132,745		4,612
1903	94,351		38,394
1904	66,839		27,512

July 1, 1904, balance unexpended	$2,059.26
June 30, 1905, amount expended during fiscal year for works of improvement	50.00
July 1, 1905, balance unexpended	2,009.26

(See Appendix S 6.)

7. Bayou Plaquemine, Grand River, and Pigeon Bayous, Louisiana.—Prior to 1867 the largest steamboats could pass through Bayou Plaquemine into Grand Lake and other connecting water routes, but at that time the police jury of Iberville Parish closed the bayou by means of a dam, shutting out the waters of the Mississippi. Grand River and Pigeon Bayous were obstructed by snags, logs, overhanging trees, and sand bars.

The present project is based upon legislation by Congress, according to project and estimate submitted February 11, 1887, and provides for dredging a channel in Bayou Plaquemine 60 feet wide and 6 feet deep from deep water up to the Plaquemine dike, constructing a lock to connect the bayou with the Mississippi River, securing the mouth of the bayou from further caving, and removing obstructions from Grand River and Pigeon Bayous; total estimated cost, $1,708,250, subsequently increased to $1,740,000.

The project of 1887 was modified on April 10, 1899, to allow for dredging Bayou Plaquemine to a depth of 10 feet and a width of 125 feet.

The protection of the bank of the Mississippi River at the mouth of the bayou was added to the improvement in 1888, and in act of July 13, 1892, the improvement of Grand River and Pigeon Bayous was also incorporated therein.

The act of June 3, 1896, authorized continuing contracts to be entered into to complete the project of improvement, not to exceed $1,173,250, exclusive of the amounts therein and previously appropriated. Of this amount $1,160,000 was subsequently appropriated by sundry civil acts of 1897, 1899, 1900, and 1901. By act of March 3, 1905, $35,000 was appropriated for maintenance of improvement, and contracts for completing improvement authorized not to exceed $100,000 exclusive of the amounts heretofore appropriated.

Dredging was carried on in Bayou Plaquemine in 1890, 1891, 1892, and 1894, resulting in securing a channel 6 feet deep and 60 feet wide from the mouth to the railroad bridge.

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Contract for the rectification of Bayou Plaquemine under the modified project of April 10, 1899, was entered into July 15, 1899. From October 29, 1899, to June 5, 1902, the contractors excavated 402,630 cubic yards of material. No work was done from June 5, 1902, to May 24, 1904; on the latter date the contractors resumed operations under the contract, and to June 30, 1905, 506,630 cubic yards of material had been removed in accordance with the terms of the contract. In addition, 16,500 cubic yards was removed under supplemental contract. A partial channel was dredged through portions of the bayou, and work was suspended on June 27, 1905, until the lock shall have been opened to navigation, when work will be resumed and the material deposited in the Mississippi River.

An allotment of $75,000 was made from the appropriation of 1888 for securing the bank of the Mississippi River at the head of the bayou. Five submerged spur dikes, placed at intervals of about 900 feet, with intervals protected by revetment, were completed in 1894. These dikes and revetments form a continuous protection 1,400 feet long below the site of the lock and 1,200 feet above, with an interval of 500 feet opposite the lock site left for excavating the necessary channel to the lock. On November 30, 1901, and January 29, 1902, two mattresses, 400 by 600 feet and 400 by 450 feet, respectively, were sunk in the river and heavily loaded with stone for protection of the banks near the proposed approach to the lock.

In 1893, 1894, and 1897 obstructions were removed from the mouth of Bayou Sorrel and down Grand River, through Pigeon Bayou to Grand Lake, a distance of 30 miles. Flat Lake, at the mouth of Grand River, was dredged in 1893 and 1897.

Work of dredging and removing obstructions from Grand River was carried on under contract of November 25, 1889, until April 20, 1901. Obstructions were removed from the mouth of Bayou Plaquemine to 2 miles below Bayou Pigeon, and at Bay Natchez, a distance of 30 miles. A survey of Flat Lake and Bay Natchez was made in 1901, and a project for dredging a 50-foot channel, 10 feet deep, through them was approved April 20, 1901, and modified March 21, 1902. A contract for the work was approved May 1, 1902. The work was commenced in Flat Lake July 5 and in Bay Natchez August 7, 1902. The channel through Flat Lake was completed on January 30, 1903, and through Bay Natchez on May 14, 1904, a total of 369,198 cubic yards of material being excavated.

With funds appropriated in 1894, the work of constructing a cofferdam, excavating, and driving piles for foundation for the lock was carried on from 1895 to 1898 and completed.

In 1891 a project for the construction of a lock was submitted, but the funds available were insufficient to warrant its commencement at that time. The Board of Engineer officers appointed to prepare plans and specifications estimated the cost of the lock at $700,000. Revised plans and specifications for the construction of the lock and approaches were approved October 27, 1897, and December 2, 1897, respectively, and a continuing contract for the work was entered into May 28, 1898, and approved June 17, 1898. The work was commenced in August, 1898. Under this contract the floor and walls of the lock were completed, and miter sills, inlet pipes, and snubbing hooks placed. By direction of the Chief of Engineers, supplemental

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contract was entered into with the contractors on June 18, and approved by the Secretary of War June 24, 1903, annulling their contract upon payment to them of the retained percentages and other items claimed by them, aggregating $24,236.41. Revised plans for construction of lock gates and of the approaches to the lock, including excavation and fill, were approved on June 11, 1903.

A contract for the construction of power house and operating machinery for the lock for $114,000 was entered into November 18, 1899. Notice to commence work was given July 23, 1904, and work on the ground commenced in February, 1905. To the end of the fiscal year the boilers and machinery had been placed in position, materials accumulated on the lock walls, etc., and work on the contract was well advanced.

For the approach to the lock 1.25 acres of land on the north side and 0.31 acre on the south side were purchased August 24, 1900, for $7,500.

A contract was approved May 5, 1902, for the construction of a protection levee from the northeast corner of the lock to connect with the main levee system in front of the lock. The work was completed August 8, 1902.

Contract for constructing the lock gates was entered into February 8, approved February 19, 1904, the work to be completed August 23, 1905. Work on the ground was commenced in December, 1904. At the close of the fiscal year work on the contract was about 75 per cent completed, three gates being erected and practically completed, and both halves of one gate and one half of the remaining gate being assembled.

Contract was entered into on February 13, approved February 17, 1905, for constructing protection levee and making a portion of the fill behind the lock walls, estimated amount of material to be placed under this contract being 40,000 cubic yards. Work was commenced in March, 1905, and at the end of the fiscal year 16,200 cubic yards had been placed.

A contract was entered into on June 19, 1905, providing for construction of the approach at the bayou end and part of the approach at the river end of the lock, the material excavated to be placed behind the lock walls. Work under this contract had not been commenced at the end of the fiscal year.

The sum of $1,191,568.88 was expended on these improvements up to June 30, 1905, including $1,000 withdrawn by the Chief of Engineers June 20, 1901, for office expenses.

For maintaining the dredged channel through Bayou Plaquemine and Grand River and for removing sediment from the lock chamber a dredge should be constructed for use in connection with this improvement. It is believed that $100,000 could be advantageously expended in this connection, as follows:

Cost of dredge	$60,000
Operating same two years, at $15,000 per year	30,000
Contingencies, etc	10,000
Total	100,000

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Comparative statement of receipts and shipments for ten years.

Date.	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
Year ending May 31—			
1896	92,379		23,163
1897	57,055		35,324
1898	76,626	19,571	
1899	89,301	12,675	
Calendar year—			
1899	111,750	22,449	
1900	88,543		23,207
1901	283,000	194,457	
1902	292,000	9,000	
1903	302,500	10,500	
1904	318,000	15,500	

July 1, 1904, balance unexpended		$571,258.08
Amount appropriated by river and harbor act approved March 3, 1905		35,000.00
		606,258.08
June 30, 1905, amount expended during fiscal year, for works of improvement		122,826.96
July 1, 1905, balance unexpended		483,431.12
July 1, 1905, outstanding liabilities		38,097.08
July 1, 1905, balance available		445,334.04
July 1, 1905, amount covered by uncompleted contracts		344,074.23
Amount (estimated) required for completion of existing project		100,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905		100,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix S 7.)

8. Bayou Teche, Louisiana.—Bayou Teche is an important commercial stream of southern Louisiana, and finds its outlet into the Gulf of Mexico through Atchafalaya River. Prior to improvement it had a depth of 8 feet to St. Martinville, La., but navigation was rendered dangerous by numerous obstructions. Above St. Martinville the bayou was navigable by steamboats during high water. The project of 1870 provided for removal of obstructions from the head to the mouth of the bayou. Work under this project was carried on from 1870 to 1886, the stream being cleared of logs, snags, wrecks, overhanging trees, and a number of sand bars. The improvement was not permanent and other obstructions formed.

The project of 1891 provided for the removal of obstructions between St. Martinville, La., and the mouth of the bayou, a distance of about 80 miles. Work under this project has been carried on since 1891, obstructions being removed as appropriations were made.

The river and harbor act of March 3, 1905, provides for a resurvey of the project submitted in House Document No. 69, Fifty-fifth Congress, first session, for securing a low-water channel of 6 feet from St. Martinville to the source of the bayou. This survey was in progress at the close of the fiscal year.

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To June 30, 1905, $88,957.78 had been expended upon this work, of which $7,500 was for maintenance and $457.78 for expenses of resurvey of the bayou.

It is estimated that $10,000 can be profitably expended, in addition to the available balance, in removal of obstructions and maintaining the low-water channel from St. Martinville to the mouth of the bayou.

Comparative statement of receipts and shipments for ten years.

	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
Year ending May 31—			
1896	293,685	13,757	
1897	303,029	9,344	
1898	238,783		64,246
1899	286,091	47,308	
Calendar year—			
1899	272,975		13,116
1900	212,109		60,866
1901	335,583	123,474	
1902	408,454	72,871	
1903	450,542	42,088	
1904	362,706		87,836

Amount appropriated by river and harbor act approved March 3, 1905	$7,500.00
June 30, 1905, amount expended during fiscal year, on resurvey of bayou	457.78
July 1, 1905, balance unexpended	7,042.22
July 1, 1905, outstanding liabilities	747.15
July 1, 1905, balance available	6,295.07

(See Appendix S 8.)

9. Removing sunken vessels or craft obstructing or endangering navigation.—It having been reported that the wrecks of three unnamed coal barges were obstructing the navigation of Bayou Teche, Louisiana, an examination of the wrecks was made under the direction of the officer in local charge, and, in accordance with his recommendation, contract was entered into for removing the wrecks. The work was completed on December 15, 1904. The total expense of the removal, including cost of examination of the wrecks, was $625.

(See Appendix S 9.)

IMPROVEMENT OF HOMOCHITTO RIVER, MISSISSIPPI, AND OF CERTAIN RIVERS AND HARBORS IN SOUTHERN LOUISIANA AND EASTERN TEXAS.

This district was in the temporary charge of Lieut. Col. H. M. Adams, Corps of Engineers, until July 7, 1904, and in the charge of Capt. James F. McIndoe, Corps of Engineers, since that date. Division engineer, Lieut. Col. H. M. Adams, Corps of Engineers, to August 12, 1904, and Lieut. Col. Clinton B. Sears, Corps of Engineers, since that date.

1. Homochitto River, Mississippi.—About 8 miles above Fort Adams, Miss., the Homochitto enters the Mississippi River. For the first 3 miles from that point it is designated as the "Narrows," and for a distance of 12 miles farther as "Old River." A preliminary examination made in 1896 showed that the Narrows had a depth of

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5 feet at low water and a width of 150 feet, except for a distance of about 1 mile, where the stream is very narrow and shoal. This narrow and shoal portion was obstructed by snags and logs. Old River was about 1,000 feet wide and about 2 feet in depth over the shoalest places at low water. It was clear of obstructions. Above Old River the Homochitto River had a navigable depth of about 8 feet and a width of about 150 feet for a distance of about 45 miles, but it was thickly obstructed by snags, logs, and overhanging trees.

The act of March 3, 1899, appropriated $16,000 for the removal of obstructions between the mouth of the river and the Yazoo and Mississippi Valley Railway bridge, a distance of about 60 miles, and a project for the work was approved April 18, 1899.

Work under this project was commenced November 27, 1899, and continued until August 13, 1900, resulting in the improvement of the channel for a distance of about 18 miles and a width varying from 60 to 200 feet.

Under act of June 13, 1902, $2,000 was appropriated for the maintenance of this improvement, which sum, together with the unexpended balance from former appropriations, made $2,521 available for expenditure under a project approved July 17, 1902, providing for the maintenance of the improved channel for a distance of 14 miles, or as far as available funds would permit. Work was begun under this project September 4, 1902, and continued until January 12, 1903, when operations were suspended on account of the high stage of the river. The improved channel was cleared of obstructions from the mouth of the Old River to its north fork, a distance of about 5 miles.

No work has been done since January, 1903, the balance available being too small for effective work.

The act of March 3, 1905, appropriated $2,000 for the maintenance of this improvement, and project approved April 7, 1905, provides for its expenditure during the low-water season in removing obstructions from the river from its mouth, at its junction with the Mississippi River, as far up as available funds will permit.

The amount expended to July 1, 1905, is $17,576.90, of which $2,097.90 was applied to the maintenance of improvement.

The improvement is not permanent, as snags and logs will continue to accumulate in the improved portion of the stream. There still remains about 36 miles of the channel to improve to complete the project of 1899.

No detailed commercial statistics for the calendar year 1904 were available. Circular letters and blank forms for furnishing statistics were sent in March, 1905, to all parties known to operate boats, etc., on this stream, but no satisfactory replies were received. The commerce consists mainly in the rafting of timber.

July 1, 1904, balance unexpended	$423.10
Amount appropriated by river and harbor act of March 3, 1905	2,000.00
July 1, 1905, balance unexpended	2,423.10

(See Appendix T 1.)

2. Bogue Chitto, Chefuncte River, Bogue Falia, Tickfaw River and tributaries, Amite River, and Bayou Manchac, Louisiana.—(*a*) *Bogue Chitto.*—Originally navigation on this stream was impeded by

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snags, logs, and overhanging trees throughout its entire length, except during very high stages of water. The minimum width of channel was 80 feet and the least depth of water 3 feet.

The present project, adopted in 1890, provided for securing and maintaining a channel 3 feet deep from the mouth of the river to Alford's bridge, near Summit, Miss., a distance of about 190 miles, by closing the west mouth and several small run-out bayous, and by the removal of obstructions and overhanging trees, at an estimated cost of $55,000.

The report of the survey upon which the project of 1890 is based will be found in the Annual Report of the Chief of Engineers for 1889, page 1465.

Owing to the inadequacy of appropriations it has been possible to carry out the above project only as far as Cross River, about 80 miles, which distance had to be cleared periodically to maintain the improvement. On June 30, 1900, the condition of the river permitted of navigation being had by light-draft boats from the mouth of the river to Cross River.

Under the project approved by the Chief of Engineers July 31, 1902, $3,000, allotted from the $9,500 appropriated by the act of June 13, 1902, for "Improving Bogue Chitto, Chefuncte River, Bogue Falia, Tickfaw River and tributaries, Amite River, and Bayou Manchac, Louisiana," was applied to maintenance of the improved channel by the removal of such snags, logs, and overhanging trees as had accumulated, with the result that the stream was made navigable for a distance of 84 miles from its mouth.

No work has been done since February, 1903, the balance available being too small for effective work.

The amount expended to July 1, 1905, is $27,803.11, of which amount it is estimated $12,890.51 was applied to maintenance.

The commerce consists mainly of the rafting of logs and lumber for the surrounding sawmills. No boats ply regularly on this stream. The only commercial statistics furnished for calendar year 1904 was 48,750 tons of logs and 975 tons of sawed lumber, although it is stated that 250,000,000 feet of pine timber is floated down this river annually.

(*b*) *Chefuncte River and Bogue Falia.*—Prior to improvement of Chefuncte River a bar, with a depth of only 4½ feet of water, obstructed the entrance to the mouth of the river. From this point to its junction with the Bogue Falia, a distance of 10 miles, the river was from 300 to 800 feet in width, with a channel 15 feet in depth, navigable for steamers and sailing vessels, but obstructed by snags and overhanging trees. Above this point the stream is not navigable.

Bogue Falia was navigable for small steamers from point of junction with the Chefuncte to Grants Landing, 4 miles above; for sailing vessels drawing 5 feet or less, to Covington, 2 miles farther; obstructed by snags and overhanging trees. Not navigable beyond Covington.

The original project of 1880 provided for dredging through the bar at the mouth of the Chefuncte River and for the removal of all obstructions between its mouth and Covington on the Bogue Falia, at an estimated cost of $5,460. It was modified in 1884 to permit of

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the construction of a breakwater to protect the channel dredged across the bar at mouth of the Chefuncte River. Estimated cost, $1,500.

For an account of the improvements under original project and modification, see Annual Report of the Chief of Engineers for 1896, page 1485.

The work of maintenance was commenced under the project approved August 10, 1892. During the fiscal year ending June 30, 1903, a number of obstructions to navigation were removed, and the channel across the bar, which had refilled, was dredged for a length of 1,239 feet, with an average width of 150 feet. Depth of water in the channel was 6.8 feet.

In February, 1903, $1,194.01 remaining to the credit of this allotment was transferred to that for "Improving Amite River and Bayou Manchac, Louisiana."

No work has been done since January 31, 1903, there being no funds available.

An allotment of $500 was made from the act of March 3, 1905, for maintenance of the improvement, and project approved May 10, 1905, provides for its expenditure in removing such snags, logs, and overhanging trees as interfere with navigation.

The amount expended to July 1, 1905, is $12,305.99, of which $5,805.99 was applied to maintenance.

Comparative statement of receipts and shipments for ten years.

	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
Year ending May 31—			
1894	242,464	212,180	
1895	49,778		192,686
1896	67,680	17,902	
1897	110,084	42,354	
1898	99,505		10,529
1899	97,789		1,716
Calendar year—			
1899	156,500	58,711	
1900	86,856		69,644
1901	92,874	6,018	
1902	100,768	7,894	
1904	184,099	83,331	

(*c*) *Tickfaw River and tributaries, Louisiana.*—These streams—the Tickfaw, Blood, Natalbany, and Ponchatoula rivers—had a 9-foot channel, navigable for steamers and schooners for an aggregate distance of 38 miles, but obstructed by snags, logs, and overhanging trees.

The original project, adopted in 1881, provided for the removal of obstructions as far as appropriations would permit; estimated cost, $10,230. The project for maintenance of the improvement was approved August 10, 1892, and under these two projects the work has been carried on since 1881.

During 1896 the water hyacinths at the mouth of the Tickfaw River were removed, and in 1889 a bar which had formed at the same locality was cut away. About 30 miles of the river and its tributaries was improved.

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Under the project approved July 31, 1902, the work of maintenance was continued until November 22, 1902, at which time these streams had ample depth for the commerce to be benefited and were practically free from obstructions except as regards the water hyacinths.

An allotment of $1,000 was made from the act of March 3, 1905, for maintenance of the improvement, and project approved May 10, 1905, provides for its expenditure in removing obstructions, beginning at mouth of Tickfaw River and extending up that stream and the Natalbany River, as far as available funds will permit.

Operations were commenced with a hired plant on June 24, 1905. The amount expended to July 1, 1905, is $12,956.38, of which it is estimated $4,956.38 was applied to maintenance.

Comparative statement of receipts and shipments for ten years.

	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
Year ending May 31—			
1894	40,003	26,009	
1895	23,384		16,619
1896	72,851	49,467	
1897	58,115		14,736
1898	75,579	17,764	
1899	52,961		22,618
Calendar year—			
1899	79,300	26,339	
1900	55,540		23,760
1901	56,464	924	
1902	45,632		10,832
1904	86,302	40,670	

(*d*) *Amite River and Bayou Manchac, Louisiana.*—Prior to improvement the Amite River was navigable for small steamers for a distance of 45 miles from its mouth, and Bayou Manchac for a distance of 10 miles, but both streams were obstructed by snags, logs, and overhanging trees.

The original project, as adopted in 1880 and modified in 1883 and 1888, provided for the removal of obstructions in Bayou Manchac from Hope Villa to the Amite River, and in the latter stream to Lake Maurepas (its mouth), at an estimated cost of $31,760.

Amite River was improved for a distance of 42 miles from its mouth, and Bayou Manchac for a distance of 10 miles from its junction with the former stream. A turning basin was made at the upper limit of improvement in Bayou Manchac.

The work of maintenance has been caried out under the project of 1892 and subsequent projects.

Under the project approved July 31, 1902, the bar at the mouth of Amite River was redredged, giving a channel 60 feet wide, with an 8-foot depth for 1,600 feet and a 6-foot depth for an additional 1,800 feet. On account of exhaustion of funds dredging was discontinued February 4, 1903, leaving a distance of 500 feet with a channel depth of only 4.5 feet.

An allotment of $5,000 was made from the act of March 3, 1905, for maintenance of the improvement, and project approved May 10, 1905, provides for its expenditure in redredging and removing ob-

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structions at the mouth of Bayou Manchac and in redredging the channel over the bar at mouth of Amite River, as far as available funds will permit.

Specifications have been prepared, the work advertised, and bids will be opened July 12, 1905.

The improvement is not considered permanent, as snags and logs will continue to accumulate and bars will continue to form at the mouths of the streams, thus obstructing navigation.

The amount expended to July 1, 1905, is $37,358.39, of which it is estimated $12,457.67 was applied to maintenance.

Comparative statement of receipts and shipments for ten years.

	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
Year ending May 31—			
1894	157,902	135,808	
1895	42,983		114,919
1896	55,103	12,120	
1897	49,509		5,594
1898	54,749	5,240	
1899	60,305	5,556	
Calendar year—			
1899	59,850		455
1900	25,400		34,450
1901	69,918	44,518	
1902	44,694		25,224
1904	120,851	76,157	

July 1, 1904, balance unexpended	$424.35
Amount appropriated by river and harbor act approved March 3, 1905	6,500.00
	6,924.35
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	48.22
July 1, 1905, balance unexpended	6,876.13
July 1, 1905, outstanding liabilities	325.88
July 1, 1905, balance available	6,550.25
Amount (estimated) required for completion of existing project	30,000.00

(See Appendix T 2.)

3. Channel, bay, and passes of Bayou Vermilion and Mermentau River and tributaries, Louisiana.—(*a*) *Channel, bay, and passes of Bayou Vermilion.*—Prior to improvement the upper 12 miles of Bayou Vermilion was only 2 feet deep and its lower portion, through the bay and passes, not less than 5½ feet deep, and had a width varying from 100 to 400 feet. The channel, however, was obstructed by snags, logs, and overhanging trees.

The original project, adopted in 1882, provided for the removal of these obstructions, the erection of guide piling to indicate the limits of the channel over the bars in Vermilion Bay, and for securing a navigable depth of 5½ feet up to the railroad bridge near Lafayette, La.

Project for maintenance (1892) was approved by the Secretary of War August 12, 1892.

Operations were carried on with the appropriations made in 1892, 1893, 1896, and 1899, and the stream cleared of obstructions from

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Abbeville, La., to the railroad bridge near Lafayette, La., a distance of about 36 miles. No work was done from February, 1900, to September, 1902.

An examination in 1901 showed that obstructions had again formed, and the project approved July 12, 1902, provided for their removal from the mouth of the bayou to the railroad bridge near Lafayette, La., or as far as funds available would permit. About 36 miles of the bayou was cleared of obstructions under this project, the work being completed in November, 1903. At that date there was an available channel from the mouth of the bayou to the Southern Pacific Railway bridge, near Lafayette, La., for vessels drawing 5 feet of water or less.

The improvement is not considered permanent, as obstructions will continue to form and must be periodically removed.

An allotment of $1,000 was made from the act of March 3, 1905, for maintenance of the improvements, and project approved May 24, 1905, provides for its expenditure in removing obstructions from the channel from its mouth to the railroad bridge, or as far as available funds will permit.

The amount expended to July 1, 1905, is $35,124.10, of which amount $25,224.10 has been expended under projects for maintenance.

Comparative statement of receipts and shipments for ten years.

	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
Year ending May 31—			
1895	12,988		30,889
1896	13,022	89	
1897	6,126		6,896
1898	8,862	2,736	
1899	14,969	6,107	
Calendar year—			
1900	21,150		
1901	31,385	10,235	
1902	37,000	5,615	
1903	15,157		21,843
1904	29,326	14,169	

(*b*) *Mermentau River and tributaries, Louisiana.*—Prior to improvement these streams had depths varying from 7 to 30 feet. The channel through Grand Lake was 6 feet deep, and the depth at the mouth of the river was about 13 feet. The width varies from 70 feet near Viterboville to 350 feet at Lake Arthur. The channel was crooked and obstructed by snags and logs.

The original project of 1892 provided for the removal of obstructions in the upper river and the construction of brush dams in the lower river to remove existing mud flats. The estimated cost was $23,615.25.

With the appropriations of 1892, 1894, and 1896 operations were carried on from December, 1892, to December, 1899, and 38 miles of the channel, from the lower end of Lake Arthur downstream, was cleared of obstructions; two brush dams, 2,500 and 3,000 feet in length, respectively, were built in Mud Lake, and a channel 8 feet in depth and 50 feet in width was cut across the flats in Mud Lake and maintained as the exigencies of navigation required.

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The project approved July 12, 1902, provided for the expenditure of the allotment from the appropriation of June 13, 1902, together with the unexpended balance from former appropriations, for the restoration of the brush dams in Mud Lake to their original condition, and for the removal of such obstructions as might be found to be necessary to facilitate navigation.

Under this project the necessary repairs to the upper brush dam in Mud Lake were completed under contract on June 2, 1903.

An allotment of $2,000 was made from the act of March 3, 1905, for maintenance of the improvement, and project approved May 24, 1905, provides for its expenditure in removing such obstructions as may develop from the mouth of the Mermentau River to the head of navigation in the tributaries, or as far as funds will permit.

The amount expended to July 1, 1905, is $25,289.88, of which it is estimated that $8,573.40 was applied to maintenance.

Comparative statement of shipments and receipts for ten years.

	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
Year ending May 31—			
1895	15,955	10,518	
1896	16,459	504	
1897	12,210		4,249
1898	18,650	6,440	
1899	22,236	3,586	
Calendar year—			
1900	27,034		
1901	29,291	2,257	
1902	50,326	21,035	
1903	63,690	13,364	
1904	45,866		17,824

July 1, 1904, balance unexpended	$808.96
Amount appropriated by river and harbor act approved March 3, 1905	3,000.00
	3,808.96
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	207.69
July 1, 1905, balance unexpended	3,601.27
July 1, 1905, outstanding liabilities	50.25
July 1, 1905, balance available	3,551.02

(See Appendix T 3.)

4. Mouth and passes of Calcasieu River, Louisiana.—Prior to improvement there existed a depth of 6½ feet over the outer bar at the entrance to Calcasieu Lake. The lake was 15 miles in length, with a depth of 6 feet. The depth of water over the inner bars was 3½ feet, and from the upper bar to Lake Charles, Louisiana, the river was not less than 8 feet deep.

Under the original project of 1872, with the modification of 1881, a channel 8 feet in depth, 70 feet wide, and 7,500 feet in length was cut through the inner bars during 1874, 1882, and 1883, but this channel having shoaled to 3½ feet it was redredged in 1886 under the project of that year, and a plank revetment to provide against refilling was commenced. The noncompletion of this revetment caused the refilling of the channel.

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Appropriations made in 1888, aggregating $85,000, for the construction of a revetment and parallel jetties, in accordance with the project of 1886, not being sufficient, this sum was increased by $100,000 in 1892.

The project of 1892, under which the present work is being carried on, provides for the dredging of a channel 8 feet in depth through the inner bars and revetting this channel; to construct parallel jetties of brush and stone at the entrance to the outer pass, and to dredge a channel between these jetties to a depth of 12 feet if necessary. The total estimated cost of these improvements is $600,000.

Under this project the revetment was completed in August, 1893. A channel 8 feet deep and 50 feet wide, connecting deep water in Calcasieu Pass and Lake, was dredged in 1894. 1895, and 1898. Construction of the east jetty was carried on in 1894, 1895, and 1896, and of the west jetty in 1897. In 1900, with an appropriation of $35,000, the foundation of the west jetty was extended 1,000 feet, making its total length 3,200 feet. During the fiscal year ending June 30, 1903, the channel was redredged for a distance of 3,770 feet, with a width of 60 feet and a mean low-water depth of 8 feet. Under authority of the Chief of Engineers and with the consent of the contractor for that work, $5,000 was transferred from the allotment for repairs to an extension of the the east jetty, with which amount the length of the redredged channel was increased to 5,770 feet.

The work of repairs and extension of east jetty, under contract, was commenced September 15, 1904, and was completed January 4, 1905. All the breaks made by the hurricane of 1900 were repaired and the east jetty extended 600 feet. Twenty-one thousand and thirty-one and nine-tenths tons of riprap stone and 5,333.34 square yards of brush mattresses were required for this work; 52 granite capping stones were also raised and replaced on the jetty. The east jetty is now 8,600 feet long and the west jetty 3,200 feet.

An examination of the channel made in May, 1905, developed the fact that the channel dredged to a depth of 8 feet in 1903 through the inner pass had shoaled to less than 4 feet and that the revetments placed for protection of this channel had almost entirely disappeared.

The channel through the outer pass between the jetties had a depth at low tide of about 10 feet, which is ample for present needs of navigation, considering the condition of channel through inner pass.

The act of March 3, 1905, appropriated $100,000 for continuing improvement and for maintenance. A survey to extend from the mouth of the river to the outer pass was authorized May 20, 1905, for the purpose of obtaining the data necessary for preparation of project, and all preliminary arrangements for the party to take the field are completed.

The amount expended to July 1, 1905, is $511,221.57. Of this amount $477,062.71 has been expended under the present project, of which it is estimated that $15,321.39 was applied to maintenance.

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Comparative statement of shipments and receipts for ten years.

	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
Year ending May 31—			
1895	254,394		90,579
1896	202,755		51,619
1897	141,029		61,726
1898	190,017	48,988	
1899	174,651		15,366
Calendar year—			
1900	139,580		
1901	139,045		535
1902	148,483	9,438	
1903	194,155	45,672	
1904	226,216	32,061	

July 1, 1904, balance unexpended	$59,956.71
Amount appropriated by river and harbor act of March 3, 1905	100,000.00
	159,956.71
June 30, 1905, amount expended during fiscal year, for works of improvement	59,678.28
July 1, 1905, balance unexpended	100,278.43
July 1, 1905, outstanding liabilities	70.40
July 1, 1905, balance available	100,208.03
Amount (estimated) required for completion of existing project	242,681.00

(See Appendix T 4.)

5. Johnsons Bayou, Louisiana.—This stream empties into Sabine Lake, Texas. Preliminary survey, made in 1897, showed a minimum depth of channel of 12 feet and only 2½ feet over the bar at the mouth of the bayou.

The project of April, 1899, provided for dredging a 6-foot channel through the bar at the mouth of the bayou of such width as the appropriation ($2,500) would permit.

This work was completed during December, 1899, and a channel 6 feet deep and 60 feet wide secured.

No work was carried on during the past fiscal year.

To June 30, 1904, there had been expended on this improvement $2,261.35, at which time the stream was navigable for vessels drawing 5 feet or less.

No further work being considered necessary the unexpended balance of the appropriation, $238.65, was, on June 30, 1904, carried to the surplus fund in the Treasury.

Comparative statement of shipments and receipts for six years.

Calendar year.	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
1899	3,163		
1900	3,594	431	
1901	4,363	769	
1902	2,951		1,412
1903	2,612		339
1904	4,574	1,962	

(See Appendix T 5.)

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6. Mouths of Sabine and Neches rivers, Texas.—Prior to improvement there was 3½ feet of water over the bar at the mouth of the Sabine River, and 3 feet over the bar at the mouth of the Neches River. Dredging was carried on at the mouth of the Sabine River in 1880 and 1895 and a channel 60 feet wide and 7 feet deep secured. At the mouth of the Neches River dredging was carried on in 1880, 1889, and 1895, and a channel 50 feet wide and 5 feet in depth for a length of 8,000 feet was obtained. Funds were exhausted before deep water in Sabine Lake was reached. In 1897 the channel at the mouth of the Sabine River still afforded a depth of 7 feet, while the channel at the mouth of the Neches River had shoaled to 4 feet.

The act of March 3, 1899, appropriated $10,000 for improving the mouths of these streams, the appropriation to include the expense of reexamination of the proposed channel through Sabine Lake by a Board of Engineer officers.

The Board constituted in compliance with this act submitted on August 11, 1899, a report on the proposed channel through Sabine Lake, which report will be found in the Annual Report of the Chief of Engineers for 1900, page 2302.

The project approved July 14, 1899, provided for dredging from deep water in the Neches River to deep water in Sabine Lake. Under this project an 8-foot channel 7,829 feet in length was dredged from the 7-foot contour in Sabine Lake. A part of the appropriation was expended in deepening the channel across the bar at the mouth of the Sabine River.

A project submitted April 23, 1904, and approved by the War Department May 6, 1904, provided for the dredging of an 8-foot channel through Sabine Lake from the mouths of the Sabine and Neches Rivers to Taylors Bayou, Texas. This work was advertised and bids therefor were opened July 18, 1904. This project, however, met with so much opposition from those interested in the improvement that the Chief of Engineers, on July 28, 1904, directed that all work under it be suspended.

On October 21, 1904, the Chief of Engineers, by direction of the Secretary of War, authorized the preparation of plans and specifications for dredging a channel 9 feet deep through Sabine Lake at or near the western shore of the lake, as laid down in report printed in House Document No. 634, Fifty-eighth Congress, second session. (Annual Report for 1904, p. 1927.)

Project was submitted December 16, 1904, and approved January 14, 1905. The work was advertised and bids therefor were opened February 18, 1905. No favorable bids were received, and, by authority of the Chief of Engineers, all were rejected.

The act of Congress approved March 3, 1905, adopted the project for this improvement in acccordance with the document above referred to, and authorized that the work be done under continuing contract, at an estimated cost not to exceed $536,500, with the following provisions: "That the channel may, in the discretion of the Secretary of War, be constructed through the land near the lake for any part of said route," and "that the right of way is furnished without expense to the United States."

Under the project the center line of the proposed channel has been marked with stakes, a map prepared, and at the end of the fiscal year negotiations for securing the right of way were still in progress.

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The amount expended to July 1, 1905, is $12,090.15. The amount estimated as a profitable expenditure will be applied to carrying on work under the adopted project.

Comparative statement of shipments and receipts for three years.

[Neches River only; statistics for Sabine River separately.]

Calendar year.	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
1902	145,740		
1903	151,672	5,932	
1904	161,516	9,844	

July 1, 1904, balance unexpended	$125,054.31
June 30, 1905, amount expended during fiscal year, for works of improvement	2,144.46
July 1, 1905, balance unexpended	122,909.85
July 1, 1905, outstanding liabilities	141.00
July 1, 1905, balance available	122,768.85
Amount (estimated) required for completion of existing project	411,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	200,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix T 6.)

7. Sabine River, Texas.—This stream is about 470 miles long, and for the greater part of its length forms the boundary between the States of Texas and Louisiana. It flows into the Gulf of Mexico through Sabine Lake.

Prior to improvement there was a depth of 3½ feet of water over the bar at the mouth of the river. From its mouth to Orange, Tex., there was ample depth. Above Orange the stream was obstructed with snags and logs.

The original project, adopted in 1871 and modified in 1873, provided for deepening the main outlet of the river at a cost of $18,000.

The project of 1889 provided for the closure of two branches forming Old River, to throw all the water into the "Narrows," and for the removal of obstructions. These projects were completed in December, 1890, and a navigable channel provided for vessels drawing 5 feet or less for a distance of 30 miles above Orange, Tex.

The project of 1892 provided for the removal of obstructions between Orange, Tex., and Sudduths Bluff, a distance of 50 miles, at an estimated cost of $10,000. This work was completed in 1895.

On June 30, 1899, the dams built in 1890 were in good condition. The river from its mouth to Morgans Bluff, a distance of 33 miles, was in fairly good condition, but obstructions had formed between Morgans Bluff and Sudduths Bluff, a distance of 31 miles, since 1895.

With $2,000 appropriated in 1896 and a like amount in 1899, work of maintenance was carried on between May 17 and July 13, 1900.

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The river was cleared of obstructions from Morgans Bluff to within 2.5 miles of Sudduths Bluff. Work ceased on account of lack of funds.

The sum of $52,538.33 was expended up to June 30, 1905, of which $3,838.33 was expended for maintenance. On June 30, 1902, vessels drawing 5 feet or less could navigate a distance of 64 miles above the mouth of the river; above Sudduths Bluff, for a distance of about 300 miles, vessels of light draft could run during high water. No work was carried on during the fiscal years ending June 30, 1902, 1903, 1904, and 1905.

Under the provisions of the act of June 13, 1902, a preliminary examination of the Sabine River was made from its mouth to Logansport, La., and the river was reported to be unworthy of improvement by the United States. (Annual Report, Chief of Engineers 1904, p. 1956.)

No further work being proposed, the balance available was, on June 30, 1905, covered into the surplus fund, and the work will be dropped from the list of duties of the local officer.

Comparative statement of shipments and receipts for ten years.

	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
Year ending May 31—			
1895	182,738		62,919
1896	271,257	88,519	
1897	245,364		25,893
1898	275,506	30,142	
1899	270,642		4,864
Calendar year—			
1899	407,372	137,730	
1900	[a]32,148		375,224
1901	459,909	427,761	
1902	413,174		46,735
1903	325,761		87,413
1904	292,184		33,577

[a] Incomplete; full statistics could not be obtained.

July 1, 1904, balance unexpended $161.67
June 30, 1905, covered into surplus fund, United States Treasury 161.67

(See Appendix T 7.)

8. Harbor at Sabine Pass, Texas.—Prior to improvement there were depths of 18 and 17 feet, respectively, over the two bars in Sabine Pass, opposite the town of Sabine and opposite Fort Point. These bars were about 200 feet long. Throughout the other portions of the pass the least mean depth was 25 feet.

Beyond the shore line at the entrance to the pass there existed a bar about 3½ miles wide, between the interior and exterior 18-foot bottom curves, over which there was not more than 6 feet of water at mean low tide. Channels 12 and 15 feet deep were dredged through this outer bar during 1878 and 1880, under the project of 1873, at a cost of $325,000, but they soon refilled.

The project of 1882 provided for the construction of parallel jetties at the entrance of the pass 1,800 feet apart and about 4 miles in length from shore line to deep water in the Gulf, and for dredging the channel between these jetties if necessary. Estimated cost, $3,177,606.50.

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Construction of the jetties began in 1883, and under successive appropriations has been carried on since that date.

The river and harbor act of 1896 authorized contracts for the completion of the project, limiting the cost to $1,050,000.

Under contract approved June 22, 1897, work was commenced in August, and on August 6, 1900, the east jetty was completed for a length of 21,818 feet, riprap work only was completed for a length of 682 feet, and foundation only for 2,600 feet. The west jetty had a length of 15,560 feet, of which 1,490 feet was only riprap work and 4,950 feet was foundation only. About 3,000 feet of previous work was capped.

Dredging in the channel was carried on, under contract, in 1897, 1898, and 1899, the depth being increased to 25 feet and the width to 100 feet. The channel was again dredged in 1900 and 1901, with an allotment of $8,000 from the emergency appropriation of June 6, 1900.

Under the act of March 3, 1899, $150,000 was appropriated for straightening, widening, and otherwise improving the harbor by the removal of oyster reefs and flats between the United States life-saving station and a point opposite the United States light-house. A project covering the proposed work was approved March 27, 1899, and the work completed April 18, 1903.

Act of June 13, 1902, appropriated $25,000 for widening and straightening the main ship channel and increasing its depth from a point 1,000 feet north of the life-saving station to the entrance of the Port Arthur Canal, in accordance with report published in the Annual Report of the Chief of Engineers for 1901, page 1915. Under a project approved July 3, 1902, this work was completed February 27, 1903, and the channel depth was increased to 25 feet at mean low water for an average width of 400 feet.

The act of June 4, 1897, appropriated $100,000 for the construction of a dredge (the *Sabine*), which was completed January 14, 1901. Since this date the dredge has worked in the channel between the jetties and removed material as follows:

February 8, 1901, to June 30, 1901, 198,800 cubic yards.
October 28, 1901, to January 15, 1902, 165,140 cubic yards.
February 17, 1902, to September 12, 1902, 246,205 cubic yards.
November 3, 1902, to April 2, 1903, 126,420 cubic yards.
August 19, 1903, to January 16, 1904, 170,155 cubic yards.
March 18, 1904, to May 12, 1904, 84,050 cubic yards.
August 22, 1904, to May 12, 1905, 403,650 cubic yards.
June 22, 1905, to June 30, 1905, 18,525 cubic yards.

The expenses of the dredge from February 17 to include June 13, 1902, were paid from funds advanced by the Kansas City Southern Railway, under authority of the Secretary of War.

The dredge *Sabine* was absent and engaged in emergency work at South Pass, Mississippi River, under authority of the Chief of Engineers, July 1 to October 27, 1901; January 16 to February 17, 1902; September 13 to October 31, 1902; April 3 to August 18, 1903; January 17 to March 17, 1904, and from July 13 to August 19, 1904. She was absent at New Orleans for repairs May 12 to July 12, 1904, and May 13 to June 21, 1905.

During the past fiscal year the *Sabine* was at Sabine Pass 274 days, absent for repairs 52 days, and at work at mouth of Mississippi

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River 40 days. The amount of material removed from the jetty channel, estimated at 60 per cent of bin measurement, was 422,175 cubic yards. At the end of the year the available depth in the jetty channel at mean low gulf level was 23 feet. At favorable stage of tide vessels have gone out drawing over 25 feet.

The storm of September 8, 1900, damaged the jetties at the entrance to the pass (see Annual Report, Chief of Engineers, 1901, p. 1919), and under a project approved July 3, 1902, a contract for repairs to and extension of the east jetty was entered into on October 10, approved November 15, 1902.

Work under this contract was commenced August 3, 1903, and carried on until May 2, 1904, when it was temporarily suspended. The contractor resumed operations July 30, 1904, and completed all work under his contract on September 12, 1904. During the current fiscal year 7,926.16 tons of riprap stone was placed in the jetties.

The act of March 3, 1905, appropriated $150,000 for continuing improvement and for maintenance. Under project approved April 22, 1905, it is proposed to expend $60,000 for repairs to and operation of dredge *Sabine* in the jetty channel, and to expend the balance in raising the low submerged section of east jetty to the level of mean high tide, as far as available funds will permit. Contract was entered into on June 22, 1905, for the repairs to and raising the east jetty.

The amount expended to June 30, 1905, is $3,623,695.46, of which $325,000 was expended on previous projects and $3,298,695.46 on the present project. Of the latter amount it is estimated $173,207.93 has been applied to maintenance of improvement.

Additional work should be done toward building the jetties to full height of mean high-water level in order that the full benefits of the improvement may be obtained. It is estimated that $926,573 will be required to complete the jetties in accordance with the original project.

Comparative statement of shipments and receipts for ten years.

	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
Year ending May 31—			
1895	47,691	6,725	
1896	48,886	1,195	
1897	87,632	38,746	
1898	238,400	150,768	
1899	326,982	88,582	
Calendar year—			
1899	326,494		488
1900	217,489		109,005
1901	150,087		67,402
1902	689,688	539,601	
1903	1,315,248	625,560	
1904	1,792,371	477,123	

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July 1, 1904, balance unexpended		$56,386.61
July 14, 1904, amount deposited by Captain McIndoe, account sale of engineer property		43.11
September 13, 1904, amount deposited by Lieut. Col. C. B. Sears, account repairs to and rental of dredge *Sabine*		2,212.21
Amount appropriated by act of March 3, 1905		150,000.00
		208,641.93
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$236.77	
For maintenance of improvement	56,392.33	
		56,629.10
July 1, 1905, balance unexpended		152,012.83
July 1, 1905, outstanding liabilities		2,840.53
July 1, 1905, balance available		149,172.30
July 1, 1905, amount covered by uncompleted contract		90,000.00

(See Appendix T 8.)

9. Removing the water hyacinth from waters in Louisiana and Texas.—Under the provisions of the sundry civil act of June 4, 1897, a Board of Engineer officers, appointed to investigate the extent of obstruction to navigation in the streams of Florida and Louisiana and to determine a method of checking the growth of or removing the water hyacinth, recommended the construction of boats fitted with crushing machinery and the use of log booms as adjuncts to the boats. (See Annual Reports of the Chief of Engineers for 1899, p. 1615.)

Under the act of March 3, 1899, $25,000 was appropriated for the purchase of a boat, $1,000 for the construction of log booms, and $10,000 for operating expenses.

A boat, purchased and fitted with machinery for crushing the hyacinths, was operated in Bayou Plaquemine and contiguous streams from July, 1900, to June, 1901, when funds were exhausted. Approximately 188,800 square yards of plants were removed.

A boom with a suitable gate to permit of the plants floating out with the tides and to prevent their return was constructed and placed at the mouth of Bayou Teche, Louisiana.

Act of June 13, 1902, permitting the destruction of the plants by chemical means or otherwise, under a project approved August 4, 1902, the boat was refitted with special machinery designed for spraying the plants with a chemical compound, and operations were carried on in this manner from September, 1902, to May, 1903, and from August to October, 1903. Approximately 522,750 gallons of the compound were sprayed over an area estimated at 3,509,024 square yards of hyacinths.

Bayou Plaquemine and contiguous streams were at date of cessation of operations (October 26, 1903) practically free from hyacinths.

The necessary repairs were made to the log boom at the mouth of Bayou Teche during the month of April, 1903.

With funds allotted May 31, 1904, from appropriation of April 28, 1904, the steamboat *Ramos* began spraying operations in Bayou Plaquemine July 8, 1904. By October 31, 1904, when the season's operations were terminated, the following streams were effectively cleared of all obstructing hyacinths: Bayou Plaquemine, Grand River, Bay Natchez, Bayou Goddell, Belle River, Bayou

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Long, Bayou Grosse Tete, and Bayou Choctaw. Booms for controlling the hyacinths were placed in Bayou Plaquemine, at mouth of Bay Grosse Tete, at the head of navigation in Bayou Grosse Tete, and across Bayou Choctaw. During the summer months watchmen are maintained at these booms, whose duty it is to require all rafts and boats to clear themselves of hyacinths before passing through.

During the winter the *Ramos* was extensively repaired and fitted with a pile driver and steam capstan.

The act of March 3, 1905, appropriated $40,000 for the removal of the water hyacinths from the navigable waters of the States of Texas and Louisiana, and projects approved April 28 and May 15, 1905, provide for continuance of spraying operations in the Plaquemine-Morgan City water route and for the outfitting of a second boat for operations in the Calcasieu River, Louisiana, and in the Sabine and Neches rivers, Texas.

Operations were resumed in Bayou Plaquemine April 8, 1905, and at the end of the fiscal year the condition of the hyacinth-infested streams was very satisfactory. During this season a new chemical compound has been used, which can be made for about one-third of a cent a gallon, whereas the price heretofore paid the Harvesta Chemical Compounding Company for their compound was 3 cents per gallon.

During the fiscal year 192,442 gallons of chemical compound were used, and it is estimated that each gallon destroyed approximately 12 square yards of hyacinths.

The amount expended to July 1, 1905, is $70,970.69.

July 1, 1904, balance unexpended	$15,000.00
July 14, 1904, amount deposited by Captain McIndoe, account sale of engineer property	3.86
December 28, 1904, amount deposited by Captain McIndoe, account sale of engineer property	.30
Amount appropriated by act of March 3, 1905	40,000.00
	55,004.16
June 30, 1905, amount expended during fiscal year, for works of improvement	14,990.69
July 1, 1905, balance unexpended	40,013.47
July 1, 1905, outstanding liabilities	4,382.77
July 1, 1905, balance available	35,630.70

(See Appendix T 9.)

IMPROVEMENT OF CERTAIN RIVERS AND HARBORS IN TEXAS.

This district was in the charge of Capt. Edgar Jadwin, Corps of Engineers, having under his immediate orders Capt. G. M. Hoffman, Corps of Engineers, until December 8, 1904. Division engineer, Lieut. Col. H. M. Adams, Corps of Engineers, until August 12, 1904, and Lieut. Col. Clinton B. Sears, Corps of Engineers, since that date.

1. Galveston Harbor, Texas.—Galveston Harbor embraces an anchorage area of over 1,960 acres, of which 1,500 acres has a depth of more than 20 feet and 460 acres has a depth of more than 30 feet.

The entrance to this harbor was originally obstructed by two bars, known as the inner and outer. The natural depth on the inner bar was about 9½ feet and on the outer bar about 12 feet. These shallow

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depths prevented all but the lightest-draft vessels from using the harbor and necessitated the lighterage of cargoes to the larger vessels anchored in the deep water beyond the outer bar.

Prior to 1874 the projects for improving the harbor related to dredging operations on a small scale and were expected to afford only temporary relief to navigation.

The project for the permanent improvement of this harbor by jetties was adopted in 1874 and modified in 1880 and 1886.

The 1886 project provided for a certain depth of 25 feet and a possible depth of 30 feet by constructing jetties to a height of 5 feet above mean low tide and extending them to the 30-foot contour in the Gulf and supplementing the action of the tidal scour by dredging. The estimated cost of this revised project was $7,000,000.

The expenditures under the above projects resulted in a depth of 26 feet at mean low tide on the outer bar, an increase of 14 feet since work began, and a depth of 26 feet at mean low tide on the inner bar, an increase of 16 feet during the same period. This increased depth of water enabled vessels to load and unload at the Galveston wharves, thereby making the lighterage of cargoes no longer necessary.

Prior to the hurricane of September 8, 1900, the completed south jetty extended 35,603 feet and the completed north jetty extended 25,907 feet.

This hurricane damaged the jetties to a considerable extent, and a report of a Board of Engineers, showing the effect of this hurricane on the jetties and the main ship channel, with an estimate for repairing same at a cost of $1,500,000, is contained in the Annual Report of the Chief of Engineers for 1901, page 2018.

The river and harbor act of June 13, 1902, appropriated $350,000 for maintenance and toward the restoration of the jetties in accordance with the Board's report, and authorized a further expenditure of $400,000 for repairing, restoring, and completing the jetties. It also made all unexpended balances of appropriations theretofore made for Galveston Harbor available for these purposes, and authorized the Secretary of War to connect the south jetty with the protection work built by the city, if found advisable.

The river and harbor act of March 3, 1905, appropriated $200,000 for continuing improvement and for maintenance, and authorized a further expenditure of $250,000 for prosecuting the improvement. The act also authorized the diversion, in the discretion of the Secretary of War, of $50,000 from the funds provided for this work, to be applied to improvement of Galveston channel.

Repairs to the jetties were continued during the year under the act of 1902.

The U. S. dredge *Gen. C. B. Comstock* continued operations during the year.

The ruling depth on the outer bars at the end of the year was 27½ feet, a net increase of one-fourth foot during the year.

The shoalest point which was formerly on the bar between the outer ends of the jetties was deepened to 30 feet in March and is now 29 feet. The worst shoal is now on a bar outside the ends of the jetties, upon which the dredge works when weather permits.

Mean tide fluctuations on outer bar, 2 feet; inner bar, 1.64 feet; Galveston channel, 1.12 feet.

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All the commerce for Galveston channel, Texas City channel, and Galveston ship channel, and Buffalo Bayou which comes in from the Gulf or passes out to the Gulf, whether coastwise or foreign, passes through the jetty channel.

A Board of Engineer officers in its report of December 19, 1902, stated that a conservative estimate of the value to the country of the present improvement at Galveston is more than $10,000,000 per annum (p. 1354, Report of Chief of Engineers for 1903).

It is proposed to apply the amount estimated as a profitable expenditure in operating the U. S. dredge *Gen. C. B. Comstock* and in repairing the south jetty.

The amount expended to June 30, 1905, was $9,332,119.47, of which $221,241.95 was for maintenance of the improvement, with an additional sum of $100,000 subscribed by the city of Galveston in 1883. Of this amount $1,478,000 was expended previous to 1886.

July 1, 1904, balance unexpended		$401,907.07
Amount appropriated by river and harbor act approved March 3, 1905		200,000.00
Proceeds of sales of condemned property		369.76
		602,276.83
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$392,295.83	
For maintenance of improvement	52,601.05	
		444,896.88
July 1, 1905, balance unexpended		157,379.95
July 1, 1905, outstanding liabilities		5,005.74
July 1, 1905, balance available		152,374.21
Amount (estimated) required for completion of existing project		[a]745,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905		250,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.		

(See Appendix U 1.)

2. Galveston channel, Texas.—This is the channel passing along the wharf front of the city and connecting the same with the jettied entrance channel.

The river and harbor act approved June 13, 1902, appropriated $100,000 and authorized a further expenditure of $200,000 for improving Galveston channel in accordance with the report submitted in House Document No. 264, Fifty-sixth Congress, second session, and provided that the amounts appropriated or authorized should be expended in obtaining a channel from the outer end of the inner bar to Fifty-first street, 30 feet in depth, and of such width in the respective portions thereof as shall best subserve the interests of commerce.

The estimated cost of the project is $1,585,000, with annual maintenance charge of $25,000.

Galveston channel, inside the inner bar, had originally depths varying from 20 feet at Fort Point to 30 feet off Twentieth street, and again to 20 feet off Thirty-second street. The width between the

[a] Present indications are that a saving will be effected on the repairs to the jetties, but it is thought better not to modify estimates in this report.

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18-foot curves was about 600 feet. As there was only about 12½ fe on the outer bar, very few vessels entered the port except light. few of the smaller vessels loaded to 12 feet went over the bar a completed their cargo by lightering, as all the larger vessels had to that could not come up to the wharves. Vessels drawing 27 feet a over can now come over the bar and up to the wharves.

Dredging was continued during the fiscal year.

Under contract a channel has been dredged 550 feet wide and ov 30 feet deep, between Red Beacon and Thirty-first street, and betwee Thirty-first and Forty-fourth streets, the westernmost face of pre ent westernmost slip of the Southern Pacific Railway Compan wharves, a channel 200 feet wide and 30 feet deep.

The U. S. dredge *Gen. H. M. Robert* excavated and deposite behind the pile and brush dike, on Pelican Island and flats, 565,13 cubic yards of material.

The low places in the pile dike were refilled with brush.

Variation of level of water surface is about 1 foot.

The river and harbor act of March 3, 1905, contained the following item:

Improving Galveston channel, Texas: Continuing improvement, one hundred and seventy-five thousand dollars: *Provided*, That the Secretary of War may, in his discretion, use not to exceed one hundred and twenty-five thousand dollars of said amount to purchase or build a dredge for use in said channel: *Provided, further*, That the Secretary of War may, in his discretion, divert the sum of fifty thousand dollars from the amounts appropriated and authorized for improving Galveston Harbor, Texas, and apply it to this improvement.

Bids for the dredge authorized by this act were advertised for and a contract entered into June 23, 1905.

Total amount expended on this improvement in dredging and dike construction, $314,927.79, of which $14,075.44 was for maintenance of the improvement.

The tonnage for the port of Galveston for the past fiscal year amounted to 2,138,161, valued approximately at $521,848,847.

July 1, 1904, balance unexpended		$81,924.59
Amount appropriated by river and harbor act approved March 3, 1905		175,000.00
Amount allotted from appropriation for maintenance of river and harbor improvements, act of April 28, 1904		20,000.00
		276,924.59
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$82,776.94	
For maintenance of improvement	14,075.44	
		96,852.38
July 1, 1905, balance unexpended		180,072.21
July 1, 1905, outstanding liabilities		470.71
July 1, 1905, balance available		179,601.50
July 1, 1905, amount covered by uncompleted contracts		102,500.00
Amount (estimated) required for completion of existing project		1,110,000.00

(See Appendix U 2.)

3. Channel from Galveston Harbor to Texas City, Tex.—This improvement was designed to afford a channel 100 feet wide at bottom

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and 25 feet deep, north of Pelican Island, from Galveston Harbor to Texas City, Tex. The natural depth on the line of the proposed channel was from 4 to 8 feet. During 1895 and 1896 a channel 16 feet deep was dredged by the Texas City Terminal Company. At the time of the adoption of the present project this channel had shoaled to its natural depth.

Work was carried on during the fiscal year under a contract entered into in January, 1900.

During the fiscal year the contractor completed the channel to prescribed cross section, 100 feet wide at bottom and 25 feet deep from Texas City wharves to 25 feet of water in Galveston Harbor, a distance of 34,000 feet.

Variation of the water surface is about 1¼ feet.

The following commercial statistics for the fiscal year were furnished by Mr. K. R. Guthrie, manager Texas City Transport Company, which amounted to 36,138 tons, of which 235 tons was bran, 1,649 tons cotton, 998 tons corn, 109 tons coal, 132 tons coffee, 47 tons cotton waste, 19 tons cocoanuts, 543 tons hay, 29 tons hides, 10,193 tons lumber, 509 tons live stock, 2,660 tons mahogany logs, 59 tons machinery, 12 tons merchandise, 35 tons oil, 4 tons onions, 368 tons packing-house products, 29 tons potatoes, 26 tons poultry, 64 tons rice, 18,418 tons sisal fiber.

Total amount expended on this improvement to June 30, 1905, $250,000 from appropriations by Congress, and $4,585,01 deposited by contractors for expenses of superintendence, inspection, etc.

DEPOSIT OF CONTRACTORS.

July 1, 1904, balance unexpended	$2,203.23
June 30, 1905, amount expended during fiscal year	1,788.24
July 1, 1905, balance unexpended	414.99
July 1, 1905, outstanding liabilities	102.92
July 1, 1905, balance available	312.07

GENERAL IMPROVEMENT.

July 1, 1904, balance unexpended	$50,000.00
June 30, 1905, amount expended during fiscal year, for works of improvement	50,000.00

(See Appendix U 3.)

4. Galveston ship channel and Buffalo Bayou, Texas.—The ship channel in Galveston Bay and Buffalo Bayou are two links in the waterway connecting Houston with deep water in Galveston Bay, the other links being the San Jacinto River and the Morgan Canal.

In their natural state these two waterways had a depth of from 4 to 8½ feet. The earlier projects for their improvement provided for a channel 100 feet wide and 12 feet deep. Dredging was carried on for a number of years, furnishing a channel sufficient for the character of vessels then navigating these channels.

In 1892 the Government purchased the Morgan Cut and Canal, 5.43 miles long, for $92,316.85.

In 1897 a Board of Engineers submitted a project (p. 1515, Annual Report of the Chief of Engineers for 1898) providing for a water channel not less than 25 feet deep and 100 feet wide extending from

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the mouth of the jetties at the city of Galveston through the existi ship channel and up Buffalo Bayou to the city of Houston, Tex., a for a harbor at or near Houston of a depth of not less than 25 feet a of a width of 500 feet.

The cost of the work was estimated by the Board as follows:

First division, including construction of two suction dredges	$1,100,0
Second division	900,0
Third division	1,700,0
Administration and contingencies	300,0
Making a total of	4,000,0

The estimated cost of maintenance was $100,000 annually.

The Board of Engineers for Rivers and Harbors submitted a r port December 15, 1904 (printed herewith in Appendix U 4), revis ing the project and estimate as follows:

For completing channel to head of Long reach, including turning basin 600 feet in diameter, 25 feet deep, side slopes 1 on 2, division 1 (bay), 1 on 3 in divisions 2 and 3 (river), least radius 2,500 feet, 150 feet on bottom in division 1 (bay), 100 feet on bottom in divisions 2 and 3 (river)	$3,170,000
26,000 feet of dike revetment	40,000
1 hydraulic dredge	150,000
Engineering and contingencies, about 10 per cent	340,000
Total	3,700,000
Amount available December 1, 1904	150,000
Balance required	3,550,000

The river and harbor act of June 13, 1902, appropriated $300,000 and authorized a further expenditure of $700,000 for Galveston ship channel and Buffalo Bayou, and provided that the amounts appropriated and authorized should be expended in developing the proposed channel in divisions 1 and 2 to a uniform depth, and that not more than one-half of said amounts should be expended upon division 2.

Contract for work under this act was entered into and during the fiscal year active operations were carried on under it, which consisted in dredging a channel 18½ feet deep and 150 feet wide at bottom in division 1 (bay) and 100 feet in division 2 (river).

Snagging by United States snag boat was also done in divisions 2 and 3.

The river and harbor act of March 3, 1905, appropriated $200.000 and authorized the expenditure of $200,000 additional for carrying on the improvement in accordance with the report of the Board of Engineers for Rivers and Harbors dated December 15, 1904, and at the same time made the amount on hand available for the project as modified by that report.

The amounts expended on these channels to June 30, 1905, are as follows:

Ship channel and Buffalo Bayou, including the purchase of Morgan Cut and Canal ($92,316.85)		$849,016.85
Buffalo Bayou, Texas		228,750.00
Galveston ship channel and Buffalo Bayou, Texas:		
For works of improvement	$1,039,505.97	
For maintenance of improvement	98,401.60	
		1,137,907.57
Total		2,215,674.42

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It is proposed to expend the amount estimated as a profitable expenditure in maintaining and deepening the channel.

The maximum draft that can be carried on June 30, 1905, at mean low tide is, division 1 (bay division), 15 feet, and division 2 (river division), 17½ feet to Lynchburg, 15 feet to Clinton bend, and 10 feet to Harrisburg, Tex.

The usual variation of level of water surface is, division 1 (bay division), lower bay, 1.3 feet; upper bay, 0.5 foot, and division 2 (river division), less than one-half foot. In times of flood rises of 12 or more feet occasionally occur in Buffalo Bayou.

The only commercial statistics that could be obtained for the fiscal year were those covering freight carried by the Direct Navigation Company, which amounted to 106,135 tons, of which 102,141 tons was cotton, 613 tons coal, 2,747 tons bank sand, 51 tons roofing slate, 13 tons linseed oil, 15 tons burlap bags, 375 tons gas pipe, 180 tons cotton bagging.

For number of vessels and tonnage passing through Morgan Canal see report on operating and care of Morgan Canal, Appendix U 5 of this report.

July 1, 1904, balance unexpended		$505,320.36
Amount appropriated by river and harbor act approved March 3, 1905		200,000.00
Proceeds of sales of condemned property		.10
		705,320.46
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$323,172.69	
For maintenance of improvement	20,055.20	
		343,227.89
July 1, 1905, balance unexpended		362,092.57
July 1, 1905, outstanding liabilities		28,304.96
July 1, 1905, balance available		333,787.61
July 1, 1905, amount covered by uncompleted contracts		45,194.77
Amount (estimated) required for completion of existing project		3,350,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905		200,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.		

(See Appendix U 4.)

5. Operating and care of Morgan Canal, Texas.—A watchman was stationed at the canal during the past fiscal year.

During the year the 620 feet of the old bulkhead of the canal destroyed by fire was replaced and the 450 feet of the fence marking the eastern boundary of the canal reservation, also destroyed by fire, was partially repaired.

A statement contained in the report of the local engineer officer shows the items of expenditure, which amounted to $360.90.

(See Appendix U 5.)

6. Trinity River, Texas.—This improvement involves that portion of the river above the mouth, work at the mouth being provided for

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under appropriations for improving West Galveston Bay channel, Double Bayou, and mouths of adjacent streams, Texas.

The river and harbor act of June 13, 1902, adopted, in part, a project for improving this portion of the river in accordance with a report submitted in House Document No. 409, Fifty-sixth Congress, first session. This report contemplated improvement to provide a 6-foot navigation from Dallas to the mouth, a distance of 511 miles, by open-channel work and a slack-water system, at an estimated cost of $4,650,000. The act appropriated $125,000 and authorized contracts in the additional sum of $275,000, stipulating that $350,000 thereof should be applied to locks and dams between the mouth and section 1, where the most serious obstructions existed, and in clearing the river to permit through navigation; also, that $50,000 of the cash appropriation should be expended for the purpose of securing open-channel navigation in section 1 (between Dallas and East Fork, 49 miles in length).

The sum of $250,000 was appropriated by the sundry civil act approved March 3, 1903, and Congress, subsequently, by act approved April 28, 1904, amended the provisions of the act of 1902 with reference to the construction of locks and dams below section 1 so as to permit the expenditure of available funds in the construction of one lock and dam between the mouth and section 1.

The application of available funds was further directed by Congress in the river and harbor act of March 3, 1905, which provided for their diversion from lock and dam construction below section 1 to construction of Locks and Dams Nos. 1, 4, and 6, in section 1, and authorized contracts in the additional sum of $161,287, making the total authorized cost of these structures $420,000 in round numbers, including the balance ($258,713.96) available January 1, 1905. This act also authorized the Secretary of War, in his discretion, to construct Lock and Dam No. 2, 3, or 5, instead of No. 4; and it provided, further, that no funds shall be expended unless $66,000 be donated by the citizens of Dallas for construction of dams at Old River and Parsons Slough, for the easing of bends, and for improvement of section 1, which funds have been provided.

The plan for improvement of section 1 by the construction of six locks and dams was submitted by a Board of Engineers under the provisions of the river and harbor act of June 13, 1902, in report printed in the Annual Report of the Chief of Engineers for 1904, page 2021. The work therein contemplated is estimated to cost $918,000; but the estimate for completion, submitted in this report, has reference only to that part of the project for section 1 specifically provided for by Congress.

During the fiscal year active operations were carried on as follows:

Section 1: Logs were removed from the Malloy drift, at mile 483½. Contour maps and borings were made at lock sites Nos. 1 and 6 and borings made at lock site No. 4 and Parsons Slough. Test piles were driven at lock site No. 6 to determine the nature of the foundation. Plans were completed for Lock and Dam No. 1 and nearly completed for Lock and Dam No. 6 and dam at Parsons Slough. Specifications for locks and dams were completed. Land for site for Lock and Dam No. 1 was deeded to the United States.

Mouth to section 1: Snags were cut off for a distance of 28 miles. Snags and overhanging trees were removed entirely for a distance of

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96.5 miles and partly removed for a distance of 46.5 miles, and 3,100 feet of drift was removed.

The stern-wheel snag boat *Gen. S. M. Mansfield* was completed, and removed obstructions.

Plans and specifications were completed for lock and dam 11 miles below Liberty, Tex., at mile 30, and approved ready for advertising, and land for site was being secured by the Dallas Commercial Club when operations on this portion of the river were suspended in March, 1905, owing to the act of March 3, 1905, diverting the funds from this section of the river to section 1.

The total amount expended on this improvement to June 30, 1905, was $133,418.43.

For commercial statistics for the fiscal year see report on the mouth of the river, under heading for Improving West Galveston Bay channel, Double Bayou, and the mouth of adjacent streams, Texas, including Trinity River, Anahuac channel, and Cedar Bayou, Texas.

The only navigation above Liberty known to this office is the rafting of logs in time of floods over the lower 180 miles of the river.

July 1, 1904, balance unexpended	$298,947.25
Amount deposited by citizens of Dallas, Tex	66,000.00
Amount received from sales of condemned property	1.50
	364,948.75
June 30, 1905, amount expended during fiscal year, for works of improvement	50,335.91
July 1, 1905, balance unexpended	314,612.84
July 1, 1905, outstanding liabilities	316.73
July 1, 1905, balance available	314,296.11
Amount (estimated) required for completion of existing project	[a]161,287.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	[a]161,287.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix U 6.)

7. West Galveston Bay channel, Double Bayou, and the mouths of adjacent streams, Texas, including Trinity River, Anahuac channel, and Cedar Bayou.—The river and harbor act approved March 3, 1899, appropriated $65,000 for the improvement of the Brazos River between Velasco and Richmond, West Galveston Bay channel, Double Bayou, and the mouths of adjacent streams.

Theretofore the projects embraced in this improvement had been independent.

The object of this improvement, in part, is to obtain and maintain a navigable channel depth of from 4 to 6 feet across the bars at the mouths of a number of the streams and bayous along the Texas coast by dredging and snagging.

The improvement is intended to develop a light-draft inland navigation tributary to Galveston and other Texas harbors, which will

[a] Refers only to that part of the project for section 1 specifically provided for by Congress.

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afford cheap transportation by light-draft steamers and barges to the coast country of Texas.

The river and harbor act approved June 13, 1902, appropriated $50,000 for this improvement, $30,000 of which was expended in the purchase of the canal from West Galveston Bay to the mouth of the Brazos River, known as the Galveston and Brazos Canal.

The river and harbor act approved March 3, 1905, appropriated $50,000 for continuing the improvement, and included therein the improvement of Anahuac channel. This is a new work. It is proposed to provide a channel 6 feet deep from Trinity Bay to Anahuac channel and thence to the mouth of Browns Pass, at a cost of $5,550.

The channel across Hannas reef (Ladies Pass), connecting lower Galveston Bay, East Bay, and East Bay Bayou, has been dredged to a depth of 7 feet and 45 to 60 feet wide. The variation of water surface is about 1 foot.

Total amount expended on this improvement to June 30, 1905, was $681.91.

During the fiscal year the following work was done:

Double Bayou.—A channel was excavated across the bar with a ruling depth of 5 feet and 85 feet wide. The variation of water surface is about one-half a foot. The bayou is navigated for 3½ miles above the mouth.

Total amount expended on this work to June 30, 1905, was $6,952.65 from act of June 13, 1902.

Anahuac channel.—A channel was excavated from 6 feet of water in Trinity Bay 12,238 feet long, 80 feet wide, and 7 feet deep, between station 0 and station 12+238. Large snags were removed from the entrance to Browns Pass off Anahuac channel, opening it to navigation; also, old bulkhead and obstructions were removed from the channel. The variation of water surface is about half a foot.

Total amount expended on this work to June 30, 1905, was $567.75 from act of March 3, 1905.

Galveston and Brazos Canal.—Work of cleaning the canal was continued and 3,236 feet of canal was cleaned to a depth of 3 feet. Work was suspended August 26, 1904. The variation of water surface is about 1 foot in the canal, except at the time of Brazos River overflows and northers. The length of the canal from west end of Oyster Bay to Brazos River is 29½ miles. Ruling depth, 18 inches.

Total amount expended on this work to June 30, 1905, was $39,204.16 from act of June 13, 1902, of which $30,000 was for the purchase of the canal, and $957.86 from act of March 3, 1905, making a total of $40,162.02.

The amount expended on these improvements to June 30, 1905, from acts of March 3, 1899, June 13, 1902, and March 3, 1905, was $48,364.33, and in addition to this amount $67,992.51 was expended on U. S. dredge *Gen. H. M. Robert* in constructing, outfitting, and installing cutter, $2.30 on examination of Clear Creek, Texas, and $103.50 in repairs to launch, making a total of $116,462.64.

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July 1, 1904, balance unexpended		$7,798.83
Amount appropriated by river and harbor act approved March 3, 1905		50,000.00
Proceeds of sales of condemned property		11.79
		57,810.62
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$11,141.00	
For maintenance of improvement	3,081.50	
		14,222.50
July 1, 1905, balance unexpended		43,588.12
July 1, 1905, outstanding liabilities		3,760.23
July 1, 1905, balance available		39,827.89
Amount (estimated) required for completion of existing project		86,800.00

(*a*) *Trinity River.*—The river empties into Galveston Bay through several mouths or passes, opposite each of which a bar existed on which the depth of water did not exceed 3½ feet at mean low tide.

Under earlier projects surveys were made, dredging and snagging done, and the west jetty at Middle Pass completed to a length of 7,359 feet, and a channel 100 feet wide by 5 feet deep secured at a cost of $75,900. Since then the channel has shoaled to a depth of about 3½ feet.

A channel 80 feet wide and 6 feet deep was dredged a distance of 5,700 feet, and a log jam was removed from the pass. The variation of water surface is about half a foot.

The amount expended on this improvement to June 30, 1905, was $83,081.50, of which $78.15 from act of June 13, 1902, and $3,003.35 from act of March 3, 1905, were applied to maintenance.

For report upon improvement of this river above the mouth, see page 387.

(*b*) *Cedar Bayou.*—For projects and work done by the United States Government at Cedar Bayou, Texas, see Annual Report of the Chief of Engineers for 1895, page 1815.

The river and harbor act approved June 13, 1902, provided as follows:

> Improving Cedar Bayou, Texas: Maintaining improvement, five thousand dollars: *Provided*, That the dredge constructed for use in this locality shall be available for this work.

During the fiscal year a channel 8 feet deep, 80 feet wide for a distance of 1,300 feet between the jetties, and a channel of same depth and width for a distance of 7,390 feet across Clappers bar to San Jacinto Bay were excavated.

A total of 307.67 tons of riprap was deposited on the jetties, leaving same in comparatively good condition, with lowest places and gaps filled.

The rise and fall of tide is about one-half foot, except during freshets. Cedar Bayou is navigable for 17 miles from the mouth.

Total amount expended on this improvement to June 30, 1905, $37,150, and, in addition, $1,826.16 allotted by act of March 3, 1905, making a total of $38,976.16.

July 1, 1904, balance unexpended	$5,000.00
June 30, 1905, amount expended during fiscal year, for works of improvement	5,000.00

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(*c*) *Channel in West Galveston Bay.*—West Galveston Bay is a body of water covering about 39 square miles, and lies between Galveston Island and the mainland. It extends from Galveston Bay to the west end of Oyster Bay, and is connected with the Gulf of Mexico by San Luis Pass at the western extremity of Galveston Island, and with the Brazos River by the Galveston and Brazos Canal. The natural depth of the bay was from 2½ to 3 feet. The navigable channel is 28¾ miles long.

The project adopted July 13, 1892, and modified in 1896, contemplated a least depth of 5 feet at an estimated cost of $28,998.80.

The amount expended was $19,775.97. This expenditure resulted in a channel 100 feet wide and 3 to 3½ feet deep from Galveston Bay to the Galveston and Brazos Canal. Beacons were also erected to define the channel. This channel has since shoaled to 18 inches in places.

During the year the U. S. snag boat *Gen. S. M. Mansfield* was prepared for dredging. Piles and iron pipes were removed from the channel and beacons were erected.

Variation of level of water surface is about 1 foot.

Total amount expended on this improvement to June 30, 1905, was $22,222.09, and in addition $68.55 allotted by act March 3, 1905, making a total of $22,290.64.

July 1, 1904, balance unexpended	$4,698.51
June 30, 1905, amount expended during fiscal year, for works of improvement	1,920.60
July 1, 1905, balance unexpended	2,777.91
July 1, 1905, outstanding liabilities	2,172.22
July 1, 1905, balance available	605.69

(See Appendix U 7.)

8. Operating and care of Galveston and Brazos Canal, Texas.—Watchmen were stationed at the canal during the year for operating the drawbridge over the canal and tending the log boom at mouth of canal.

A statement contained in the report of the local engineer officer shows the items of expenditure, which amounted to $334.23.

(See Appendix U 8.)

9. Brazos River, Texas, from Old Washington to Waco.—This is a new work provided for conditionally by the river and harbor act of March 3, 1905, in the following terms:

> Improving Brazos River, Texas, from Old Washington to Waco: The Secretary of War is authorized and directed to cause an examination of this section of the river with a view of determining whether four or six months' navigation can be secured to Waco at a reasonable cost by any method other than by locks and dams, and if not the least number of locks and dams that will furnish such navigation, and in the event it should appear feasible to secure four or six months' navigation by open-channel work or by not to exceed nine locks and dams the Secretary of War may expend for the improvement of said river an amount not to exceed seventy-five thousand dollars, which amount under the conditions named is hereby appropriated.

Amount conditionally appropriated by river and harbor act approved March 3, 1905	$75,000.00
July 1, 1905, balance unexpended	75,000.00

10. Brazos River, Texas.—(*a*) *Velasco to Richmond.*—This improvement is at present limited to that portion of the river lying

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between Richmond and Velasco, a distance of about 85 miles. Its low-water level is affected by the Gulf tide as far up as Bolivar Landing, 40 miles above Velasco. The course of the river is tortuous, and the channel was obstructed by shoals and snags.

The project for improvement was adopted June 3, 1896, and proposed the removal of snags and overhanging trees. Remaining work on this improvement will be conducted in connection with appropriation for the improvement of the Brazos River from Velasco to Old Washington.

The work during the fiscal year consisted in dredging at various places by the U. S. snag boat *Captain C. W. Howell* to such depth as to allow her to proceed to Richmond, Tex.

The amount expended on this improvement to June 30, 1905, was $1,626.12.

The commerce on this portion of the river at present is limited and exact statistics were not obtainable.

(*b*) *Velasco to Old Washington.*—The river and harbor act approved June 13, 1902, provides as follows:

Improving Brazos River, Texas, from Richmond to Old Washington, in accordance with the second plan of the report submitted in House Document Numbered Two hundred and eighty-three, Fifty-sixth Congress, second session, one hundred and fifty thousand dollars.

The river and harbor act approved March 3, 1905, provided as follows:

Improving Brazos River, from Velasco to Old Washington, continuing improvement, twenty-five thousand dollars.

The plan referred to is printed in the Annual Report of the Chief of Engineers for 1901, page 1974, et seq., and contemplates improvement of the river by open-channel work between the mouth and Old Washington, at a cost of $225,000.

The approved project contemplated dikes at 41 shoals. There have been several marked changes in the river since the project was submitted, cut-offs having been formed and several floods having caused changes in the position of shoals. The report of the assistant engineer, on which the project was based, stated that his survey was made under very unfavorable conditions and that rainy weather kept the river often half and once bank full and made it difficult to determine shoals. Recent surveys indicate more shoals than his map showed, but the additional ones are largely sand or sand and gravel, many of them being amenable to improvement by dredging alone.

During the fiscal year active operations were carried on in construction of plant, snagging, construction of pile and brush dikes, plank dikes, rock jetties, rock removal, and miscellaneous dredging.

A depth of 2½ feet at low water, corresponding to 4 feet for eight months in the year approximately, has been obtained at the shoals where work has been completed. At some of the shoals, where work has not yet been done, the depth is still less than 1 foot at low water. It is proposed to utilize funds recommended in completing and maintaining the work, and attention is invited to the fact that the estimate of the officer submitting the project for maintenance was $40,000 a year, and that the appropriation this year was only $25,000 for new work. If the desired depth is to be had along the entire section under improvement at once it will be necessary to appropriate larger sums.

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The amount expended on this improvement to June 30, 1905, was $122,050.67.

There is no commerce on this portion of the river.

The distance from the mouth of the river to Velasco is 5 miles; to Richmond, 100 miles; to Hempstead, 191 miles; and to Old Washington, 254 miles.

July 1, 1904, balance unexpended	$109,719.30
Amount appropriated by river and harbor act approved March 3, 1905	25,000.00
Refunded by civilian employee	.25
	134,719.55
June 30, 1905, amount expended during fiscal year, for works of improvement	78,396.09
July 1, 1905, balance unexpended	56,323.46
July 1, 1905, outstanding liabilities	3,542.10
July 1, 1905, balance available	52,781.36

(See Appendix U 9.)

11. Mouth of Brazos River, Texas.—The improvement of the mouth of this stream was at first undertaken by the Brazos River Channel and Dock Company, which partially constructed a system of parallel jetties.

The river and harbor act approved March 3, 1899, provides for this work as follows:

> Mouth of Brazos River, Texas: For dredging and such other work as may be deemed most effective, in the judgment of the Secretary of War, in improving and developing the harbor, eighty-five thousand dollars: *Provided*, That no part of said sum shall be expended until the Brazos River Channel and Dock Company shall file with the Secretary of War a transfer to the United States of the jetties, and auxiliary works; also a release of all rights and privileges conferred upon said company by its charter or by the Act of Congress approved August ninth, eighteen hundred and eighty-eight, to charge or collect tolls for the use and navigation of said river.

In 1899 the Brazos River Channel and Dock Company complied with the conditions of the act.

The Brazos River Channel and Dock Company's map shows that in March, 1889, there was a channel depth of 6 feet before the work began, and later, in March, 1896, there was 20 feet. The company measured their depth from a plane of "average flood tide," or mean high water, 1.3 feet above the United States standard of mean low water. The channel width is about 440 feet.

Depth over the bar and below jetties at different dates.

	M. L. T. feet.
March, 1889, before the jetties were begun, as reported in Mr. Wisner's paper, page 532	4.7
December, 1891, as shown by United States Coast Survey chart	14.5
March, 1896, after completion of the jetties, as shown by survey of the Brazos River Channel and Dock Company	19.0
January, 1897, as shown by the survey made for the Board by Mr. H. L. Marindin, United States Coast and Geodetic Survey	14.8
February 28, 1905, life-saving inspector, Velasco, Tex	12.7
June, 1905, Charles Clarke & Co., approximately	12.0

Mean range of tide, 1.77 feet.

The proposed work at this locality consists in putting the present jetties at the mouth of the river in a fair condition to resist the effects

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of storms and to protect a dredge while working between them; the construction of spur dikes, and to dredge a channel as far up as the light-house to a depth of 18 feet at mean low tide and 150 feet wide.

The estimate for completion of existing project has been increased by $175,000, the amount estimated by Board of Engineers to be necessary for repair of damages by the hurricane of September 8, 1900.

The river and harbor act approved June 13, 1902, appropriated $50,000, under which the shore end of the north jetty was reenforced and some of the worst gaps in the jetty were repaired, also spur dikes placed along the right bank of the river in the big bend above the light-house as bank protection.

No work was done during the fiscal year.

The river and harbor act approved March 3, 1905, contained the following item:

Improving the mouth of the Brazos River, Texas: Continuing improvement, fifty thousand dollars: *Provided*, That a contract or contracts may be entered into by the Secretary of War for such materials and work as may be necessary to prosecute said project, to be paid for as appropriations may from time to time be made by law, not to exceed in the aggregate eighty-seven thousand five hundred dollars, exclusive of the amounts herein and heretofore appropriated.

Amount expended on this improvement to June 30, 1905, was $288,471.23.

The amount estimated as a profitable expenditure it is proposed to apply to repairing the jetties and to bank protection in the river.

No commercial statistics for the fiscal year ending June 30, 1905, could be obtained.

July 1, 1904, balance unexpended	$5,419.01
Amount appropriated by river and harbor act approved March 3, 1905	50,000.00
	55,419.01
June 30, 1905, amount expended during fiscal year, for works of improvement	131.58
July 1, 1905, balance unexpended	55,287.43
July 1, 1905, outstanding liabilities	43.24
July 1, 1905, balance available	55,244.19
Amount (estimated) required for completion of existing project	225,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	87,500.00

(See Appendix U 10.)

12. Aransas Pass, Texas.—Aransas Pass is on the south coast of Texas, 175 miles southwest of Galveston and 125 miles north of the Rio Grande, and is the outlet of Aransas Bay to the Gulf of Mexico. The area of the bay is about 80 square miles. It is connected with Corpus Christi Bay on one side and with the shallow bays of Mosquite, St. Charles, and Copano on the other.

For projects and work done by the United States Government and private corporations at Aransas Pass, see Annual Report of the Chief of Engineers for 1898, page 1527 et seq.

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The river and harbor act of March 3, 1899, contains the following item:

Improving Aransas Pass, Texas: For dredging and other improvement of Aransas Pass Harbor, sixty thousand dollars: *Provided*, That the Secretary of War is hereby authorized to contract for the removal of that portion of the old Government jetty in said harbor from the end nearest the curved jetty constructed by the Aransas Pass Harbor Company to the wreck *Mary*, in such manner as to in no wise interfere with the curved jetty now located in said harbor: *And provided further:* That said contract shall not be let by the Secretary of War, nor said work done, until the said Aransas Pass Harbor Company shall have properly released and surrendered all rights and privileges heretofore granted to it in said harbor by Congress, also the jetty constructed in said harbor.

The Aransas Pass Harbor Company, under date of March 27, 1899, released and surrendered all rights and privileges heretofore granted to it in Aransas Pass Harbor by Congress, also the jetties constructed in said harbor.

For condition of the jetties and pass at the time the works were surrendered to the United States, see map accompanying Annual Report of the Chief of Engineers for 1900, page 2336.

The depth over Aransas bar has varied greatly—from 9 feet in 1852, 9½ feet in 1871, 7 feet in 1875, to 8½ feet in 1887.

With the funds appropriated by the river and harbor act of March 3, 1899, 1,300 feet of jetty was completed.

The river and harbor act of June 13, 1902, appropriated $250,000 for improving Aransas Pass, and provided that the work at this harbor shall be confined to the completion of the north jetty in accordance with the design and specifications of the Aransas Pass Harbor Company and in continuation of the work heretofore carried out on said jetty by said company, and to such additional work as may be necessary for strengthening such jetty and for the removal of such part of the old Government jetty and any other hard material which may interfere with the formation of a channel by the natural action of the currents.

During the fiscal year, under contract with Henry Clay Ripley, 10,751.33 tons of stone was placed in the jetty.

Inspection of the work of removing part of the old Government jetty, under contract with Moore & Sieber, was completed. Under this contract 1,000 feet of the old jetty has been removed to a depth of 25 feet.

The minimum depth in the thalweg at the time of the September and October survey was 12¼ feet.

The maximum draft that can be carried June 30, 1905, as reported by the bar pilot, is 11½ feet.

Greater depths have been reported at different times during the year, one vessel, drawing 12 feet, having gone out on a low tide after a succession of northers. The usual range of tide is 1.1 feet across the bar.

The river and harbor act of March 3, 1905, appropriated $100,000, and authorized an additional expenditure of $100,000 for continuing the improvement, with the proviso that the amounts therein appropriated and authorized shall be applied to the completion of the project in accordance with the design and specifications of the Aransas Pass Harbor Company and in continuation of the work theretofore

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done, and to such additional work as might be necessary for strengthening the jetty.

Bids for work under this act were advertised for May 29, 1905, and opened June 28, 1905.

The amount expended on this improvement to June 30, 1905, was $886,503.47, exclusive of $9,938.93 subscribed by the citizens of Rockport and Corpus Christi, Tex.

It is proposed to apply the additional appropriation recommended to completing the Haupt jetty.

No commercial statistics for the fiscal year ending June 30, 1905, could be obtained.

July 1, 1904, balance unexpended	$133,352.59
Amount appropriated by river and harbor act approved March 3, 1905	100,000.00
	233,352.59
June 30, 1905, amount expended during fiscal year, for works of improvement	128,606.06
July 1, 1905, balance unexpended	104,746.53
July 1, 1905, outstanding liabilities	43.23
July 1, 1905, balance available	104,703.30
Amount (estimated) required for completion of existing project	1,330,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	100,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix U 11.)

13. Harbor at Brazos Santiago, Tex.—The project for the improvement of this harbor, adopted in 1881, contemplated the construction of two jetties extending out into the Gulf of Mexico, the object being to fix the channel over the bar at the entrance to the harbor and to deepen it. These two jetties were to be built about 1,500 feet apart, and one, the south, or Brazos Island, jetty, to be 3,630 feet long, and the other, the north, or Padre Island, jetty, to be 2,940 feet long. Work was suspended on this improvement in October, 1884, and the subject of the new improvement referred to the Board of Engineers for report. A new survey was called for, which was made in 1887 and reported on September 29, 1887. The report showed that the south, or Brazos Island, jetty had practically disappeared. The cost of an improvement, to consist of two parallel jetties placed about 1,100 feet apart, was estimated at $1,130,000. Adding previous expenditures of $188,590.23 to this estimate makes the revised cost of the improvement $1,318,590.23.

During the year bids were advertised for dredging and contract entered into with the Bowers Southern Dredging Company, of Galveston, Tex., and active operations carried on to June 30, 1905, when the contract was completed. A channel 70 feet wide on the bottom, with a least depth of 10 feet, was excavated from deep water inside the bar in a straight line across the Laguna Madre to the railroad wharf at Isabel, Tex., a distance of 12,000 feet; also a turning basin 400 feet long by 300 feet wide and 10 feet deep.

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Prior to dredging this channel and turning basin, there was a natural channel permitting boats drawing 5½ to 6 feet to navigate across the Laguna Madre from the bar to the railroad wharf at Isabel, Tex., at high tide. With the channel and turning basin now completed, a boat drawing 8 to 8½ feet can navigate between the bar and Isabel, Tex., and light-draft steamers and sailing vessels that can get over the bar can proceed direct to the railroad wharf at Isabel, Tex., and unload in place of being lightered off Brazos Island. During the year there has been an average of from 8 to 10 feet of water on the bar, and a tide range of from 1½ to 2 feet.

The amount expended on this improvement to June 30, 1905, was $227,475.28.

The amount of commerce during the year was 5,497 tons, of which 1,112 tons was lumber, 3,075 tons general merchandise, 53 tons cotton, 543 tons rice and rice products, 688 tons hides and bones, and 26 tons miscellaneous.

July 1, 1904, balance unexpended	$54,785.39
June 30, 1905, amount expended during fiscal year, for works of improvement	34,760.67
July 1, 1905, balance unexpended	20,024.72
July 1, 1905, outstanding liabilities	14,193.06
July 1, 1905, balance available	5,831.66

(See Appendix U 12.)

14. Construction of sea wall, embankment, and fill along the front of Fort Crockett Reservation, Galveston, Tex., and constructing sea wall from Thirty-ninth street to the west line of Forty-fifth street in the city of Galveston.—The sundry civil act approved April 28, 1904, contained the following item:

Fort Crockett Reservation, Galveston, Texas: For the construction along the entire front of the Fort Crockett Reservation, except those parts of said front where the protected fortifications already act as a breakwater, a sea wall, embankment, and fill, as designated, specified, and described in the report of the board of engineers constituted in accordance with section one of the river and harbor act approved June thirteenth, nineteen hundred and two, four hundred and ten thousand dollars, and upon the conveyance in fee simple to the United States of the land lying between Thirty-ninth and Forty-fifth streets and south of Avenue U, in the city of Galveston, Texas, the said sea wall in front of the Fort Crockett Reservation shall be extended and completed under the direction of the Secretary of War from Thirty-ninth street to the west line of Forty-fifth street in the city of Galveston, Texas, as designated, specified, and described in the report of the Board of Engineers, constituted in accordance with section one of the river and harbor Act approved June thirteenth, nineteen hundred and two, and for this purpose the sum of one hundred and eighty-one thousand and forty-six dollars and twenty-five cents is hereby appropriated.

Contract for constructing the sea wall was entered into and carried on during the fiscal year and about 80 per cent of the work completed to the close of year.

Contract was entered into for the construction of riprap embankment along the western boundary of the reservation.

To close of the year the title to the land lying between Thirty-ninth and Forty-fifth streets in the city of Galveston, Tex., to be deeded to the United States, had not been perfected.

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July 1, 1904, balance unexpended	$591,046.25
June 30, 1905, amount expended during fiscal year, for works of improvement	43,706.17
July 1, 1905, balance unexpended	547,340.08
July 1, 1905, outstanding liabilities	44,956.94
July 1, 1905, balance available	502,383.14
July 1, 1905, amount covered by uncompleted contracts	225,048.94

(See Appendix U 13.)

15. Removing sunken vessels or craft obstructing or endangering navigation.—The hurricane of September 8, 1900, strewed the waters of West Galveston Bay with wrecks of boats, beacons, and bridges, and same have become a menace to navigation.

An allotment of $2,500 was made for the expense of removing these wrecks from the navigable waters of West Galveston Bay.

The U. S. snag boat *Gen. S. M. Mansfield* commenced operations on June 19, 1905, and was engaged on this work at close of year.

(See Appendix U 14.)

WESTERN RIVERS.

IMPROVEMENT OF CERTAIN RIVERS AND WATERWAYS IN LOUISIANA, TEXAS, ARKANSAS, INDIAN TERRITORY, AND MISSISSIPPI TRIBUTARY TO MISSISSIPPI RIVER.

This district was in the temporary charge of Lieut. Col. H. M. Adams, Corps of Engineers, until July 8, 1904; of Capt. James F. McIndoe, Corps of Engineers, from July 8, to December 10, 1904, and in the charge of Capt. George M. Hoffman, Corps of Engineers, since December 10, 1904. Division engineer, Lieut. Col. H. M. Adams, Corps of Engineers, to August 12, 1904, and Lieut. Col. Clinton B. Sears, Corps of Engineers, since that date.

1. Red River, Louisiana, Arkansas, Texas, and Indian Territory.—This improvement was undertaken by the United States in 1828, and between 1828 and 1841 more than $425,000 was appropriated for removal of the great Red River raft. When work commenced the raft was 92 miles long, extending from Loggy Bayou, 65 miles below Shreveport, La., to Hurricane Bluffs, 27 miles above. A channel was opened through this obstruction, but, owing to the failure of appropriations between 1841 and 1852, additional raft formed. In 1852 $100,000 was appropriated, and in 1857 the agent in charge reported the route opened, but not completed, with recommendation for appropriations of $50,000 a year for completion and maintenance. The total amount expended from 1828 to 1857 was $532,219.90. Nothing further was done for fifteen years, and in that long interval the results of much of the former work were lost.

When work was resumed in 1872 the river above Shreveport, La., was closed by a raft 32 miles long and growing constantly. Below Shreveport the enlargement of an outlet through Tones Bayou was depleting the main channel and threatening its closure to navigation. At Alexandria, La., the falls were impassable at low stages. Navigation was difficult and dangerous at all places and at all times. The channel shifted frequently, and at flood the river overflowed the

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entire raft region. Both above and below Shreveport the bed of the river was a mass of sunken logs and stumps. The banks were heavily timbered, and each flood caused them to cave or slide.

The project entered upon in 1872 contemplated opening navigation through the raft and closing Tones Bayou Outlet. Under river and harbor act of 1878 the removal of wrecks, snags, and other obstructions below Shreveport was commenced, and the act of 1879 authorized the same kind of work above the raft to Fulton, Ark. Work was carried on under three distinct appropriations until 1882, when they were combined in a general appropriation for continuing the improvement from Fulton, Ark., to the Atchafalaya River, Louisiana, with a provision for work at Alexandria, La. The river and harbor acts of 1886 to 1896 made appropriations for snagging work above Fulton, Ark., to mouth of Kiamichi River, Indian Territory, which stretch was added to the general project by act of 1899. The acts of 1884 and 1890 contained provisions for closing Sale and Murphy Outlet, Louisiana; the acts of 1888, 1892, and 1894 authorized expenditures for improvement of Cypress Bayou, Bayou Dorcheat, and Sulphur River, tributaries of Red River; the act of 1902 provided for improvement of the channel at Shreveport, La., and the act of 1905 contained provision for improvement of the channel at Alexandria, La., and for extending work above Fulton, Ark., to Denison, Tex.

The existing project, adopted by Congress in the river and harbor act of July 13, 1892, contemplates the systematic clearing of the banks to remove the source of drift and snags; continuing snagging operations and the removal of jams and raft; dredging towheads and shoals; constructing a substantial system of levees, either alone or by cooperating with riparian States, to fix the course of the river; the closure of all outlets that deplete the river; the fixing of caving banks to confine the river to the selected channel, and the prevention of injuries to regimen by new cut-offs or outlets. The nature of the improvement requires that it be continued for many years, and no estimate for completion is given on this account.

The amount expended from 1872 to the close of the fiscal year ending June 30, 1905, was $1,682,888.28 with the following chief results: The channel cleared through the great raft in 1872–73 opened to navigation 188 miles of river above Shreveport to Fulton, and at high stages about 170 miles above Fulton. Subsequent work secured the complete removal of the raft, prevented formations of the same nature, increased the width of the river 100 feet or more, and there now flows in the course laid out for it in the old raft region a broad and deep river, safe for navigation at all but the lowest stages. Thirteen years ago the survey showed that the low-water line at head of the raft had lowered more than 15 feet since 1872 and that this change continued downstream through the raft region and gradually diminished to about 3 feet at Shreveport. The continual progressive scour is attaining a normal slope in that stretch. Incidentally the removal of the raft drained the fertile valley and reclaimed thousands of acres of productive lands. Tones Bayou Outlet is closed by a heavy earthen dam, connected with the line of levee above and below it. The main channel, called "Little River," has widened and scoured, and navigation of the stretch is uninterrupted at low stages. All of the chief outlets along the right bank above Tones Bayou to the Louisiana-Arkansas line, 89 miles, have been closed with dams by

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cooperation with the State of Louisiana and local levee districts. Work at Alexandria Falls has rendered them navigable at all stages. The channel was deepened from 2½ to 5½ feet at the lower falls and to 6 feet at the upper falls, lengthening the period of navigation about two months. Persistent snagging operations, repeated from year to year, have kept the river open and enabled steamboats to make regular trips, the river from the Atchafalaya to Fulton ordinarily being open for boats of 3 feet draft at stages about a foot above zero of the Shreveport gauge. The maximum draft that can be carried at mean low water is 3 feet to Montgomery, La., 162.5 miles above the Atchafalaya; 2½ feet to Shreveport, La., 320.5 miles, and 2 feet to Fulton, Ark., 508.6 miles. The range between low and high water at the several gauge stations is as follows: Fulton, Ark., 35.65 feet; Shreveport, La., 41.2 feet; Alexandria, La., 41.95 feet, and Barbre Landing, La. (head of Atchafalaya River), 52.72 feet.

At present steamboats seldom run above Fulton, Ark., but at high stages the river is navigable in fact to Denison, Tex., 292 miles above Fulton and 800 miles above the Atchafalaya River.

During the fiscal year ending June 30, 1905, snagging operations, etc., for maintenance of the improvement extended from the head of the Atchafalaya River, Louisiana, to Pine Bluff Ferry, Texas, about 30 miles above the mouth of Kiamichi River.

To maintain what has been accomplished and to gradually secure a more stable improvement will require a continuance of work for many years. The estimated cost is $75,000 a year, or biennial appropriations of $150,000, exclusive of the extraordinary demands for new plant that will arise from time to time. The funds available probably will suffice for two years' operations.

Notwithstanding the facilities for quick transportation afforded by the railways, the commerce of Red River consists of large shipments of cotton, cotton seed and its products, lumber, staves, timber, etc., with heavy return freights of general merchandise and plantation supplies. For the fiscal year 1905 this commerce aggregated 174,870 tons, valued at $1,506,500. The commerce and navigation reported for the past sixteen years show great variations, due to changing crop conditions, occasional periods of extraordinary low water during the busy season, and other causes, ranging in quantity from 66,376 to 279,946 tons per annum, with estimated values of from $1,506,500 to $9,185,000. The average for the sixteen years is 121,428 tons, valued at $4,720,333. To this should be added the commerce from Ouachita River, entering Red River at the mouth of Black River, the average of which is 174,962 tons, valued at $6,206,550, making a total of 296,390 tons, valued at $10,926,883.

The project has effected a reduction of freight rates on all commodities.

For more extended information respecting the work performed, reference is invited to the report and illustrations on page 1909 of the Report of the Chief of Engineers for 1893, and to the subsequent reports of the district officers. Maps of Tones Bayou, Bayou Pierre, etc., are published in the reports of 1882, page 1542, and the report of 1885, page 1490. An index sketch of the basin of Red River and diagrams showing the limits of high and low water are published in

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the report of 1891, page 1956, and the report of 1892, page 1587. Maps of the river at Shreveport are published in the report of 1887, page 2682, and 1893, page 1921. Map of the river at Alexandria was printed in House Document No. 462, Fifty-sixth Congress, first session.

References were given in the last annual report to reports of examinations and surveys, with page numbers at which they may be found in the various annual reports. (See Report of the Chief of Engineers, 1904, pp. 385 and 386.)

July 1, 1904, balance unexpended		$87,613.07
Amount appropriated by river and harbor act approved March 3, 1905		200,000.00
Amount received from sales of condemned property and from overpayments in fiscal year 1904		[a] 168.19
		287,781.26
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$5,947.14	
For maintenance of improvement	32,722.40	
		38,669.54
July 1, 1905, balance unexpended		249,111.72
July 1, 1905, outstanding liabilities		2,656.85
July 1, 1905, balance available		246,454.87

(See Appendix V 1.)

2. Cypress Bayou, Texas and Louisiana.—During the period of the great raft in Red River the bottom lands of Cypress Bayou were flooded, became lakes, and afforded a navigable route from Red River near Shreveport, La., to Jefferson, Tex., 65 miles. Work by the United States for improvement of this route commenced in 1872, and from 1872 to 1879 $94,000 was appropriated for the purpose. The funds were expended for dredging and straightening the channel, removing stumps, snags, and logs, and cutting leaning timber. This work was completed in 1880, but on account of its temporary nature appropriations and allotments aggregating $39,701.33 were made for maintenance.

The removal of the raft and the subsequent closure of outlets and construction of levees down the right bank of Red River, from the hills in Arkansas to near Shreveport, La., cut off the water supply of the lakes, which, in conjunction with the quicker drainage resulting from the lowering of the bed of Red River, gradually caused them to dry up. In consequence, the period of navigation shortened from year to year until 1897, when boats from Red River ceased plying altogether. A survey to ascertain if improvement could be obtained by locks and dams was completed in 1893, but the plan proposed was not adopted by Congress.

The amount expended to June 30, 1905, was $130,498.67 for improvement and maintenance and $12,000 for surveys. No work has been done since 1898. The water supply of the drainage basin of the lakes has been reduced so greatly and the channel of Red River above Shreveport has lowered so much that steamboats now can cross Albany flats, at foot of the lakes, only at rare intervals during exceptionally high stages of the river, or after heavy rains in the drainage basin of the lakes.

[a] Eighty cents deposited September 14, 1904, account of overpayments made during preceding fiscal year.

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The river and harbor act of March 3, 1905, provided (1) that "the available balance on hand may, in the discretion of the Secretary of War, be expended in cleaning and clearing the bayou and lakes between Jefferson, Texas, and Mooringsport, Louisiana," and (2) "the Secretary of War is authorized and directed to survey Cypress Bayou and the channels connecting Shreveport, Louisiana, with Jefferson, Texas, including an examination of the falls near Little Pass." Under authority of the Secretary of War, dated April 7, 1905, it is proposed to make the survey this summer, as soon as conditions are favorable for field work, and to defer until after its completion any work for cleaning and clearing the bayou and lakes, as the available balance may not be sufficient for both purposes.

Reference is invited to the special report published in the Report of the Chief of Engineers for 1890, page 1914, which gives extended information of this improvement.

References to reports of examinations and surveys were given in the last annual report, with the page numbers at which they may be found in the various annual reports. (See Report of the Chief of Engineers, 1904, p. 387.) Report of the last examination was printed in the report for 1904, page 2075.

July 1, 1904, balance unexpended	$3,202.66
July 1, 1905, balance unexpended	3,202.66

(See Appendix V 2.)

3. Ouachita and Black rivers, Arkansas and Louisiana.—The improvement of Ouachita River by the United States commenced in 1871. At that time navigation was much obstructed at all stages by snags, sunken logs, wrecks, leaning and caving trees, etc., and at low water the greater part of the river was unnavigable on account of numerous rock, gravel, and sand bars.

A project was entered upon in 1871 for temporary improvement from Trinity, La., to Arkadelphia, Ark., by removal of snags and other obstructions and by dredging the worst bars. In 1872 a project was adopted for locks and dams to give 4 feet depth from Trinity, La., to Camden, Ark., but was abandoned two years later. The project under which work continued after 1874 contemplated the removal of snags, logs, wrecks, leaning timber, etc., obstructing navigation below Camden, Ark. The stretch of 56 miles, known as Black River, below Trinity to Red River, Louisiana, was added to the project in 1884. The amount expended on the original and modified projects prior to operations under the existing project was $605,802.19.

The existing project, besides continuation of snagging work, contemplates the construction of nine locks and movable dams to afford a navigable depth of 6½ feet from the mouth of Black River, Louisiana, upstream to a point 10 miles above Camden, Ark. (360 miles). The original estimate of cost was $1,998,576, increased to $2,038,888 by the act of March 3, 1905. The project was adopted in part by a provision in the river and harbor act of June 13, 1902, authorizing continuing contracts for building Lock and Dam No. 4 near Monroe, La., and Lock and Dam No. 6 near Roland Raft, Arkansas. Provisions were made in the same act for completing the survey for locks and dams and for maintenance of prior work.

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The amount expended under the existing project to June 30, 1905, was $71,872.20, of which $11,178.03 has been applied to completion of survey and $25,667.83 to maintenance.

A contract for building Locks and Dams Nos. 4 and 6 was let September 7, 1904, and provides for their completion by December 31, 1906. Work commenced October 28, 1904, but was stopped by high water January 6, 1905, and continued high stages to end of the year prevented further construction work. No work for maintenance was performed during the year beyond that required for proper care of plant.

The work heretofore done has consisted chiefly of the removal of snags, logs, wrecks, leaning timber, tree slides, etc., for the purpose of maintaining navigation, and the improvement of Catahoula shoals, a rock and gravel bar about 20 miles above Trinity, La., where the available depth was increased from 15 to 40 inches. At moderately high stages, or during six to seven months of the year, New Orleans steamboats ascend the river to Camden, Ark.; at medium stages they run to Monroe, La., but during the periods of low water Harrisonburg, La., 72 miles above Red River, is considered the head of navigation, though small local packets make trips between points on the river above. The maximum draft that can be carried at mean low water is 3½ feet to Harrisonburg, La.; 1¼ feet to Monroe, La., and 8 inches to Camden, Ark. The range between high and low water at the several gauge stations on Ouachita River is as follows: Camden, Ark., 44.2 feet; Monroe, La., 48.6 feet; Riverton, La., 51.3 feet, and Jonesville, La., 54.1 feet. Camden, Ark., is considered the head of navigation, but at high stages the river is navigable in fact to Arkadelphia, Ark.

The commerce of Ouachita River and its tributaries is considerable, and consists of shipments of cotton, cotton seed, lumber, staves, saw logs, and miscellaneous articles, with return freights of general merchandise and plantation supplies. Most of the cotton is shipped to New Orleans, and large quantities of staves for export are sent to that city each year. The commerce reported for the fiscal year 1905 aggregated 141,779 tons, valued at $3,243,200. The volume of commerce as reported for the past sixteen years ranges between 73,679 and 313,863 tons per annum, with values estimated at $3,243,200 to $10,234,250. The average for the sixteen years is 174,962 tons, valued at $6,206,550. The variations are due to crop yields, the uncertainty of navigation, droughts, and other causes, and the proposed improvement by locks and dams is for an extension of benefits by affording navigation to Camden the year round.

Statements appended to the district officer's report (Appendix V 3) show that the project has effected a reduction of railroad rates from New Orleans to Monroe, La., and points below to meet the steamboat rates. The territory above Monroe recently has been opened to railroad traffic, but the lines as yet have not met the water rates. During periods of navigation the rate on cotton from Monroe to New Orleans is $1.25 per bale, but when navigation is suspended this rate is advanced to $1.75 per bale. Railroad rates from Monroe, La., to inland towns, as a rule, are greatly in excess of those to points where there is water competition.

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For more extended information respecting this improvement reference is invited to the report of 1895 (p. 1887) and to subsequent reports of the district officers.

An index to reports of examinations and surveys was published in the last report (Report of the Chief of Engineers, 1904, p. 389).

The estimate of amount that can be expended profitably in the fiscal year ending June 30, 1907, is $132,266, the balance authorized under continuing contract (expiring December 31, 1906) for completing Locks and Dams Nos. 4 and 6.

July 1, 1904, balance unexpended		$318,677.10
Amount appropriated by river and harbor act approved March 3, 1905		80,000.00
Amount appropriated by sundry civil act approved March 3, 1905		12,000.00
Amount received from sales of property		17.50
		410,694.60
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$17,006.33	
For completion of survey	1,549.65	
For maintenance of improvement	3,813.01	
		22,368.99
July 1, 1905, balance unexpended		388,325.61
July 1, 1905, outstanding liabilities		1,219.81
July 1, 1905, balance available		387,105.80
July 1, 1905, amount covered by uncompleted contracts		416,216.82
Amount (estimated) required for completion of existing project		[a]132,266.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905		[b]132,266.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.		

(See Appendix V 3.)

4. Bayou Bartholomew, Bœuf River, Tensas River, and Bayou Maçon, and bayous D'Arbonne and Corney, Louisiana and Arkansas.—These streams are tributaries of Ouachita River and were navigated at high stages to a considerable extent before their improvement was undertaken by the United States, but the passage of steamboats was difficult and dangerous on account of numerous obstructions, consisting of snags, sunken logs, wrecks, leaning timber, etc.

In the river and harbor act of March 3, 1881, Congress entered upon projects for the removal of these obstructions, so as to give greater ease and safety to the navigation of Bayou Bartholomew, Bœuf River, and Tensas River. The river and harbor act of July 5, 1884, appropriated funds for the same kind of work in bayous D'Arbonne and Corney, and added Bayou Maçon to the improvement of Tensas River; and under the river and harbor act of August 5, 1886, a supplemental project was entered upon for the closure of three outlets of Bœuf River. The various works continued for twenty-one

[a] The estimate for completion refers only to that part of the project authorized by Congress for construction of Locks and Dams Nos. 4 and 6 at a cost of $674,266.

[b] Of this amount $91,954 is for continuing contract work authorized by the river and harbor act of June 13, 1902, and $40,312 by the act of March 3, 1905.

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years under four distinct titles of appropriation, but were consolidated by the river and harbor act of June 13, 1902, in a general appropriation for maintenance of the work performed. Drift, sliding and caving banks, and the rapid growth of vegetation constantly add obstructions to navigation which become more difficult to remove each year they are allowed to remain.

The projects are epitomized as follows:

Stream.	Original project.		Modifications of project.	
	Nature of work.	Year adopted.	Nature.	Year adopted.
Bayou Bartholomew, La.	Removing obstructions between mouth and Baxter, Ark., 182 miles; completed, 1897, to McComb Landing, Ark., 141 miles.	1881	Maintenance of work below McComb Landing, the head of navigation. Annual cost, $2,500.	1897
Bœuf River, La	Removing obstructions between mouth and Wallace Landing, about 170 miles; completed, 1896.	1881	Closing 3 outlets near Point Jefferson. (Closed, 1887-88, at a cost of $5,441.78, but dams destroyed in 1890 and not rebuilt.)	1886
Do			Maintenance of work below Wallace Landing, the head of navigation. Annual cost, $2,500.	1897
Tensas River and Bayou Maçon, La.	Removing obstructions between mouth of Tensas River and Dallas, 138 miles above; completed, 1898, to Westwood, head of navigation, 81 miles.	1881	Removing obstructions between mouth of Bayou Maçon and Floyd, 112 miles, completed, 1899. Lane Ferry, about 20 miles above Floyd, is head of navigation in Bayou Maçon.	1884
Do			Maintenance of work performed in both streams. Annual cost, $2,500.	1900
Bayous D'Arbonne and Corney, La.	Removing obstructions between mouth of Bayou D'Arbonne and Stein Bluff on Corney branch, 40¼ miles above; completed, 1896.	1884	Extending work in Bayou Corney above Stein Bluff 16¼ miles to Cobb Landing; completed, 1896.	1892
Do			Removing obstructions in Little D'Arbonne branch ($1,000).	1894
Do			Maintenance of work performed between mouth of Bayou D'Arbonne and Cobb Landing, the head of navigation. Annual cost, $1,000.	1902

The expenditures to June 30, 1905, were as follows:

Stream.	For improvement.	For maintenance.	Total.
Bayou Bartholomew	$45,873.53	$11,126.47	$57,000.00
Bœuf River	46,434.62	13,333.84	59,768.46
Tensas River and Bayou Maçon	11,947.02 / 23,915.42	7,356.09	43,218.53
Bayous D'Arbonne and Corney	18,000.00	2,063.58	20,063.58
Total expenditure	146,170.59	33,879.98	180,050.57
Balance unexpended			22,949.43
Total amount appropriated			203,000.00

The streams are not navigable for steamboats at low water. The work performed has reduced the dangers of navigation, enabled larger boats to run, and to make trips in less time than was required formerly, has lengthened the periods of navigation, and has resulted in lower rates of freight.

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During the fiscal year ending June 30, 1905, operations for maintenance extended over Bayou Bartholomew, between its mouth and the Arkansas State line, 85.7 miles; Bayou D'Arbonne, below Ford Landing to its mouth, 12.4 miles; and about 9 miles of lower Bœuf River, putting these stretches in good navigable condition for the time.

The available funds are to be applied to two years' work for maintenance, under allotments for the streams authorized by the Secretary of War.

The commerce of these streams consists chiefly of shipments of cotton, cotton seed, staves, timber, etc., and return freights of general merchandise and plantation supplies. It varies with the crops, and to a considerable extent with the navigable stages, which frequently are not conicident with the needs of transportation. The volume and changes of the commerce are shown in the following table:

Stream.	Maximum reported.			Minimum reported.			Average.		
	Year.	Tons.	Value.	Year.	Tons.	Value.	Period.	Tons.	Value.
							Years.		
Bayou Bartholomew	1891	49,299	$826,000	1905	2,007	$143,400	16	13,790	$329,750
Bœuf River	1897	11,261	69,000	1903	545	30,000	16	6,080	258,880
Tensas River and Bayou Maçon	1905	29,957	781,000	1898	2,649	122,500	16	14,880	552,000
Bayous D'Arbonne and Corney	1890	14,416	646,000	1903	682	55,000	10	7,066	383,370
Total	.....	104,933	2,322,000	.....	5,883	350,900	.....	41,816	1,523,500

A condensed history of the work performed to that time in Bayou Bartholomew, Bœuf River, and Tensas River and Bayou Maçon will be found in the Report of the Chief of Engineers for 1896, pages 1601–1613, and of that performed in bayous D'Arbonne and Corney, in the report of 1895, page 1914. Subsequent reports of the district officers refer only to the yearly operations.

An index to reports of examinations and surveys was published in the last report. (Report Chief of Engineers, 1904, p. 391.)

July 1, 1904, balance unexpended	$9,161.53
Amount appropriated by river and harbor act approved March 3, 1905	17,000.00
	26,161.53
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	3,212.10
July 1, 1905, balance unexpended	22,949.43
July 1, 1905, outstanding liabilities	469.71
July 1, 1905, balance available	22,479.72

(See Appendix V 4.)

5. Mouth of Yazoo River and harbor at Vicksburg, Miss.—The shifting bar at the former mouth of the Yazoo was the most serious obstruction to navigation of that river and its tributaries, a system comprising about 800 miles of navigable waterways. At low stages steamboats were prevented from entering or leaving the river without lightering their cargoes across the bar, and it frequently happened that the outlet was entirely closed to navigation throughout the busiest season of the year.

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Prior to 1876 the city of Vicksburg possessed the most commanding site and the finest harbor on the Mississippi River. There was deep water along the city front, and the entire width of river was available for steamboats at all stages, with not less than 25 feet depth in any part of the harbor. The cut-off of April 27, 1876, and subsequent shoaling of the old channel leading from the river to the front of the city practically destroyed the harbor, which became unnavigable except at high stages of the river.

The original project for improving Vicksburg Harbor, based upon the report of a Board of Engineers dated January 22, 1878, was entered upon under the river and harbor act of June 18, 1878. The first work consisted of revetting the rapidly caving bank at Delta Point, Louisiana, opposite Vicksburg, the continued recession of which was increasing the distance from the harbor to the river channel. From 1878 to 1881 there were built about 5,400 linear feet of revetment, 1 mattress spur dike, and 2 screen dikes, at a cost of $203,229.87. The river and harbor act of August 2, 1882, placed the work under the Mississippi River Commission; the revetment at Delta Point was continued; 6,448 linear feet was built, and repairs to the upper bank paving were made. Practically all of the work constructed prior to 1882 was destroyed, or was covered up by later work. Only the mats built in 1893–94 (1,065 feet) have the present standard width of 300 feet, the earlier ones having been from 150 to 175 feet wide. Extensive repairs were made in 1899–1900. No work has been done at Delta Point since. Some caving has occurred above the upper end of the revetment, which, however, is protected by a hard point, and there appears to be no immediate danger of flanking. The amount expended by the Mississippi River Commission at Delta Point was $186,256.21, which, with the prior expenditures of 1878–1881, makes a total of $389,486.08.

When Vicksburg Harbor was placed under the Mississippi River Commission in 1882 a project was adopted for dredging a basin 1,700 feet long by 300 feet wide in front of the city, with a canal 150 feet wide to connect it with the river. Dredging under this project amounted to 350,035 cubic yards in 1883, when discontinued. It was resumed in 1888, under a slightly modified project, and continued until 1893. During the latter period the dredging amounted to 1,729,994 cubic yards, making a total of 2,080,029 cubic yards of excavation. In 1888 pile dikes were built at the north end of the basin and along the west side of the canal, aggregating 6,800 feet in length. The total expenditures for Vicksburg Harbor were $442,724.77, which, added to the amounts expended at Delta Point, makes a total of $832,210.85. The improvement of Vicksburg Harbor was transferred to the Engineer Department under a provision of the river and harbor act of August 18, 1894.

The existing project, adopted by Congress in the river and harbor act of July 13, 1892, contemplated opening a new mouth or outlet for Yazoo River from its original mouth on Old River (9.8 miles above the former outlet to the Mississippi) through deep water down the wrong end of Old River, thence across a neck of low land between Old River and Lake Centennial and around the head of De Soto Island and down the east arm of Lake Centennial to the Mississippi River, entering it upon the channel side at Kleinston Landing.

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Lake Centennial is the old bend of the Mississippi River cut off in 1876, and De Soto Island, prior to the cut-off, was the Louisiana peninsula, around which the river flowed. The estimate of cost—$1,500,000—was revised in 1893 and reduced to $1,200,000.

The amount expended under the existing project to June 30, 1905, was $1,179,210.87, and the work practically is completed. The new outlet was opened in the spring of 1903; uninterrupted navigation of Vicksburg Harbor has been maintained for two years, and the new mouth of Yazoo River has been open to boats of 6 feet draft at mean low water. The extreme range between high and low water at Vicksburg is 59 feet, but the usual variation is about 45.3 feet.

The chief features of this work were the purchase of 1,155.54 acres of land for right of way of the main cut between Old River and Lake Centennial; the clearing and grubbing of the route; the excavation by dredging of 6,229,281 cubic yards of earth in opening the new outlet, of which about 934,000 cubic yards was used for building a dam, to an elevation above ordinary low water, extending across the west arm of Lake Centennial from mouth of the main cut to head of De Soto Island, and the building of a levee containing 429,677 cubic yards from mouth of the canal at Kleinston westward along West Pass bar (which separates the west arm of Lake Centennial from Mississippi River) to within about 4,500 feet of King Point.

The annual commerce of Yazoo River, its tributaries, and Vicksburg Harbor, as reported for seven years, varies between 222,792 and 441,765 tons, the estimated values of which range from $6,801,000 to $13,272,000 per annum. The average of the commerce is 321,594 tons per annum, and the average of the value is $8,753,650.

July 1, 1904, balance unexpended	$76,646.06
June 30, 1905, amount expended during fiscal year, for works of improvement	55,856.93
July 1, 1905, balance unexpended	20,789.13
July 1, 1905, outstanding liabilities	218.38
July 1, 1905, balance available	20,570.75

(See Appendix V 5.)

6. Yazoo, Tallahatchie, Coldwater, and Big Sunflower rivers and Tchula Lake, Mississippi.—The improvement of Yazoo River by the United States was commenced in 1873. At that time the period of navigation was limited to high stages on which steamboats could pass the wrecks of gunboats and steamers and rafts sunk for the purpose of preventing passage during the war of the secession. The channel also was much obstructed by numerous snags, stumps, tree slides, sunken logs, etc., and by a heavy growth of leaning timber. The improvement of Tallahatchie and Big Sunflower rivers and of Lower Coldwater River, the principal tributaries of the Yazoo, was commenced in 1879. At that time Tallahatchie River was navigable to Sharkey, about 65 miles above its mouth, for about six months each year, but passage was difficult and dangerous at all stages on account of the great number of obstructions in the channel and along the banks, including the wreck of the ocean steamship *Star of the West*, sunk in February, 1863, about 8 miles above the mouth. Above Sharkey the leaning timber was dense, the boughs from opposite banks at places overlapped the river, and this condition, together with

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the number of snags, logs, and stumps in the channel, rendered that part of the stream practically impassable. Lower Coldwater River was obstructed by snags, logs, and overhanging trees. Big Sunflower River was navigable for very light boats about six months of the year, but was much obstructed by snags, sunken logs, sand bars, and shoals; navigation was impeded at all stages by leaning timber, and at many places the channel was so choked with obstructions as to afford no greater depth than 18 inches and was so narrow that it gave passage room only for the smallest craft. The improvement of Tchula Lake, an arm of Yazoo River in Holmes County, about 60 miles long, flowing down the east side of Honey Island, was commenced in 1881, when the lake was obstructed its entire length by a network of snags on the bottom, with arms projecting upward, by sawyers, heavy leaning timber, and a thick growth of brush along both banks, which encroached on the channel at places until passage of steamboats was difficult at any stage.

The project adopted March 3, 1873, contemplated removing obstructions to give ease and safety to the navigation of Yazoo River. The additional projects adopted March 3, 1879, contemplated the same kind of work in Tallahatchie River from its mouth to the Coldwater River, about 100 miles above, thence up the Coldwater about 80 miles to Yazoo Pass, and in Big Sunflower River from its mouth to Clarksdale, about 180 miles above, and the building of inexpensive pile and brush wing dams to scour depths of about 40 inches on the bars. The river and harbor acts of 1880, 1881, and 1882 required expenditures aggregating $10,000 for the improvement of Tallahatchie River above mouth of the Coldwater to Batesville. Under river and harbor act of March 3, 1881, the removal of obstructions in Tchula Lake was commenced for the purpose of prolonging the navigable period and to permit light-draft steamboats to pass through the lake earlier in the cotton season. No appropriation for Coldwater River was made between 1880 and 1905.

The four works were carried on under distinct appropriations until the river and harbor act of June 13, 1902, combined them in one general appropriation for continuing the improvements and for maintenance of the work done. Work has continued under the plans formerly pursued with allotments from the general appropriation authorized by the Secretary of War.

The amount expended to the close of the fiscal year ending June 30, 1905, and the unexpended balances on that date were as follows:

	Amount expended.	Balances unexpended.
For improvement of—		
Yazoo River	$311,735.41	$94,264.59
Tallahatchie and Coldwater rivers	76,319.56	5,180.44
Big Sunflower River	92,604.04	10,395.96
Tchula Lake	24,210.52	4,789.48
Total	504,869.53	114,630.47

The results of the work are marked. In Yazoo River the wrecks that blocked the channel and restricted the period of navigation to high stages were removed so as to present no obstruction, and work for

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the removal of snags, logs, leaning timber, etc., repeated from time to time, opened and maintained steamboat navigation from the mouth to the head of the river. Various short stretches of Yazoo River remain more or less obstructed by bars at the lowest stages, but steamboats of 3½ feet draft navigate the river at mean low water without serious difficulty. The range between low and high water at Yazoo City is 40.8 feet. In Tallahatchie River the wreck of the steamship *Star of the West* was destroyed and obstructions were removed from the channel and banks so as to permit steamboats of 3 feet draft to run to Sharkey the year round and into Coldwater River at moderately high stages. In Big Sunflower River the cutting of leaning timber, the removal of channel obstructions and the building and renewal of wing dams at the bars have maintained navigation in the lower 100 miles and enabled boats of 30 inches draft to run to Woodburn, 77 miles above the mouth, at mean low water. The work in Tchula Lake was completed in 1895, but was of temporary character, and in 1902 the obstructions at its lower end, consisting of accumulations of drift in jams, snags, logs, leaning trees, brush, etc., were removed.

Yazoo River is navigable its entire length the year round. Tallahatchie River is navigable to Sharkey the year round, and thence to and up Coldwater River about 80 miles to Yazoo Pass at high stages. The mouth of Coldwater River is considered the head of navigation of the Tallahatchie, but it is navigable in fact for 10 or 15 miles above that point. Clarksdale now is the head of navigation of Big Sunflower River only at long intervals during periods of general overflow from Mississippi River caused by disasters to the levees. Faisonia, about 100 miles above the mouth, is considered the head of navigation. Boats can pass through Tchula Lake at moderately high stages.

Snagging operations, etc., for maintenance of the improvements, were continued during the fiscal year ending June 30, 1905, as follows: In Yazoo River from mouth to head, at a cost of $7,114.73; in Tallahatchie River from mouth to Philipp, at a cost of $735.44; in Big Sunflower River, including construction and repair of wing dams, between its mouth and Osceola Landing, at a cost of $4,486.42; and a jam of drift was removed in Tchula Lake, at a cost of $394.96.

Floods, sliding and caving banks, and the rapid growth of vegetation along these alluvial rivers constantly add obstructions and render a continuance of snagging operations necessary in the interest of safe and uninterrupted navigation. It is estimated that the funds available will be sufficient for two years' work, after applying $60,000 of the allotment for Yazoo River to the construction of a new steel-hull snag boat.

The chief shipments out of Yazoo River and tributaries are cotton, cotton seed, staves, timber, etc., with return freights of general merchandise and plantation supplies. The commerce of the past fifteen years ranges between 102,098 and 544,503 tons annually, with values estimated at $2,840,000 to $9,198,000, the average being 223,927 tons, valued at $5,529,100.

Freight rates on cotton by boat are about 50 per cent less than by rail; cotton seed is about 33⅓ per cent less; live-stock shipments by boat cost about one-third of the railroad rates, and grain, flour, meal, and provisions shipped by boat cost about 50 per cent less than by rail. To inland points the railroad rates are largely in excess of boat

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rates for the same distance. Large quantities of timber are rafted which could not be reached by rail.

A résumé of the work performed in Yazoo, Tallahatchie, and Big Sunflower rivers is given in the Report of the Chief of Engineers for 1896, pages 1613, 1626, and 1630. Subsequent annual reports of the district officers give each year's operations only. A résumé of work in Coldwater River is given in the Report of the Chief of Engineers for 1885, page 1518.

An index to reports of examinations and surveys was published in the last report (Report Chief of Engineers, 1904, p. 397).

July 1, 1904, balance unexpended	$22,344.77
Amount appropriated by river and harbor act approved March 3, 1905	105,000.00
Amount received from sales of property	17.25
	127,362.02
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	12,731.55
July 1, 1905, balance unexpended	114,630.47
July 1, 1905, outstanding liabilities	118.49
July 1, 1905, balance available	114,511.98

(See Appendix V 6.)

IMPROVEMENT OF ARKANSAS RIVER AND OF CERTAIN RIVERS IN ARKANSAS AND MISSOURI.

This district was in the charge of Maj. Graham D. Fitch, Corps of Engineers. Division engineer, Lieut. Col. H. M. Adams, Corps of Engineers, until August 12, 1904, and Lieut. Col. Clinton B. Sears, Corps of Engineers, since that date.

1. Arkansas River, Arkansas.—In its original condition the channel of the river was greatly obstructed by shifting sand bars and numerous snags in its lower reaches, and by gravel and rock shoals and some snags in its upper reaches. Navigation was difficult and uncertain at medium and low stages, and during periods of extreme low water was impossible.

Prior to act of Congress approved June 13, 1902, the work on this river was carried on under two general projects—one entitled "Removing obstructions in Arkansas River, Arkansas and Kansas," the other "Improving Arkansas River, Arkansas."

The original project for "Removing obstructions in Arkansas River, Arkansas and Kansas" (act July 3, 1832), was to remove snags and wrecks. Subsequently this project was enlarged to include removing bars by wing dams, and many of the appropriations were made for this work in combination with other rivers. By act of March 3, 1879, Congress adopted an additional project—that of improving the river between Fort Smith, Ark., and Wichita, Kans., by removing the snags and rocks and constructing dams at some of the worst shoals. Later these projects were merged into one, making the project extend from the mouth of the river to Wichita. Under these projects there was expended to June 30, 1902, $968,256.81.

The original projects for "Improving Arkansas River, Arkansas," were local and had in view the permanent improvement of the river at Fort Smith, Vanburen, Dardanelle, and Pine Bluff. By act of August 11, 1888, Congress adopted a general project, namely: "That

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the Secretary of War shall expend the appropriation under this head with reference to the final improvement of this river as contemplated in the Report of the Chief of Engineers for the year ending July 1, 1885, and as authorized in the act for the improvement of rivers and harbors approved August 5, 1886, and in House Executive Document No. 90, Forty-ninth Congress, first session, said methods to be applied as the Secretary of War may direct at such points between Wichita, Kans., and the navigable mouth of the Arkansas River at its junction with the Mississippi River, as he may deem for the best interest of commerce." The "said methods" referred to in the act were "To remove rock and gravel reefs by blasting and dredging, to contract the channel by dikes and dams, permeable or solid, of such construction as the local conditions require, and to hold the channel so obtained by revetment where necessary." The improvement authorized by the act covers 771 miles, while estimates have been rendered for 708 miles, thus making the estimated cost of the improvement under this project indefinite. Act of August 18, 1894, authorized the operation of snag boats under this head in addition to similar operations under the project "Removing obstructions in Arkansas River, Arkansas and Kansas." To the close of the fiscal year ending June 30, 1902, there had been expended under the general project for improving Arkansas River, Arkansas, $903,311.93 for original construction, $314,119.14 for maintenance, and $63,397.32 for operating snag boats, making the total amount $1,280,828.39.

Act of Congress approved June 13, 1902, merged these two general projects into one, which makes the existing project in substance: "The improvement of the river from its mouth to the head of navigation by snagging operations, by dredging operations, and by contraction works, holding the improved channel by revetment where necessary." No definite estimate of cost can be given.

To June 30, 1905, there had been expended under the consolidated project $89,595.53; of which $68,855.53 was for operating snag boats, the remainder, $20,470, having been expended for maintaining works of permanent improvement. The total expenditures under all projects to June 30, 1905, is $2,338,680.73, of which $100,779.66 is for operating snag boats, $903,311.93 for original construction of works for permanent improvement, and $334,589.14 for maintenance of those works.

The works erected for the permanent improvement of the stream were of no material benefit to navigation, they having been built in disconnected reaches. The snagging operations, which must be repeated each year, give immediate relief, but the benefits derived from them are in a large measure lost during the high-water seasons following the periods when the work is done. This is due to the continual caving of the banks and the consequent shifting of the channels.

During this fiscal year navigation out of Pine Bluff and all points above was suspended from November 1 to the last week in February on account of shoal water, there being only 18 to 20 inches of water over many of the shoals. The Memphis and Pine Bluff packet was compelled to turn back at Carsons from November 16 to 20; at Silver Lake, November 23 to 28; at Heckatoo, November 29 to December 22, and at Garrettsons, January 1 to 8. In February ice in the river stopped navigation as far down as Cummins from the 4th to the 20th of the month.

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Fort Gibson, on Grand River, 2 miles above its mouth and 463 miles from the mouth of the Arkansas River, is the head of steamboat navigation.

Of the balance available July 1, 1905, $26,174.14 is to be expended in operating snag boats; $49,530 is available for application toward building a hydraulic dredge, and $30,000 is available for construction of revetment in Red Fork bend, provided the revetment be needed in the interests of navigation. The low-water flow of the Arkansas River is so very small, and the shoals, which are entirely of sand, are so numerous and changeable in position that it is highly probable that no relief worthy of the name can be given navigation by means of dredging. The district officer in his annual report for fiscal year 1903, page 1410, gives a very thorough review of the conditions that exist in that river during low water. He estimates that a suitable dredge fleet will cost $635,000, and is of the opinion that some experimental dredging should be done before any expenditures are made looking toward the procurement of a fleet. Such experimental dredging will be made during the coming low-water season if the Mississippi River Commission can spare one of its dredges for the work. The district officer reported that a revetment in Red Fork bend would not be of any benefit to navigation. He was authorized to withhold, for the present, project for the expenditure of the $30,000 available for that work.

Commercial statistics, year ending May 31.

Year.	Tons.	Value.	Year.	Tons.	Value.
1894	68,563	$2,846,395	1900	75,654	$2,078,940
1895	50,498	2,380,420	1901	71,998	2,628,797
1896	54,261	2,408,720	1902	40,557	1,630,297
1897	66,077	1,657,218	1903	86,068	2,389,020
1898	58,578	1,626,756	1904	92,041	2,078,893
1899	68,057	2,470,131	1905	86,458	1,686,980

Twenty-two per cent of the commerce reported was saw logs, in rafts, floated with the current. The commerce handled by steamboats was made up of plantation products and supplies, saw logs, building materials, and cooperage stuffs.

Reference to the principal examinations and surveys is given on page 401 of the Annual Report for 1904.

July 1, 1904, balance unexpended		$71,630.56
Amount appropriated by river and harbor act approved March 3, 1905		65,000.00
Amount allotted from appropriation for maintenance of river and harbor improvements, act of April 28, 1904		1,000.00
		137,630.56
June 30, 1905:		
Amount expended during fiscal year, for maintenance of improvement	$29,527.83	
Deposited to credit Treasurer United States	498.59	
		30,026.42
July 1, 1905, balance unexpended		107,604.14
July 1, 1905, outstanding liabilities		1,900.00
July 1, 1905, balance available		105,704.14

(See Appendix W 1.)

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2. White River, Arkansas.—In its original condition this river was much choked by logs, snags, and drift in its lower reaches, and in its upper reaches—i. e., above Jacksonport—by gravel shoals, bowlders, and some snags.

The original project (act of March 3, 1871) was to remove snags and similar obstructions, the work being combined with similar work on Black and Little Red rivers. Act of June 23, 1874, extended the improvement to Forsythe, Mo., the project being to remove snags and bowlders and to contract the water width at shoals. During the period 1873–1884 the snagging operations on the lower river were in connection with similar work on St. Francis River, while the improvement above Jacksonport was under appropriations confined to that portion of the stream. The act of July 5, 1884, was the first independent appropriation for the river as a whole. It readopted and consolidated into one the separate projects and provided for a survey with a view to the permanent improvement of the river from Forsythe, Mo., to the mouth. The project of 1888 (Annual Report of the Chief of Engineers for 1888, p. 1406) was to deepen the water on shoals by contracting the channel, and to remove rock, bowlders, and snags from the channel, the object being to obtain a channel 5 feet deep at low water from the mouth to Newport and 2 feet deep from Newport to Buffalo shoals, at an estimated cost of $105,815, with an additional amount of $8,000 a year for two or three years for snagging. For reasons given in the Annual Report of the Chief of Engineers for 1891, page 2049, the estimates were inadequate to accomplish the object. The act of July 13, 1892, appropriated $53,815 to complete the project, and an additional sum of $21,185 to be expended "in the discretion of the Secretary of War." These funds and those appropriated since have been expended on the lines of the project of 1888, with the addition of dredging on the shoals. The act of March 3, 1899, adopted a lock-and-dam project for the improvement of this river above Batesville, thus reducing the scope of the former project to improving the river from the mouth to Batesville by contracting the channel, by removing rocks, bowlders, and snags, and by dredging, the expenditures to be made in the discretion of the Secretary of War.

It is not practicable to state the expenditures on this river when the work was carried on in connection with other rivers. From the separate appropriations for the whole river, or for reaches of it, to the close of the fiscal year ending June 30, 1905, there had been expended $415,448.73. Of this amount, $4,000 was allotted to Cache River, $11,061.46 was spent on special works at Batesville, $166,000 was on projects prior to that of 1888, $108,815 was for original construction under the project of 1888, and $125,572.27 on maintenance of works and on snagging and dredging.

In a few instances the contraction works above Jacksonport gave a slight increase in channel depth, but, on the whole, there was not enough improvement in the channel to be of any material benefit to navigation; the dredging between Jacksonport and Batesville in fiscal year 1898 made a channel 3 feet deep during one low-water season, but the dredging has not been continued, no plant being available; the snagging operations make the natural depths of the stream available during the low-water season in which the snagging is done. The winter and the spring floods following bring other obstructions into the stream; hence snagging operations are needed every year.

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Forsythe, Mo. (505 miles above the mouth), is the head of steamboat navigation. The river from its mouth to Jacksonport, 264 miles, is generally spoken of as being navigable at any time for boats of not over 3-foot draft. This year, however, there were six shoals that had less than 3 feet over them during the lowest-water period. These were: Mauree reach (86), 26 inches; Deadman Point (99), 28 inches; Devall Bluff bridge (126), 28 inches; New Augusta bridge (201), 34 inches; Dudleys Dread (222), 28 inches, and Grand Glaize (242), 30 inches. Between Jacksonport and Batesville, 38 miles, the channel depths at minimum low water were approximately 16 inches.

Commercial statistics, year ending May 31.

Year.	Value.	Tons.	Year.	Value.	Tons.
1895	$2,494,377	73,759	1901	$1,700,355	148,574
1896	2,056,991	74,882	1902	1,242,433	184,086
1897	2,435,814	73,962	1903	882,225	140,013
1898	1,415,013	102,337	1904	1,021,778	193,498
1899	1,619,351	117,891	1905	676,989	131,938
1900	2,244,222	134,696			

Fifty-eight per cent of the tonnage reported this fiscal year was rafted saw logs and railway ties. Lumbering and kindred industries make up the bulk of the steamboat commerce, these industries alone making 90 per cent of the total commerce reported.

The expenditures this year were for operating snag boats between the mouth of the river and Jacksonport and in caring for the plant during period of no operations.

The available balance is to be expended in operating and maintaining snag boats.

On page 1668 of the Annual Report of the Chief of Engineers for 1896 there is given the location of all the principal works built for the improvement of this river. Report of survey from Forsythe, Mo., to the mouth, with plans for improvement, is given in the Annual Report of the Chief of Engineers for 1888, page 1406.

July 1, 1904, balance unexpended	$10,372.66
Amount appropriated by river and harbor act approved March 3, 1905	15,000.00
	25,372.66
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	11,906.39
July 1, 1905, balance unexpended	13,466.27
July 1, 1905, outstanding liabilities	850.00
July 1, 1905, balance available	12,616.27

(See Appendix W 2.)

3. Upper White River, Arkansas.—Earlier works on this portion of White River were made under appropriations for improving White River, Arkansas, and have been fully reported upon under that head.

The original condition of the river and previous projects for its improvement are also reported there.

The existing project, adopted March 3, 1899, is based on a report printed in the Annual Report of the Chief of Engineers for 1897, page 1992, and is to provide slack-water navigation from Batesville, Ark.,

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to Buffalo shoals, 89 miles, by 10 fixed dams with concrete locks. The locks are to be 175 feet between hollow quoins and 36 feet wide, with a depth of about 4 feet on the lower miter sills. The estimated cost is there given as $1,600,000 for the 10 locks and dams. The district officer reports that this estimate is too small. He is of the opinion that the cost of the remaining 7 locks and dams will be between $217,000 and $260,000 a lock and dam. Pending the action of the Board of Engineers appointed to pass upon the worthiness of this improvement, he makes no recommendation for future appropriations other than that $57,410 be provided in the next river and harbor act for the completion of Lock and Dam No. 3.

To the close of the fiscal year ending June 30, 1905, there had been expended on this work $585,947.08.

Lock and Dam No. 1 was placed under the indefinite appropriation for "Operating and care of canals and other works of navigation" on January 16, 1904; Lock and Dam No. 2 was placed under the same appropriation on February 16, 1905. Work at Lock and Dam No. 3 was begun in April, 1905.

Forsythe, Mo. (204 miles above Batesville), is the head of navigation for steamboats. The only steamboat navigation on this river this year was that of a single trip of the steamer *Myrtle Corey*, from Cotter, Ark., to the mouth of the river. She carried no freight. The only tonnage reported was that of rafted railway ties.

Commercial statistics, year ending May 31.

Year.	Value.	Tons.	Year.	Value.	Tons.
1899	$548,335	9,059	1903	$737,080	16,315
1900	1,260,716	39,253	1904	53,942	15,655
1901	639,855	23,522	1905	42,736	12,496
1902	758,040	27,472			

The amount available July 1, 1905, will be expended in completing Lock and Dam No. 2 and in building the lock and the abutment for the dam at Lock and Dam No. 3.

July 1, 1904, balance unexpended		$65,494.17
Amount appropriated by river and harbor act approved March 3, 1905		160,000.00
		225,494.17
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$71,649.53	
Less sales	208.28	
		[a] 71,441.25
July 1, 1905, balance unexpended		154,052.92
July 1, 1905, outstanding liabilities		8,168.43
July 1, 1905, balance available		145,884.49

(See Appendix W 3.)

4. Operating and care of Locks and Dams Nos. 1 and 2, upper White River, Arkansas.—These locks and dams were built from funds derived from appropriations for improving upper White River,

[a] Lock No. 1, $1,117.80; Lock No. 2, $59,428.10; Lock No. 3, $10,895.35.

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Arkansas. The available length of the locks is 147 feet, available width is 35 feet, and depth over the miter sills at normal pool levels is 5 feet. Lock and Dam No. 1 was placed under this appropriation on January 16, 1904; Lock and Dam No. 2 on February 16, 1905.

The total amount expended in operating and care of these works to June 30, 1905, is $5,011.86, of which $4,650 was expended this fiscal year.

Commercial statistics, year ending May 31, 1905.

		Lock and Dam No. 1.	Lock and Dam No. 2.
Lockages	number	244	[a]60
Steamboats	do	1	[a]1
House boats	do	19	[a]2
Small craft	do	44	
Railway ties, rafted	tons	8,771	[a]4,165

[a] Three and one-half months.

(See Appendix W 4.)

5. Cache River, Arkansas.—In its original condition this river was much obstructed by snags, drift, and overhanging timber. The low-water depth on the controlling shoals was 6 to 8 inches.

The original project, adopted by act of August 11, 1888, was to remove logs, snags, and overhanging timber from the mouth to Riverside (102 miles). The amount expended on this project was $9,000.

Acts of August 18, 1894, and June 3, 1896, each authorized the Secretary of War to expend $2,000 of the White River appropriations on this stream. These funds were expended in snagging operations from the mouth of the river to James Ferry, 79 miles, in accordance with a project adopted in 1888. Acts of March 3, 1899, and June 13, 1902, made independent appropriations for this stream. These were expended in snagging operations between the mouth of the river and James Ferry along the lines of the 1888 project, under which there has been expended $6,990 to June 30, 1904, the entire expenditure being for maintenance of channel. Those operations were of material benefit to commerce by lengthening the navigable period and by making available the full natural depths of the stream. The benefits have been partially lost, as no work has been done on this stream since the high waters of 1903 and 1904.

The river is not navigable at lowest stages, there being only 8 to 10 inches depth in the channels over the shoals during that time. Gray's bridge, 95 miles above the mouth, is the head of steamboat navigation. Rafts are run from one hundred or more miles farther up.

Commercial statistics, year ending May 31.

Year.	Value.	Tons.	Year.	Value.	Tons.
1895	$25,494	12,603	1901	$30,100	10,374
1896	62,483	20,748	1902	40,301	15,676
1897	108,460	34,990	1903	109,681	16,843
1898	36,635	10,193	1904	49,601	15,865
1899	52,936	7,667	1905	29,860	11,660
1900	29,961	11,215			

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Ninety-two per cent of the commerce reported this year was rafted. Railway ties and saw logs made up the bulk of the steamboat commerce.

Reports of the more recent preliminary examinations of this river are given in the Annual Report of the Chief of Engineers for 1887, page 1547, and in the Annual Report of the Chief of Engineers for 1895, page 2037.

July 1, 1904, balance unexpended	$10.00
Amount appropriated by river and harbor act approved March 3, 1905	2,000.00
July 1, 1905, balance unexpended	2,010.00
July 1, 1905, outstanding liabilities	10.00
July 1, 1905, balance available	2,000.00

(See Appendix W 5.)

6. Black and Current rivers, Arkansas and Missouri.—Heretofore the work on these rivers has been provided for under separate appropriation titles. The works were consolidated by river and harbor act of March 3, 1905.

(*a*) *Black River.*—In its original condition this river below the mouth of Current River had, at ordinary low water, a controlling depth of 2 to 2½ feet on the shoals, but this was not available on account of snags and similar obstructions. Above the mouth of Current River navigation was practically impossible at ordinary low stages and no rafting was possible above the Arkansas and Missouri State line.

The original project, adopted by act of June 14, 1880, contemplated removing logs, etc., cutting down shoals by means of wing dams, and closing some of the most troublesome sloughs. The estimated cost was $80,800. The only modification of the project has been that of changing the estimate to $8,000 a year for maintenance. The district officer recommends that this be increased to $15,000.

To June 30, 1905, there had been expended on this work $140,470.45.

Navigation has been made possible all the year to Poplarbluff, Mo. The minimum depths on the shoals above Current River this fiscal year were 18 to 20 inches; below Current River the depths were 3 feet. Poplarbluff, Mo., is the head of navigation.

The report of the examination upon which the present project for the improvement of Black River is based is given in the Annual Report of the Chief of Engineers for 1880, page 1326.

(*b*) *Current River.*—The original condition of this stream was such that no steamboat navigation above the mouth of Little Black River was attempted except when the river was at high stages. Below Little Black River navigation was suspended when the river was below medium stage. The natural depths were not available on account of snags and leaning trees.

Although the United States made some improvements to this stream in 1873, and again in 1882 and 1883, the regular improvement of it was not undertaken until act of Congress of August 18, 1894, adopted a project for its improvement from Vanburen, Mo., to the mouth, by snagging operations and by contracting the channel at the worst shoals by wing dams, at an estimated cost of $10,000. The appropriation of June 3, 1896, completed the amount originally estimated for the completion of the project, and all operations since then have been

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under estimates for maintenance. No wing dams have been built, all operations having been confined to snagging.

To June 30, 1905, there has been expended on this river $31,756.46, $7,000 of which was in the early work mentioned above, leaving $24,756.46 as the amount expended on the existing project. Of this latter amount, $14,756.46 was for maintenance.

Reference to the preliminary examination of this stream and to a subsequent examination of it is given on page 408 of Annual Report for 1904.

The minimum channel depths during the low-water season of this year were 3½ feet from mouth of river to White Horse shoal, 32 miles; 2 feet from White Horse shoal to Pitmans Landing, 9 miles, and 12 inches from Pitmans Landing to Tucker Bay, 31 miles.

Pitmans Landing, near the State line between Arkansas and Missouri, is generally spoken of as the head of steamboat navigation, but boats can not go so far up all the year. Small gasoline boats occasionally ply the stream as far up as Vanburen, and either rafting or driving of logs is carried on all the year over the river below that point.

Commercial statistics.

Year ending May 31—	Black River.		Current River.	
	Value.	Tons.	Value.	Tons.
1895	$1,085,415	132,433	$362,447	31,205
1896	891,437	111,278	227,291	29,867
1897	1,704,799	111,611	581,528	17,078
1898	788,640	115,612	306,216	52,417
1899	529,336	83,404	239,869	43,050
1900	966,961	129,698	578,834	65,043
1901	989,635	185,714	234,555	64,102
1902	919,767	166,213	165,766	37,185
1903	695,649	138,181	142,899	45,309
1904	1,092,648	191,285	139,119	55,573
1905	1,004,299	144,065	409,297	74,048

Of the commerce reported this fiscal year, 39 per cent of that on Black River and 53 per cent of that on Current River were rafted saw logs, railway ties, and piling. Timbering and kindred industries produced the bulk of the steamboat commerce.

The balance available will be expended in snagging operations.

July 1, 1904, balance unexpended		$13,488.47
Amount appropriated by river and harbor act approved March 3, 1905		18,000.00
		31,488.47
June 30, 1905:		
Amount expended during fiscal year, for maintenance of improvement	$12,915.38	
Less sales	85.00	
	12,830.38	
Deposited to credit of Treasurer of United States	319.50	
		13,149.88
July 1, 1905, balance unexpended		18,338.59
July 1, 1905, outstanding liabilities		298.00
July 1, 1905, balance available		18,040.59

(See Appendix W 6.)

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7. St. Francis and L'Anguille rivers, Arkansas.—(*a*) *St. Francis River.*—In its original condition this stream was not navigable above Lesters Landing at any stage; between Lesters Landing and Marked Tree navigation was possible at high stages only, and below Marked Tree it was difficult at medium and lower stages and impossible at extreme low water.

The original project, adopted by act of March 3, 1871, contemplated improvement from the mouth to Wittsburg by snagging operations. For the period 1873–1882 the appropriations were made for this work in connection with White River, Arkansas. By act of June 14, 1880, appropriation was made for improving the river from Wittsburg to Lesters Landing, the project for the expenditure of this appropriation being to cut a channel through "The Lake" and clear the river of obstructions by snagging operations. Appropriation made by act of July 5, 1884, was the first separate appropriation for the entire river. The act did not state the limits within which it was to be applied. Under it snagging operations were carried on to the town of St. Francis, Ark., and several of the sloughs or side channels were closed. When the improvement of St. Francis River, Missouri, was begun (act of August 11, 1888), Kennett, Mo., was taken for the upper limit of this work, making the existing project—

removal of logs, drifts, and snags from the channel, and overhanging timber from the banks from the mouth to Kennett, Mo., and closing the chutes and sloughs in the Sunk Lands, so as to make the river navigable at high stages to Kennett, Mo., at medium stages to Marked Tree, and at low stages to a point 30 miles below Madison, Ark., the estimated cost being $8,000 annually.

(*b*) *L'Anguille River.*—By acts of June 18, 1878, March 3, 1879, and June 14, 1880, a total of $17,000 was appropriated for snagging operations on L'Anguille River to Marianna. This was finally expended in fiscal year ending June 30, 1887. Act of June 13, 1902, revived this work and included it with St. Francis River.

There has been expended on these rivers to June 30, 1905, $96,989.91, which amount, however, does not include the expenditures on St. Francis River while it was combined with White River, as those expenditures can not be determined.

By the early operations the St. Francis River between Wittsburg and Lesters Landing was improved to such an extent that boats could reach the latter-named place on the same stage that they could the former. By subsequent operations the period of navigation below Wittsburg was lengthened about two months, and above Lesters Landing a fair high-water channel was made. During periods of low water neither stream is navigable, there not being sufficient depth of water over the shoals. Marianna is the head of navigation on L'Anguille River. The head of navigation on St. Francis River is near Wappapello, Mo., about 100 miles above Kennett, Mo., the upper limit of the portion of the river covered by this project. Lying between Kennett, Mo., and Foot of Lake, 80 miles below, are the Sunken Lands of the St. Francis, one vast swamp, through which the river flows in several channels, none of which are well defined and all of which are more or less obstructed and frequently blocked. Lesters Landing is 34 miles above Foot of Lake and is the practicable head of navigation on the St. Francis River in Arkansas. Boats can pass between it and Kennett, Mo., only during high stages, and then only with great difficulty.

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Reference to examination and survey of these rivers is given on page 410 of Annual Report for 1904.

Commercial statistics, year ending May 31.

Year.	Value.	Tons.	Year.	Value.	Tons.
1894	$98,375	19,763	1900	$194,237	45,085
1895	321,439	58,107	1901	272,609	57,102
1896	401,457	67,740	1902	269,190	85,831
1897	1,117,891	97,348	1903	294,495	88,035
1898	237,481	23,819	1904	423,469	119,172
1899	315,459	27,892	1905	497,305	96,854

Ninety-two per cent of the commerce reported this year was saw logs. Seventy-two per cent of the commerce reported was saw logs in rafts floated with the current.

The available balance will be expended in snagging operations.

July 1, 1904, balance unexpended		$4,937.22
Amount appropriated by river and harbor act approved March 3, 1905		6,000.00
		10,937.22
June 30, 1905:		
Amount expended during fiscal year, for maintenance of improvement	$4,637.13	
Less sales	10.00	
	4,627.13	
Deposited to credit of Treasurer of United States	62.81	
		4,689.94
July 1, 1905, balance unexpended		6,247.28
July 1, 1905, outstanding liabilities		460.00
July 1, 1905, balance available		5,787.28

(See Appendix W 7.)

8. St. Francis River, Missouri.—In its original condition this river was not navigable at low stages on account of shoals, snags, and similar obstructions. At higher stages it was difficult on account of snags and overhanging timber.

The original project, adopted by act of Congress approved August 11, 1888, contemplated improvement from Greenville, Mo., to Kennett, Mo., by snagging operations and the removal of shoals about 12 miles below Greenville, at an estimated cost of $7,300, which was not sufficient. After $20,500 had been expended on this work it was discontinued.

The existing project, adopted by act of Congress approved June 13, 1902, is to "clear the river of snags, drifts, and overhanging timber from the head of the Sunk Lands to Chalk Bluff, and to confine the river to one channel; to remove the snags, drifts, and overhanging timber that interfere with navigation at medium and high stages of water from Chalk Bluff to Poplin, Mo.," at an estimated cost of $11,200, and $2,000 per year to remove the annual accumulation of snags after the proposed improvement is once accomplished.

To June 30, 1905, $10,000 has been expended on the existing project.

Under authority granted by the Secretary of War June 7, 1904, the movable property used on this work was shipped to Batesville, Ark., and the snagging barge and scows were sold at public auction.

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Section 7 of the river and harbor act of March 3, 1905, repeals the provisions of previous acts providing for the prosecution of improvement on this stream, and no further work is contemplated.

Reference to examinations and surveys of this stream is given on page 411 of annual report for fiscal year ending June 30, 1904.

July 1, 1904, balance unexpended	$174.40
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	174.40

(See Appendix W 8.)

REMOVING SNAGS AND WRECKS FROM MISSISSIPPI RIVER; IMPROVEMENT OF MISSISSIPPI RIVER BETWEEN OHIO AND MISSOURI RIVERS.

This district was in the charge of Maj. Thos. L. Casey, Corps of Engineers. Division engineer, Col. O. H. Ernst, Corps of Engineers, until April 5, 1905, and Lieut. Col. W. H. Bixby, Corps of Engineers, since that date.

1. Removing snags and wrecks from the Mississippi River below the mouth of the Missouri River.—Before this work was begun the navigation of the river was seriously interfered with by numerous snags, logs, etc., which had lodged in the channel, and to which additions were made with each rise of the river. A large number of wrecked flatboats, barges, steamboats, and other river craft were found in the navigable channels and formed a continual menace to life and property.

For the removal of these obstructions appropriations were made as early as 1824. The project adopted consisted of building boats suitable for removing snags, logs, drift heaps, etc., and operating them whenever the stage of water was favorable and funds were available.

The amount expended upon this work prior to June 30, 1872, can not now be approximately ascertained, for the reason that during this time and to March 3, 1879, appropriations were made in lump sums, to be applied to several streams as their needs or the terms of the laws required. The approximate amount expended from July 1, 1872, to June 30, 1880, was $493,437.23, and the definitely known amount expended from July 1, 1880, to June 30, 1905, was $1,834,722.32, making the total of approximate and known expenditures to date $2,328,159.55. This expenditure greatly improved the river and lessened the dangers of navigation.

Two steel-hulled snag boats were employed in removing the obstructions to navigation between the mouth of the Missouri River and Natchez, and during the year 4,118 snags were pulled, 19 drift piles removed, 15,241 trees cut, 12 wrecks removed, and 13,471 miles patrolled.

An annual appropriation, not to exceed $100,000, for carrying on this work was made by the act of August 11, 1888. Under this appropriation the two snag boats will continue to patrol the river and remove obstructions where necessary.

For recapitulation of commercial statistics, reference should be made to the report upon improving the Mississippi River between the Ohio and Missouri rivers.

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Amount drawn under section 7, act of August 11, 1888	$81,809.61
June 30, 1905, amount expended during fiscal year	81,809.61
July 1, 1905, amount available for fiscal year 1905–6	100,000.00

(See Appendix X1.)

2. Mississippi River between Ohio and Missouri rivers.—In its original condition the navigable channel of this section of the Mississippi River had a natural depth in many places of only 3½ to 4 feet at low water. The channels were divided by islands which formed sloughs and secondary channels, or chutes, through which a great deal of the volume of the flow was diverted, to the detriment of navigation.

The first effort to improve this condition was begun in 1872 and was continued for a number of years as appropriations were made, the works consisting of dikes and dams of brush and stone erected with a view to confining the low-water volume to a single channel and of revetments to hold and preserve the banks where necessary or advisable to do so.

The project followed up to the present time has been that adopted in 1881, approved by letter of the Chief of Engineers dated March 31, 1881, contemplating the confinement of the flow of the river to a single channel having an approximate width below St. Louis of 2,500 feet at bank-full stage, the natural width in many cases being a *mile* or more at mean high water; this result to be sought by closing sloughs and secondary channels and by building out new banks where the natural width is excessive, using for this purpose permeable dikes or hurdles of piling that collect and hold the solid matter that is carried in suspension or rolled on the bottom of the river; the banks, both new and old, to be revetted or otherwise protected where necessary to secure permanency, and, pending the completion of *the* permanent improvement, the low-water channel to be improved each season by the use of dredges and other temporary expedients. The cost of the work remaining to be done was estimated in 1903 at $20,000,000, with annual expenses of $400,000 for maintenance. It was hoped that the cost might be reduced by increasing the amount of dredging.[a]

The river and harbor act of March 3, 1905, appears to contemplate, however, a permanent departure from the project of 1881, above outlined, in devoting more attention to dredging and less to works of permanent improvement, and authorized the construction of two new hydraulic dredges of the most approved type.

The object of the improvement is to obtain and maintain a minimum depth, at standard low water, of 6 feet from the mouth of the Missouri to St. Louis, and of 8 feet from St. Louis to the mouth of the Ohio.

The total amount expended to June 30, 1905, was $11,345,893.15, exclusive of $180,000 allotted by acts to projects for improvement between the Illinois and Missouri rivers, including Alton Harbor.

The amount expended during the fiscal year ending June 30, 1905, includes $62,600.68 expended for temporary expedients. The total amount thus far expended for temporary channel improvements is $693,437.02, much of which has been for plant that is now on hand and available for future work. The approximate value of this plant is $168,695.49.

[a] See Annual Report of the Chief of Engineers for 1904, p. 2144 et seq.

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The result of the expenditure of this amount has been the partial improvement of the entire extent of the river from St. Louis to Cairo.

Theoretically this improvement should have some influence on freight rates, but an accurate estimation of such effect has been impracticable during recent years.

During the past year there was maintained a channel depth of 8 feet, except for very short periods in the low-water season, when at several bars 7 feet was noted, until a dredge could be moved to the locality. These obstructions were promptly removed.

The river at St. Louis reached a high-water stage of 24.4 feet above standard low water on July 12, 1904, and a low-water stage of 4.3 feet below standard low water on January 1, 1905.

With the present appliances and such others as may be developed for the temporary improvement of low-water channels, it is expected that a navigable depth of about 8 feet can be maintained between St. Louis and Cairo during all stages while the river is open to navigation.

The local officer states that $400,000 should be provided annually for the purpose of maintaining an 8-foot channel by dredging, with such auxiliary works as temporary diking, bank protection, and occasional hurdle building.

The sundry civil act approved March 3, 1905, appropriated $650,000 for continuing the improvement of the Mississippi River from the mouth of the Ohio to and including the mouth of the Missouri River.

Recapitulation of commercial statistics.

	1901.	1902.	1903.	1904.
	Tons.	*Tons.*	*Tons.*	*Tons.*
Receipts and shipments at St. Louis	672,076	641,182	552,617	377,985
Transferred by ferries at St. Louis	5,860,592	5,731,635	6,328,154	6,080,109
Shipped from landings between St. Louis and Cairo	30,978	17,179	43,867	43,672
Total	6,563,646	6,389,996	6,924,638	6,501,716

July 1, 1904, balance unexpended		$949,313.93
July 1, 1905, miscellaneous receipts		2,557.77
Amount appropriated by sundry civil act approved March 3, 1905		650,000.00
		1,601,871.70
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$503,203.20	
For maintenance of improvement	213,299.29	
		716,502.49
July 1, 1905, balance unexpended		885,369.21
July 1, 1905, outstanding liabilities		28,302.17
July 1, 1905, balance available		[a]857,067.04

[a] Distributed under subheadings as follows:

For protection of bank of Missouri side and to deepen and straighten channel at Wittenberg, Mo., act of March 3, 1899	$10,000.00
For from mouth of Ohio River to mouth of Missouri River:	
Act of April 28, 1904	212,356.48
Act of March 3, 1905	634,710.56
	857,067.04

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July 1, 1905, amount covered by uncompleted contracts..... $48,880.00
Amount (estimated) required for completion of existing project.. 18,251,654.55

(See Appendix X 2.)

OPERATING SNAG BOATS AND DREDGE BOATS ON UPPER MISSISSIPPI RIVER; IMPROVEMENT OF MISSISSIPPI RIVER BETWEEN MOUTH OF MISSOURI RIVER AND ST. PAUL, MINNESOTA, OF HARBOR AT MOLINE, ILLINOIS, AND OF LA CROSSE HARBOR, WISCONSIN; OPERATING AND CARE OF GALENA RIVER IMPROVEMENT, ILLINOIS, AND OF ILLINOIS AND MISSISSIPPI CANAL AROUND THE LOWER RAPIDS OF ROCK RIVER, AT MILAN, ILLINOIS.

This district was in the charge of Maj. Jas. L. Lusk, Corps of Engineers, until July 18, 1904; in the temporary charge of Maj. C. S. Riché, Corps of Engineers, from July 18 to October 18, 1904; in the charge of Major Lusk from October 18, 1904, until April 1, 1905, and of Major Riché since April 1, 1905. Division engineer, Col. O. H. Ernst, Corps of Engineers, until April 5, 1905, and Lieut. Col. W. H. Bixby, Corps of Engineers, since that date.

1. Operating snag boats and dredge boats on upper Mississippi River.—By the river and harbor act of August 11, 1888, provision was made for securing the uninterrupted work of snag boats and dredge boats on the upper Mississippi River under a permanent appropriation, the sum so expended not to exceed $25,000 annually.

During the past fiscal year the snag boat *Colonel A. Mackenzie* was employed from July 1 to November 4, 1904, and from May 12 to June 30, 1905, in removing snags and other obstructions and otherwise assisting interests of navigation between Minneapolis and the mouth of Missouri River.

Dredge *Vulcan* was employed for a few days in September, 1904, in removing sand deposits at Fulton steamboat landing, and for about six weeks in September and October, 1904, in dredging a channel through the bar above Keithsburg bridge.

Dredge *Phœnix* in September and October, 1904, was engaged in removing obstructions at various points between Keokuk and Turners Landing, and in May and June, 1905, in removing deposits from the Keokuk steamboat landing.

The total amount expended for snag-boat service to June 30, 1905, was $949,584.

The total quantity of freight transported on the upper Mississippi River during the calendar year 1904 was about 4,534,539 tons, and the ton-miles 943,951,451; in 1903, 4,545,129 tons, and 979,951,901 ton-miles.

The amount expended during the fiscal year ending June 30, 1905, was $25,000.

(See Appendix Y 1.)

2. Mississippi River between Missouri River and St. Paul, Minn.—Under this head is carried on the improvement of through navigation and also such special harbor or levee work as is provided for by Congress. Systematic work was begun in 1878, and such good results have been secured as to demonstrate that with a continuance of

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operations under liberal appropriations the low-water channel of the Mississippi River between St. Paul and the Missouri River can be made sufficiently deep, available, and permanent to satisfy the demands of commerce.

The original condition of the channel between the Missouri River and St. Paul was such that in low stages the larger boats were unable to proceed farther upstream than La Crosse or Winona, and in many seasons at points much lower down their progress was checked or seriously hindered.

The original project for the improvement, adopted in 1879 (which has not been materially changed), proposed the contraction of the channel or waterway by means of wing and closing dams to such an extent as, by means of the scour thereby caused, to afford a channel of sufficient width and of a depth of 4½ feet at low water, to be eventually increased to 6 feet by further contraction.

There was expended on the improvement to June 30, 1905, the sum of $11,286,757.11, of which about $600,000 was applied to maintenance. At that date, and for many years previous, the condition of the channel was such as to permit the passage of the largest river boats at very low stages to St. Paul. It should be noted that of the amount above stated $1,021,000 has been expended for harbors and levees not connected with through channel improvement.

During the past year work has been carried on by hired labor and use of Government plant between Wabasha and Bellevue; at Rock Island Rapids; between Keokuk and the Missouri River, and in the vicinity of St. Paul, and under formal contract between Sabula and Hamburg. At all localities where work was performed good results were obtained.

There was expended for channel improvement during the past year, including maintenance, $406,026, and an increased depth was obtained at several localities. Needed repairs were made to dams and shore protections broken, settled, or otherwise damaged.

The maximum draft that could be carried June 30, 1905, from the Missouri River to St. Paul, 658 miles (which latter point is the upper end of this district), at mean low water (stage 1.5 above extreme low water) was, as nearly as could be ascertained, 4.5 feet. For the past fiscal year the stage during the navigable season was never at any point less than 1.3 feet, and there was at least 5 feet depth in the channel at all times.

The navigation interests are very large and important, especially those pertaining to logs and lumber. The amount of freight carried during the season of 1904 was about 4,535,000 tons, and the ton-miles 943,951,000, with an approximate valuation of $34,666,000, which figures are about the same as for 1903.

For repairing, enlarging, and strengthening the Warsaw to Quincy levee and for protecting the bank of the river adjacent there has been expended to June 30, 1905, $95,217.29. This levee is 39 miles in length, running along the east bank of the Mississippi River, and was built by private persons. The available balance July 1, 1905, was $10,282.71, from allotments made in the sundry civil act of March 3,

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1899 ($5,000), and the river and harbor act of June 13, 1902 ($10,000).

For constructing, revetting, and repairing the Flint Creek to Iowa River levee and for protecting adjacent river banks there has been expended to June 30, 1905, $299,556.48. This levee runs from a point about 7 miles up the Iowa River down the west bank of that river and of the Mississippi River to Flint Creek, near Burlington, Iowa. The levee is 35¼ miles in length, and, excepting the upper 3 miles on the Iowa River, was built by the United States. The available balance July 1, 1905, was $443.52, from an allotment of $50,000 made in the sundry civil act of March 3, 1899.

For dredging Quincy Bay there has been expended to June 30, 1905, $129,481.36, and for Quincy Bay and bar, $20,760.63 additional. There was available July 1, 1905, for work in the bay and on the bar, $6,058.39, from allotments in river and harbor act of June 13, 1902 ($20,000).

For the construction of a harbor of refuge below Davenport, Iowa, there has been expended to June 30, 1905, $11,699.51 for raising the closing dam at the head of Rockingham Slough, dredging, and driving piles. The available balance July 1, 1905, was $3,300.49, from allotment in river and harbor act of June 13, 1902 ($5,000).

For the channel at Clinton, Iowa, there has been expended to June 30, 1905, $22,071.15. No work was done during the past year. The available balance July 1, 1905, was $2,928.85, from an allotment of $25,000 in the sundry civil act of March 3, 1899.

For the channel and harbor at Hannibal, Mo., there has been expended to June 30, 1905, $14,661.69 in construction of dams and in dredging. The available balance July 1, 1905, was $338.31, from an allotment of $15,000 made in the river and harbor act of June 13, 1902.

For the harbor at Muscatine, Iowa, there has been expended to June 30, 1905, $35,000. The river and harbor act of June 13, 1902, allotted $10,000 for this harbor, but the entire sum is still available.

For the harbor of refuge at Pepin, Wis., on Lake Pepin, there has been expended to June 30, 1905, $17,080.60. The available balance on July 1, 1905, was $8,419.40, which will be expended in lengthening the pier.

July 1, 1904, balance unexpended		$557,974.28
Amount appropriated by sundry civil act approved March 3, 1905		[a]400,000.00
		957,974.28
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$376,246.46	
For maintenance of improvement	60,000.00	
		436,246.46
July 1, 1905, balance unexpended		521,727.82
July 1, 1905, outstanding liabilities		28,931.61
July 1, 1905, balance available		492,796.21
July 1, 1905, amount covered by uncompleted contracts		121,230.62

[a] The river and harbor act of March 3, 1905, authorized contracts in the sum of $300,000, which does not become available until appropriated.

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Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	$300,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix Y 2.)

3. Operating and care of Des Moines Rapids Canal and dry dock.—During the past fiscal year the Des Moines Rapids Canal was open for navigation 235 days, during which time there passed through it 928 steamboats and 285 barges, carrying 33,906 passengers, 14,451 tons of merchandise, and 3,700 bushels of grain. There also passed through the canal 17,190,000 feet B. M. of lumber, 4,475,000 feet of logs, 4,655,000 shingles, and 8,262,000 laths. This is about double the statement of the previous year, but the business of both years, especially in logs and lumber, was made smaller by prevailing high stages of water, which permitted most of the rafts and many boats to pass over the rapids instead of through the canal. The draft afforded by the canal is 5 feet at extreme low water, which may be increased to 6 feet at high stages. There are 3 locks, having an available length of 325 feet and width of 78.5 feet.

The dry dock was in constant use during the whole year.

The cost of operating and care of the canal is provided for by an indefinite appropriation made by act of July 5, 1884.

The amount expended during the past year was $43,668.83.

(See Appendix Y 3.)

4. Mississippi River at Moline, Ill.—The river and harbor act of March 3, 1905, adopted a definite project for improving Mississippi River at Moline, Ill., by excavating a channel 250 feet wide and 4 feet deep at low water from the city of Moline to the head of the so-called arsenal dike, above the city, and a similar channel connecting with the main river by means of a lock and dam at the foot of Benhams Island, opposite the city, at an estimated cost of $386,000, and $10,000 annually for operation, care, and maintenance. Of the estimate, $100,000 has been appropriated and the remainder authorized.

No channel at present exists on the line of the proposed lock and its immediate approaches.

The amount expended to June 30, 1905, is $792.36. Some work was done in designing and preparing plans for the lock.

The approved project is printed in the Annual Report of the Chief of Engineers for 1904, page 2206.

Amount appropriated by river and harbor act approved March 3, 1905	$100,000.00
June 30, 1905, amount expended during fiscal year, for works of improvement	792.36
July 1, 1905, balance unexpended	99,207.64
Amount (estimated) required for completion of existing project	286,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	286,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix Y 4.)

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5. Operating and care of Illinois and Mississippi Canal around the lower rapids of Rock River, at Milan, Ill.—This portion of the canal is 4½ miles in length, surmounting a fall of 18 feet, and was formally opened to navigation April 17, 1895. During the past fiscal year the canal was open for navigation 247 days, during which time there passed through it 1,261 boats and barges, carrying 10,555 tons of freight and 2,310 passengers, the traffic being much larger than that of the previous year, due to the carrying of rock used by the United States in revetting the canal banks.

The draft afforded by the canal is 7 feet. The locks, 3 in number, have a length of 170 feet between miter sills and a width of 35 feet. The cost of operating and care of the canal is provided for by an indefinite appropriation made by act of July 5, 1884.

The amount expended during the past year was $13,601.96.

(See Appendix Y 5.)

6. Operating and care of Galena River improvement, Illinois.—This improvement, consisting of a lock and dam in the Galena River, was purchased by the United States in March, 1894, under provisions of the act of September 19, 1890, at a cost of $100,000.

During the past fiscal year the lock was open for navigation 234 days, in which time there passed through it 2,162 boats and barges, carrying 10,628 passengers and 2,940 tons of merchandise. The traffic was very small and about equal to that of the previous year.

The draft that can be carried at extreme low water is 2 feet, as limited by the depth on the lower miter sill of the lock, which has an available length of 307 feet and width of 52 feet.

The cost of operating and care of the improvement is provided for by an indefinite appropriation made by act of July 5, 1884.

The amount expended during the past year was $3,833.28.

(See Appendix Y 6.)

7. La Crosse Harbor, Wisconsin.—The approved project contemplates the construction of a lateral bulkhead, a cross dam, and a certain quantity of filling between the bulkhead and the shore.

The full amount of the estimate, $17,000, has been appropriated, and no further funds are asked for.

The amount expended to June 30, 1905, is $16,634.61.

Some shore protection on Barrows Island was constructed during the year.

July 1, 1904, balance unexpended	$1,964.35
June 30, 1905, amount expended during fiscal year	1,598.96
July 1, 1905, balance unexpended	365.39

(See Appendix Y 7.)

RESERVOIRS AT HEADWATERS OF MISSISSIPPI RIVER; IMPROVEMENT OF MISSISSIPPI RIVER FROM ST. PAUL TO MINNEAPOLIS, MINN.; OF RIVERS IN WISCONSIN AND MINNESOTA TRIBUTARY TO MISSISSIPPI RIVER; OF WARROAD HARBOR AND RIVER, MINNESOTA, AND OF RED RIVER OF THE NORTH, MINNESOTA AND NORTH DAKOTA.

This district was in the charge of Maj. George McC. Derby, Corps of Engineers. Division engineer, Col. O. H. Ernst, Corps of Engineers, until April 5, 1905, and Lieut. Col. W. H. Bixby, Corps of Engineers, since that date.

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1. Mississippi River between St. Paul and Minneapolis, Minn.—This stretch of river may be divided into three sections—lower, middle, and upper. The lower section, extending from the Chicago, St. Paul, Minneapolis and Omaha Railroad bridge in St. Paul to the old mouth of the Minnesota River, is navigable, in its natural condition and during low water, for boats drawing 3 feet of water. Its further improvement is not now required. The middle section, old mouth of the Minnesota River to Minnehaha Creek, has a swift current and a narrow channel of about 2½ feet depth. It is possible for the smaller boats to navigate it, but upstream freighting upon it is impracticable. No provision has been made for the improvement of this section. The upper section, Minnehaha Creek to Washington Avenue Bride, in Minneapolis, is a succession of shallow rapids separated by deeper pools. The ruling low-water depth is about 2 feet, but the swift current precludes in low stages the upstream passage of boats drawing more than 12 to 15 inches. The risks run and the expenditure of power required to navigate this section have effectually prevented its use even by small-draft boats.

The project for the improvement of the upper section, submitted March 1, 1894, called for the construction of two dams, with locks of the same dimensions as those of the Des Moines Rapids Canal and with 5 feet on the lower miter sills at low water. The project was approved by Congress and construction work inaugurated by the river and harbor act of August 18, 1894, which provided for commencing the construction of Lock and Dam No. 2, located near Meekers Island. The river and harbor act approved March 3, 1899, authorized the completion of Lock and Dam No. 2, together with Lock and Dam No. 1, under continuing contracts or otherwise, at a total cost for both locks and dams of $1,166,457. An increase in the limit of cost to $1,466,000 was authorized by the river and harbor act approved March 3, 1905.

The amount expended to June 30, 1905, was $813,303.59.

During the past year the upper lock and dam, No. 2, were completed. In September a deep scour was discovered below the sluices at the west end of the dam, which necessitated heavy riprapping to protect the structure. On April 4 the lock was opened to the passage of water, as on former occasions, for the purpose of clearing the channel of obstructions at the lower entrance to the lock. During the operation the lock floor was injured, and must be repaired before boats can be locked through. The repairs would have been made at once but for the prevailing high water, which has continued to date. The stage of water throughout the open season of the past fiscal year has been high and has very materially retarded the progress of the work, particularly at Lock No. 1. At the latter place the lock cofferdam was completed, necessary buildings erected, cableway towers commenced, and pumping plant and steam derrick installed, preparatory to commencing excavation early in season of 1905, but the high stage of water has limited excavation work to ten days only.

But little effect upon the navigable channel can result until both locks and dams are completed. The usual variation of water surface at Lock No. 1 is 7 feet and the maximum 16 feet.

The head of navigation for large boats is now the old mouth of the Minnesota River, 2.6 miles above the Chicago, St. Paul, Minneapolis and Omaha Railway bridge at St. Paul. Freight boats and raft boats

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can and do navigate this portion. The reach from the old mouth of the Minnesota River to Minnehaha Creek, a distance of 3.4 miles, is available for light-draft excursion boats and is regularly used by them.

The full amount required to build the two locks and dams has now been made available. During the ensuing year it is proposed to put Lock No. 2 in operation and continue construction of Lock No. 1. At the present time the principal commerce is the passage of logs. During the calendar year 1904, 124,000,000 feet B. M. of logs, approximately 434,000 tons, with an estimated value of $1,250,000, was floated loose on the upper and middle sections and towed in rafts by steamboats over the lower section. The excursion business on the lower and middle sections amounts to about $15,000 per annum.

The construction of the two locks and dams will develop a passenger traffic between St. Paul and Minneapolis, and it is expected to reduce the freight rate on flour and grain shipped from Minneapolis.

July 1, 1904, balance unexpended	$457,039.78
June 30, 1905, amount expended during fiscal year, for works of improvement	103,886.37
July 1, 1905, balance unexpended	353,153.41
July 1, 1905, outstanding liabilities	20,752.63
July 1, 1905, balance available	332,400.78
July 1, 1905, amount covered by uncompleted contracts	2,550.85
Amount (estimated) required for completion of existing project	299,543.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	299,543.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix Z 1.)

2. Reservoirs at headwaters of Mississippi River, and Mississippi River between Brainerd and Grand Rapids, Minn.—The project adopted January, 1880, called for the construction of 41 reservoirs in Minnesota and Wisconsin.

The object of these reservoirs is to collect surplus water, principally from precipitation of winter, spring, and early summer, to be systematically released during the low-water season so as to benefit navigation on the Mississippi River below.

Dams have been constructed as follows: At Lake Winnibigoshish, Leech Lake, Pokegama Falls, Pine River, and Sandy Lake.

The total amount expended at the close of the fiscal year ending June 30, 1905, was $1,307,802.97. These expenditures cover cost of construction of five dams and their operating machinery; the reconstruction of the dams at Lake Winnibigoshish, Leech Lake, and Pokegama Falls; work on reconstruction of Pine River dam, now well under way; superintendence and contingencies; certain awards for damages; purchase of lands and flowage easements; repairs and partial renewals; operating the dams up to February 1, 1895; and the removal of overhanging trees, snags, and other obstructions to navigation on the Mississippi River between Grand Rapids and Brainerd, Minn.

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The expenditure has resulted in benefit during the low-water season to the navigable portions of the Mississippi River from Cass Lake, Minn., to Lake Pepin and below, and incidentally in the mitigation of the floods in the river above St. Paul.

Reasons are given in the Annual Report of the Chief of Engineers for 1887, page 1681 et seq., for limiting the system at that time to the reservoirs then actually constructed. The project for the construction of a sixth reservoir at Gull Lake, Minnesota, is still in abeyance, the United States holding a flowage right for this reservoir over about 15,000 acres.

The project at present is to replace the present timber structures, which are annually becoming more and more decayed, by permanent dams of concrete or masonry; to define by proper surveys the areas which are occupied for flowage or other purposes in the construction and operation of the reservoirs, and to acquire by purchase necessary rights not yet obtained over such areas. The project also includes the improvement of the Mississippi River between Brainerd and Grand Rapids, Minn., by the removal of snags and other obstructions.

For original plans and surveys, see Annual Reports of the Chief of Engineers for 1870, page 285; 1875, page 441; 1879, page 1206; 1881, pages 1761 and 2748; 1882, page 1830; 1885, page 1749. Report of Board of 1880, Annual Report of the Chief of Engineers for 1881, page 1763. Modifications, Annual Report of the Chief of Engineers for 1883, page 1472. Effects on low-water stages, Annual Reports of the Chief of Engineers for 1886, page 1503; 1887, page 1669. Board of 1887 disapproved extension to St. Croix, Chippewa, and Wisconsin rivers, Annual Report of the Chief of Engineers for 1887, page 1680. Description of dams, 1881, page 1763; 1883, page 1456; 1887, page 1667; 1901, page 2313. History, 1892, page 1824; 1901, page 2309. For regulations prescribed by the Secretary of War for operating, see page 1830, report for 1896. Crevasse, Pine River reservoir, page 1844, report for 1896, and page 1813, report for 1897. Second cut in natural embankment, Pine River reservoir, page 2184, report for 1899. Description of Lake Winnibigoshish dam as reconstructed, page 2313, report for 1901.

Before work was commenced on the Mississippi River between Brainerd and Grand Rapids, Minn., the channel was seriously obstructed by snags and sunken logs, and the banks were covered with overhanging trees and bushes, making steamboat navigation both difficult and dangerous. The work done during the past two years has resulted in a greatly improved channel and a steamboat now makes regular trips between Aitkin and Grand Rapids.

The maximum draft that can be carried at low water depends upon the amount of water that is being released from the reservoirs. This amount varies with the requirements of navigation, but a depth of 4 feet could readily be maintained throughout the low-water season if it were necessary. The usual variation in the level of the water surface is about 10 feet. Cass Lake, Minn., is the head of navigation on the river, though it is interrupted by dams without locks at Minneapolis and several points above. There are no such obstructions between Brainerd and Grand Rapids, a distance of 190 miles.

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There is at present only one steamboat operating on the Mississippi River between Brainerd and Grand Rapids. During the year it carried about 1,300 passengers and about 2,000 tons of general merchandise, valued at $101,000. About 491,000,000 feet B. M. of logs—about 1,715,000 tons—was floated down the river, their value being about $4,500,000.

There are no railroads paralleling the river on this stretch of 190 miles; settlers are mainly dependent upon the river as a means of transportation or are compelled to haul long distances by team.

The navigation interests most particularly benefited by the reservoir system, in addition to the above, are the steamboats operating on the Mississippi River from St. Paul down. Without the reservoirs the gauge at St. Paul is liable to fall to zero, as it did in 1896, but under the existing system it can readily be kept from falling below 3 feet, a very substantial benefit to navigation.

July 1, 1904, balance unexpended	$80,078.55
Amount appropriated by river and harbor act approved March 3, 1905	160,000.00
Miscellaneous receipts	34.00
	240,112.55
June 30, 1905, amount expended during fiscal year, for works of improvement	22,381.52
July 1, 1905, balance unexpended	217,731.03
July 1, 1905, outstanding liabilities	4,262.70
July 1, 1905, balance available	213,468.33
July 1, 1905, amount covered by uncompleted contracts (estimated)	1,000.00

(See Appendix Z 2.)

3. Operating and care of reservoirs at headwaters of Mississippi River.—The river and harbor act of August 18, 1894, made applicable to the reservoirs at headwaters of Mississippi River, "so far as concerns their care, preservation, and maintenance," the provisions of the general appropriation for "Operating and care of canals and other works of navigation, indefinite," contained in section 4 of the river and harbor act of July 5, 1884. The first allotment was made January 25, 1895, and the expenses from February 1, 1895, have been paid from the indefinite appropriation.

Amount expended to June 30, 1905	$194,018.51
Amount expended during the past year	12,855.57

Lake Winnibigoshish, Leech Lake, Pokegama Falls, and Sandy Lake reservoirs have been operated during the entire year. Pine River reservoir was also operated until April, 1905, when it was put out of use pending the rebuilding of the dam. During the year necessary repairs of a minor nature were made to the various dam tenders' quarters and to the telephone lines between Lake Winnibigoshish and Leech Lake dams and Bena, Minn., and between Sandy Lake dam and McGregor, Minn.

The reservoir system was built by the Government primarily for the benefit of navigation in the Mississippi River and incidentally to mitigate its floods. The system is operated by impounding the waters in excess of the natural low-water flow at times when this excess is not needed by navigation, and releasing during the low-water season of navigation such a volume of water as will maintain the gauge at

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St. Paul at a constant height as much above low water as the available water in storage will permit. Without the addition of stored waters from the reservoir system the river at St. Paul is liable to fall to a stage of 0.2 foot, as happened in July and August, 1894, or to zero, as happened in April, 1896, whereas with judicious and economical use of the reservoir waters it is quite practicable to keep the gauge at St. Paul from ever falling below 3 feet. This is a very substantial benefit to navigation. On the 424 miles of river above St. Paul, where the stream is smaller, a still greater effect can be obtained.

The effect of the reservoirs in mitigating the floods of the upper Mississippi is equally pronounced. A flood stage existed this season from Sandy River to Aitkin, Minn., and below, from May 20 to July 1, during which period there was impounded and held back in the reservoirs over 16,000,000,000 cubic feet of water, the flood waters of a drainage basin of 3,265 square miles. This volume of water stored and held back from the floods below is sufficient to maintain a steady stream of 4,630 cubic feet per second throughout the period named, while the discharge of the Mississippi at the mouth of Sandy River at a bank-full stage is only about 4,000 cubic feet per second. Had it not been for the holding back of this water in the reservoirs, the flood height between Sandy River and Aitkin would have been several feet higher than it was.

Lake Winnibigoshish reservoir was full at the end of the year, while Leech Lake reservoir was little more than half full. The Leech Lake reservoir when full being about 4 feet below the level of Lake Winnibigoshish reservoir, a channel between the two would have made it possible to draw off the surplus water from Lake Winnibigoshish, storing it in Leech Lake, and relieving further the flood situation both at Cass Lake and in the Mississippi River below. Such a channel could be constructed at small expense.

There is, however, much local opposition to the reservoir system in northern Minnesota, due primarily to the fact that much land is necessarily overflowed around the edges of the reservoirs, the country being rather flat; and while the flowage rights on these lands were in nearly all cases secured by the United States many years ago, some of the present owners, generally large dealers in real estate, would like the reservoirs abandoned in order that these lands may revert to them free from the incumbrance caused by the Government's flowage right. While most of this land is swamp or exceedingly poor sandy soil, its speculative value is considerable.

For capacities of reservoirs, maps of region, and comparison of rainfall and run-off, see Annual Report of the Chief of Engineers for 1896, page 1841. For break in Pine River reservoir, see Annual Reports of the Chief of Engineers for 1896, page 1844, and for 1897, page 2144. For diagram showing how much water had been stored each year in each reservoir, see Annual Report of the Chief of Engineers for 1900, Part 4, page 2798.

(See Appendix Z 3.)

4. St. Croix River, Wisconsin and Minnesota.—Before the improvement was begun, the low-water depth in the channel above Lake St.

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Croix was but 2 feet on many of the bars. In Lake St. Croix the channel over the Hudson and Catfish bars was narrow and tortuous.

The project adopted in 1875, and amended as to cost in 1882 and 1889, contemplates removal of snags, bowlders, bars, etc., and the contraction of the low-water channel from Taylors Falls to the head of Lake St. Croix, and widening and straightening the channel where it is narrow and tortuous in Lake St. Croix by dredging and contraction works. The improvement of the harbor and water front of Stillwater, Minn., was added by the river and harbor act of June 3, 1896.

The object of the improvement is to furnish an open channel 3 feet deep from Taylors Falls to the confluence with the Mississippi River, 52.3 miles, and to better the harbor facilities at Stillwater. The last estimate placed the cost at $136,700.

In a report upon a preliminary examination and survey of the river from Taylors Falls to Stillwater, submitted in 1899, and printed in the Annual Report of the Chief of Engineers for 1900, page 2836, a project was recommended for the annual expenditure of $1,000 "to keep the river in as good order as is needed for the small steamboat traffic which now exists or is likely to exist in the future." This amount has been found insufficient, and the district officer recommends that the project be amended so as to provide for an annual expenditure of $3,600, which he considers necessary to maintain a sufficient channel and keep the plant in proper condition.

The amount expended to June 30, 1905, was $139,971.46.

Taylors Falls, about 52 miles from its mouth, is the head of navigation on this stream, and the entire reach is navigable. The usual variation of level of water surface is about 6 feet. The maximum draft that could be carried June 30, 1905, at low water was 3 feet at and below Stillwater, and 2½ feet above Stillwater. The tonnage passing over the river is approximately 600,000 tons per annum in tows of lumber and log rafts. A few steamboats made several irregular trips to Taylors Falls during the season, but regular trips could not be made owing to the large number of loose logs running in the river.

During the season of 1904 the running of logs and the flow of water were so controlled by the lumbermen that the operation of steamboats between Taylors Falls and Stillwater, Minn., was not practicable. The handling of over 500,000 tons of loose logs on this small stream utilizes its channel to its full capacity. There are 4 steamboats engaged in passenger excursion business at Stillwater and 30 engaged in handling loose logs and rafting them to points below.

There being practically no funds available, no work was done during the year until after the passage of the river and harbor act of March 3, 1905, when the dredge fleet was put in repair. Owing to the high stage of water in the St. Croix and Minnesota rivers, no dredging had been begun at the close of the fiscal year.

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July 1, 1904, balance unexpended	$1,056.48
Amount appropriated by river and harbor act approved March 3, 1905	4,000.00
	5,056.48
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	1,662.94
July 1, 1905, balance unexpended	3,393.54
July 1, 1905, outstanding liabilities	51.00
July 1, 1905, balance available	3,342.54

(See Appendix Z 4.)

5. Minnesota River, Minnesota.—For project and history, see pages 1725–1727, Annual Report for 1894, and page 2200, Annual Report for 1899. Since 1893 work has been confined to the improvement and maintenance of channel at mouth of river.

The existing project provides for dredging at the outlet of the river. It is estimated that the sum of $1,400 will be required annually for the maintenance of the dredged channel. Page 1542, Annual Report for 1903, gives reasons why this dredging should be done annually in connection with that on the St. Croix River.

The amount expended upon all projects to June 30, 1905, was $132,618.12, of which sum $983.64 was expended in 1899–1900 and 1902 in dredging as above.

The maximum draft that could be carried June 30, 1905, at low water was about 18 inches, the bar at the outlet of the river not having been dredged since 1902. From Little Rapids, Minn., to the mouth, a distance of about 37 miles, is at present the limit of navigation on this stream. The usual variation in level of water surface is about 7½ feet.

Until a constant and sufficient low-water depth is assured, which can only be by such regularity in the appropriations as will permit annual dredging at the outlet, this stream can have no effect on freight rates.

On the subsidence of the spring high water in 1903 a break was discovered at the west end of the dam at old mouth of river. The break extended about 20 feet from shore and to a depth of about 6 feet below the top of the dam. There being no funds available no repairs were made. Regular examinations have been continued, and up to this time the damage does not seem to have greatly increased. The dam will be repaired as soon as practicable, the necessary funds being now available.

No commerce exists on this stream except that of small pleasure launches and occasional excursion steamers, the river not having been maintained in such condition as to make other commerce possible.

Owing to the limited amount of funds available, no work was done during the year until after the passage of the river and harbor act of March 3, 1905, when the dredging plant used on this stream and the St. Croix was put in repair preparatory to resuming dredging operations. Part of the expense was paid from each appropriation.

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July 1, 1904, balance unexpended	$13.20
Amount appropriated by river and harbor act approved March 3, 1905	3,000.00
	3,013.20
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	131.32
July 1, 1905, balance unexpended	2,881.88
July 1, 1905, outstanding liabilities	180.41
July 1, 1905, balance available	2,701.47

(See Appendix Z 5.)

6. Red River of the North, Minnesota and North Dakota.—When the improvement of this river began, the navigation of the reach from Breckenridge to Moorhead, 97 miles, was difficult at all stages and impossible at low water. The second reach, from Moorhead to Grand Forks, 155 miles, had a ruling depth at low water of 1.5 feet. The third reach, from Grand Forks to the boundary line of the United States, 143.5 miles, had a ruling low-water depth of 2 feet. The low-water navigation of Red Lake River was obstructed by bowlders between Thief River Falls and High Landing, a distance of 35 miles, and by a bad bar at the outlet of Red Lake.

The object of the improvement is to provide an open channel on the Red River of the North from Breckenridge to the northern boundary line, 395.5 miles, as follows:

1. Breckenridge to Moorhead (97 miles), a channel capable of being navigated during the high and medium stages of water.
2. Moorhead to Grand Forks (155 miles), a channel 50 feet wide and 3 feet deep at low water.
3. Grand Forks to the northern boundary line (143.5 miles), a channel 60 feet wide and 4 feet deep at low water.

Also to provide a 3-foot open channel improvement of the Red Lake River and Red Lake from Thief River Falls to and including Red Lake, a total distance of 135 miles.

The original estimated cost for improvement of Red River of the North was $364,598.17, increased in 1883 to $398,598.17. The estimate was revised in 1887, after Congress had substituted an open-channel improvement for lock and dam at Goose Rapids, and placed at $252,598.37. An increase of the latter estimate was authorized May 8, 1893, to $310,320. Congress, in 1896, added $5,000 to the estimate of cost by attaching the improvement of Red Lake River to the project. In 1899, $4,000 of the $10,000 authorized was allotted to Red Lake River, so that the present estimate of cost is $319,320 for both rivers from the beginning of operations. Red Lake River has been under improvement as part of the Red River of the North, in accordance with the river and harbor act of June 3, 1896, but owing to the limited amount of funds available nothing has been done, except to care for the plant, since 1900. Red Lake River formed no part of the original project for the Red River of the North and has never been accurately surveyed. No properly considered project for its improvement is possible without such a survey, and no reliable estimate of the cost of the improvement exists. Beyond clearing the river of bowlders and logs, nothing should be done until a survey with estimate of cost is available. The total amount expended to June 30, 1905, including work on Red Lake River, was $314,196.78.

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On June 30, 1905, the object of the improvement had not been attained on the first division of the Red River of the North, which has for some years been closed against all navigation by highway bridges. The desired results have been obtained on all but 13 miles of the second division, but owing to shortage of funds, which has prevented sufficient dredging being done, the navigable depth on this division is now only 2 feet at low water. On the third division the object has been attained, but for the reason given above the navigable depth is now only 3½ feet at low water.

On Red Lake River work has been confined to the removal of snags, bowlders, and similar obstructions from the channel. Its navigable depth does not exceed 1½ feet at low water.

Belmont, N. Dak., about 35 miles by river south of Grand Forks, may be considered at present the head of navigation on Red River of the North, as above this point the river is obstructed by fixed bridges, unauthorized by law. The distance from Belmont to the international boundary line is about 180 miles.

Red Lake River is navigable from Thief River Falls, Minn., to the outlet of Red Lake, about 35 miles, and Red Lake is also navigable. Below Thief River Falls the river is not navigable, owing to the existence of numerous rapids and several dams.

The usual variation in the level of water surface of Red River of the North is about 25 feet, with a maximum difference between extreme high and low water of 49 feet. On Red Lake River the usual variation is about 3½ feet, with a maximum of 6 feet.

Navigation on the Red River of the North is at present confined to comparatively short reaches north and south of Grand Forks, and consists mainly in the transportation of wheat to Grand Forks by two steamboats (100 and 50 tons, respectively) and 10 barges. The tonnage during the years 1900–1904 was as follows:

	Tons.		Tons.
1900	20,000	1903	28,353
1901	20,000	1904	19,295
1902	20,086		

On Red Lake River one steamer carried general merchandise and passengers to points on Red Lake, the total tonnage in 1904 being about 600, and about 300 passengers were carried. One hundred and fifteen million feet B. M. of logs was run on the river during the year. Three steamboats are running on Red Lake towing the above 115,000,000 feet of logs to the head of Red Lake River.

For physical characteristics, see Annual Reports of the Chief of Engineers for 1874, page 295; 1875, page 370; 1878, page 730; 1879, page 1192. For plans of improvements, see Annual Reports of the Chief of Engineers for 1874, page 297; 1879, page 1191; 1881, page 1757. For revisions of projects, see Annual Reports of the Chief of Engineers for 1883, page 1450; 1887, page 1712. For description of large landslide caused by Northern Pacific Railroad embankment, see Annual Report of the Chief of Engineers for 1898, page 1831.

The work during the year has been confined to the care of boats and property at Grand Forks, N. Dak., and at Thief River Falls, Minn., there having been no funds available for operating the plant. Since the passage of the act of March 3, 1905, materials have been assembled and the plant will be put in repair and made ready for

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use as soon as possible, so that dredging in the vicinity of Grand Forks may be resumed when the river falls sufficiently.

There not being sufficient funds to permit the necessary repairs of the derrick fleet and to continue work on Red Lake River, the boats at Thief River Falls were sold under authority of the Secretary of War and the removable property transferred to Grand Forks.

July 1, 1904, balance unexpended	$1,865.32
Amount appropriated by river and harbor act approved March 3, 1905	9,000.00
Proceeds of sale of boats	70.00
	10,935.32
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	1,439.10
July 1, 1905, balance unexpended	9,496.22
July 1, 1905, outstanding liabilities	680.75
July 1, 1905, balance available	8,815.47

(See Appendix Z 6.)

7. Warroad Harbor and Warroad River, Minnesota.—The river and harbor act approved March 3, 1899, as amended by the emergency river and harbor act approved June 6, 1900, appropriated $3,000, or so much thereof as might be necessary, for improving the mouth of Warroad River, Minnesota. Under this appropriation no work was undertaken beyond making surveys, the balance of funds available having been held subject to action by Congress upon a preliminary report, plan, and estimate submitted June 6, 1900, and published in the Annual Report of the Chief of Engineers for 1901, page 2356. The estimate was $45,000 for a dredging plant and two years' expenses of running the dredge. The river and harbor act approved June 13, 1902, appropriated $45,000 for carrying on the work as indicated. The House Committee on Rivers and Harbors, by resolution, referred this project to the Board of Engineers for Rivers and Harbors, established under section 3 of the river and harbor act of June 13, 1902, for report upon the desirability of continuing the same or any modification thereof. The report of the Board was made December 22, 1903, and is printed in the Annual Report of the Chief of Engineers for 1904, pages 2253 et seq.

The existing project is definitely specified by the river and harbor act approved March 3, 1905, which appropriated $35,000 for "Improving Warroad Harbor, Warroad River, Minnesota, by dredging a channel one hundred feet wide and seven feet deep from the inner end of the channel dredged in nineteen hundred and four to the boat landing at Warroad, with a turning channel for boats at the inner harbor, and continuing present improvement."

The outlet of Warroad River is the only natural harbor in the United States on the Lake of the Woods. Before dredging was commenced the ruling depth of water on the bar at the mouth of the river was about 3½ feet and on the outer bar 5 feet. From the improvement so far made the depth of water in both places has been increased to 7 feet.

The amount expended to June 30, 1905, was $45,143.35.

The town of Warroad, now five years old, has a population of about 1,000, and the adjacent country is rapidly filling up with settlers. The imports of Warroad have increased from 254 tons in 1900 to

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3,300 tons in 1905. During the same period the exports increased from 1,215 tons to 20,867 tons.

There are now upward of 25 steamboats, from 10 to 500 tons capacity, navigating Lake of the Woods, and all of these are able to enter Warroad Harbor as now improved.

July 1, 1904, balance unexpended	$14,106.73
Amount appropriated by river and harbor act approved March 3, 1905	35,000.00
	49,106.73
June 30, 1905, amount expended during fiscal year, for works of improvement	11,250.08
July 1, 1905, balance unexpended	37,856.65
July 1, 1905, outstanding liabilities	779.17
July 1, 1905, balance available	37,077.48

(See Appendix Z 7.)

8. Survey of Otter Tail Lake and Otter Tail River, Red Lake and Red Lake River, Minnesota, and Big Stone Lake and Lake Traverse, Minnesota and South Dakota.—The river and harbor act approved June 13, 1902, provided for the continuation of these surveys, which were ordered by Congress with a view to the construction of reservoirs for the improvement of the navigation of Red River of the North and Minnesota River.

Preliminary reports were submitted in April, 1900, and are printed in the Annual Report of the Chief of Engineers for 1900, pages 2828–2836. A final report was submitted August 11, 1903, and printed in the Annual Report of the Chief of Engineers for 1904, page 2260 et seq.

Amount expended on all projects to June 30, 1905, $16,320.98.

No work was done during the year, operations having been suspended May 15, 1904. The expenditures during the year were for transportation during 1903–4. It is proposed to reserve the available funds for the purpose of making hydrological observations during the next flood affecting these localities.

July 1, 1904, balance unexpended	$9,201.50
June 30, 1905, amount expended during fiscal year	22.48
July 1, 1905, balance unexpended	9,179.02

(See Appendix Z 8.)

9. Gauging Mississippi River at or near St. Paul, Minn.—This work is provided for by allotment from the permanent annual appropriation of $9,600 made by the river and harbor act of August 11, 1888, as amended by section 9 of the river and harbor act of June 13, 1902, for the purpose of securing the uninterrupted gauging of the waters of the Mississippi River and its tributaries. No gaugings were made until the fall of 1899. Since then gaugings have been made as frequently as the funds available would permit, and the conditions justified the expenditure. For location of gauges, see map facing page 1832, Report of the Chief of Engineers for 1898.

Tables showing relation of rainfall to run-off in the Mississippi Valley above St. Paul are printed on page 2169, Report of the Chief of Engineers for 1897. The slope of the Mississippi River between Minneapolis and St. Paul is shown in the table of gauge readings

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given on pages 2823 et seq., Report of the Chief of Engineers for 1900.

Amount expended to June 30, 1905, $6,510.88.

During the year the gauges between Lock and Dam No. 2 and the mouth of the Minnesota River were read from time to time, as required. Further operations were impracticable on account of the high stage of the river throughout the year, low-water gaugings only being now required.

Amount allotted August 11, 1904	$500.00
June 30, 1905, amount expended during fiscal year	192.15
July 1, 1905, balance unexpended, returned to Treasury	307.85

(See Appendix Z 9.)

IMPROVEMENT OF THE MISSOURI RIVER, AND OF OSAGE AND GASCONADE RIVERS, MISSOURI.

This district was in the charge of Maj. H. M. Chittenden, Corps of Engineers. Division engineer, Col. O. H. Ernst, Corps of Engineers, until April 5, 1905, and Lieut. Col. W. H. Bixby, Corps of Engineers, since that date.

1. Missouri River.—(*a*) *General improvement.*—The Missouri River has been navigated by steamboats since 1819; first boat to Council Bluffs, 1819; first to mouth of Yellowstone, 1832; first to head of navigation, 1859. The length of navigable river from Fort Benton to mouth is 2,285.8 miles. Some portions of the river above the Great Falls are also navigable.

No project for the improvement of the river as a whole has been adopted.

Government work on the river in the matter of removal of snags began as early as 1838 and continued thereafter, under annual appropriations (for the most part made jointly for the Ohio, Mississippi, Missouri, and sometimes the Arkansas rivers), with occasional intermissions, for the next forty years. Prior to 1878 one or two small appropriations had been made for general improvement, but it was with the act of June 18 of the latter year that appropriations began on a large scale.

The work prior to 1884 was carried on under separate districts. From 1884 to 1890 the work on the entire river was under the Missouri River Commission. After 1890 that portion above and including Sioux City, Iowa, was under a separate district until 1902. Since the discontinuance of the Missouri River Commission the works on the entire river have been consolidated under one district.

The greater part of the work on the portion of the river below Sioux City has been done by the Missouri River Commission, reporting to the Chief of Engineers. The Commission was constituted by act of Congress of July 5, 1884, and was abolished by the river and harbor act of June 13, 1902.

On the portion of the river above Sioux City the work has been done under the immediate charge of officers of the Corps of Engineers, except during the period from 1884 to 1890, when it was in charge of the Missouri River Commission. The effort of the Commission in its work below Sioux City was to accomplish a continuous, progressive control of the river, contracting it where necessary, giving the channel proper direction, and securely holding it in place. Work in this

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direction was done in the vicinity of Kansas City and on the first reach of the river, which extends from near Jefferson City to the mouth. On 45 miles of this reach a continuous channel of not less than 6 feet in depth at low water was obtained on what was originally one of the worst parts of the river, in the vicinity of the mouth of the Osage. In addition to forming a channel, much new land was formed and much land protected from destruction by the river. The greater part of the funds appropriated for expenditure under the direction of the Commission was not applicable to the comprehensive plan of improvement adopted, and about one-third of it was diverted to work at separate localities.

A condensed description of the works on the river executed under the supervision of the Missouri River Commission is given in the Commission's last annual report (Annual Report of the Chief of Engineers for 1902, Supplement).

On the upper portion of the river the work originally consisted mainly in improving the shoals and rapids on the so-called "Rocky River" from Fort Benton downstream for 150 miles. In recent years it has largely been limited to channel regulation and bank protection at the following points: Bismarck, N. Dak.; Pierre, Yankton, and Elkpoint, S. Dak., and Sioux City, Iowa. Two ice harbors have been established, one at Rockhaven, N. Dak., the other in the mouth of the Big Sioux River, just above Sioux City.

Works of channel regulation have also been built in the Long Pool, or the reach of the river from the crest of the Great Falls to Cascade, and a small amount of open-river work in the steeper stretch from Cascade to Stubbs Ferry.

A condensed description of the work above the Great Falls will be found in the Annual Report of the Chief of Engineers for 1899, pages 385–386, and in later annual reports; and of the work on the river between Fort Benton and Sioux City in the Annual Report of the Chief of Engineers for 1902, pages 382–385.

A complete survey of the river has also been made, in part by the Commission and in part by officers in charge of the districts on the upper portions of the river.

In addition to the foregoing work a fleet of snag boats has been in operation clearing the channel of snags and other obstructions on the portion of the river where boats have been running. This work is considered to be directly beneficial to navigation.

The total of the appropriations for the river from the mouth to Sioux City since the organization of the Commission is $7,575,000.

The total of the appropriations and of receipts from other sources for improvements of the upper river, beginning with the act of August 14, 1876, is $1,963,851.46.

The total expenditures for all purposes have been $9,674,340.98. The result of these expenditures has been to demonstrate the possibility of regulating the river in such manner as to make it navigable for a channel of commerce; that the cost of such regulation would be very great, and that no permanent good to navigation can be accomplished by appropriations for specific localities not so connected as to form part of the systematically improved reaches. The result of the expenditures at separated localities has been beneficial locally by protecting the banks and in this manner preserving private property

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from the ravages of the river, but has given little, if any, encouragement to through navigation.

During the past year work has been in the main confined to repair work and snagging.

The river formerly carried an active commerce, which has practically been entirely diverted to other channels.

(*b*) *Snagging.*—The removal of snags has formed a part of the scheme for improving both the lower and upper river since the work of improvement began. As snags form the most dangerous obstacle to navigation on this stream, their removal has been one of the most efficacious aids to its navigation. At present one snag boat on each division of the river regularly operates over such portions as are used by commercial vessels. The river had been kept fairly clear of snags until the occurrence of the great flood of 1903 on the lower river, which brought many new snags to light.

The work of the past fiscal year has consisted mainly in repair work and snagging carried on with small remaining balances from the appropriation of June 13, 1902, and allotments from the appropriation of April 28, 1904.

The river and harbor act of March 3, 1905, contained the following items for the Missouri River:

General improvement by maintenance of open-channel work and by snagging:	
Between mouth and Sioux City, Iowa	$90,000
Above Sioux City, Iowa	75,000
Work at designated localities:	
At Herman, Mo	10,000
At St. Joseph, Mo. (on condition that the public authorities of St. Joseph contribute a like sum, which has been done)	50,000

Projects have been approved for the expenditure of these sums and work has now commenced, but has not yet progressed far enough for consideration in this report.

Amount of freight carried on the Missouri River from mouth to Sioux City, Iowa.

Calendar year—	Tons.	Calendar year—	Tons.
1897	391,029	1901	569,666
1898	319,793	1902	410,527
1899	263,114	1903	750,291
1900	277,306	1904	455,000

Amount of freight carried on the Missouri River above Sioux City, Iowa.

Calendar year—	Tons.	Calendar year—	Tons.
1887	13,961	1896	10,368
1888	12,895	1897	17,105
1889	16,723	1898	26,896
1890	14,072	1899	23,041
1891	14,211	1900	27,179
1892	17,292	1901	37,340
1893	19,481	1902	31,070
1894	37,936	1903	37,994
1895	21,264	1904	28,951

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July 1, 1904, balance unexpended	$98,694.16
Amount appropriated by river and harbor act approved March 3, 1905	225,000.00
Amount contributed by citizens of St. Joseph, Mo	50,000.00
Amount refunded on account of overpayment	.45
	373,694.61
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	93,541.43
July 1, 1905, balance unexpended	280,153.18
July 1, 1905, outstanding liabilities	42,630.40
July 1, 1905, balance available	237,522.78
Amount (estimated) required for completion of existing project	Indefinite.

(See Appendix A A 1.)

2. Osage River, Missouri.—A history of the work of improvement on this river from the adoption of the original project in 1871 to the end of the fiscal year 1900 was published in the Annual Report of the Chief of Engineers for 1900, page 4944.

The work has been carried on under two projects—that of open-channel improvement by the construction of cross and wing dams in addition to dredging and removal of obstructions to navigation, such as snags, etc., and the construction of a lock and dam 7 miles above the mouth of the river.

The removal of obstructions under the first project contemplates only temporary relief. The obstructions are constantly forming anew, and while the cross and wing dams have a degree of permanency, they must receive frequent repair and extension to keep up their efficiency. No definite time, therefore, can be fixed for its completion and no estimate made of its ultimate cost. The improvement must be a continuous one, and the annual estimates must depend upon conditions as they arise.

The amount expended by the General Government upon both projects up to June 30, 1905, is $374,106.17.

By act of March 3, 1905, the sum of $80,000 was appropriated for continuing improvement of the Osage River. A project has been approved for using so much of this sum and balances from previous appropriations as are necessary for the completion of Lock and Dam No. 1. Work is now in progress, but has not yet progressed beyond a general overhauling of plant and preparation for active construction as soon as the summer high water subsides.

Amount of freight carried on the Osage River.

Calendar year—	Tons.	Calendar year—	Tons.
1895	76,706	1900	96,144
1896	72,393	1901	72,339
1897	71,247	1902	95,194
1898	84,286	1903	38,501
1899	76,702	1904	35,746

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July 1, 1904, balance unexpended	$15,040.96
Amount appropriated by river and harbor act approved March 3, 1905	80,000.00
	95,040.96
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	6,109.68
July 1, 1905, balance unexpended	88,931.28
July 1, 1905, outstanding liabilities	7,020.66
July 1, 1905, balance available	81,910.62

(See Appendix A A 2.)

3. Gasconade River, Missouri.—The project for the improvement of this stream, adopted in 1880, consisted in the removal of snags and logs from the channel and of leaning timber from the banks of the river where necessary, and the construction of wing dams and training walls to concentrate the flow of water upon the shoals to increase the depth over them.

From the nature of the project, which contemplates only temporary relief from year to year and the removal of obstructions which are constantly forming anew, no definite time can be fixed for its completion and no estimate made of its ultimate cost. The improvement must be continuous, and the annual estimates must depend upon conditions as they arise.

During the past season the boating channel was cleared of snags and wreck heaps and all overhanging trees were trimmed or felled.

The amount expended under the project to June 30, 1905, is $86,496.01.

The act of March 3, 1905, appropriated the sum of $15,000 for continuing improvement of this river. A project for the expenditure of this money has been approved, but work has not yet begun.

Amount of freight carried on the Gasconade River.

Calendar year—	Tons.	Calendar year—	Tons.
1895	47,544	1900	51,580
1896	46,294	1901	19,460
1897	30,515	1902	44,380
1898	30,981	1903	10,788
1899	24,259	1904	14,791

July 1, 1904, balance unexpended	$1,914.06
Amount appropriated by river and harbor act approved March 3, 1905	15,000.00
	16,914.06
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	1,910.07
July 1, 1905, balance unexpended	15,003.99
July 1, 1905, outstanding liabilities	812.02
July 1, 1905, balance available	14,191.97
Amount (estimated) required for completion of existing project	Indefinite.

(See Appendix A A 3.)

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IMPROVEMENT OF CUMBERLAND RIVER, TENNESSEE AND KENTUCKY, AND OF OBION AND FORKED DEER RIVERS, TENNESSEE.

This district was in the charge of Lieut. Col. Clinton B. Sears, Corps of Engineers, until August 10, 1904, and of Maj. H. C. Newcomer, Corps of Engineers, since that date. Division engineer, Col. G. J. Lydecker, Corps of Engineers, until October 25, 1904, and Lieut. Col. Clinton B. Sears, Corps of Engineers, since that date.

1. Obion and Forked Deer rivers, Tennessee.—The river and harbor act of June 13, 1902, authorized the conjunctive improvement of the Obion and Forked Deer rivers.

(*a*) *Obion River.*—This stream is situated in northwestern Tennessee. It is formed by the junction of its north and south forks about 6 miles northeast of Obion, which is considered the head of navigation, and it flows in a general southwesterly direction about 75 miles, entering the Mississippi River some 5 miles below the Missouri and Arkansas State line.

In its original condition the obstructions on this river were almost wholly drift, snags, and overhanging trees, which made navigation difficult and uncertain.

The original project was based on a survey made in 1891, and was adopted by the river and harbor act of July 13, 1892. The scope of the work was to obtain 3-foot navigation at low water by means of open-channel work, at an estimated cost of $50,000. After an expenditure of $15,795.01 this project was modified in June, 1897, to one for maintenance, so as to keep the river free from such obstructions as would prevent navigation at medium and high stages, at an estimated annual cost of $2,500.

In 1903 the annual expenditure recommended for maintenance of the Obion and Forked Deer rivers was reduced from $4,500 to $2,250. (See Annual Report for 1904, p. 2351.) Appropriations for maintenance were made in the river and harbor acts of 1899, 1902, and 1905.

Appropriations and allotments aggregating $27,700 have been made for the Obion River, of which $25,857.12 has been expended to June 30, 1905.

The expenditures have resulted in temporary improvements to the channel, lessening the dangers to navigation at medium and higher stages, from Obion, Tenn., to mouth of river.

The navigability of the Obion River depends largely on the stage of water in the Mississippi.

For additional details, see account of survey in Annual Report of 1891, p. 2292.

(*b*) *Forked Deer River.*—This stream is formed by the junction of its North and South forks about 8 miles southeast of Dyersburg, and flows thence in a general southwesterly direction about 21 miles, entering the Obion River about 3½ miles from the Mississippi. Dyersburg is considered the head of navigation on the North Fork. Jackson, Tenn., was formerly considered the head of navigation on the South Fork, but in recent years navigation appears to have been limited to the lower portion of this stream.

In their original condition the main stream and its branches, the North Fork and South Fork, were greatly obstructed by snags, drift, etc. The original project may be said to have been adopted by the river and harbor act of August 2, 1882, and was based on a report of

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an examination of South Fork, dated December 16, 1880. This project was subsequently modified by extension to include the North Fork and main stream until appropriations aggregating $25,000 were made and expended. The operations proposed were open-channel work, by which it was sought to maintain a satisfactory channel all the year round. This project was set aside in view of the fact that the result aimed at could not be accomplished by said method.

The present project for maintenance, based on the provisions of the act of March 3, 1899, provides for the removal of surface obstructions from the Forked Deer River and its navigable branches (North and South forks), at an estimated annual cost of $2,000 up to 1903, when the annual expenditure recommended for maintenance of the Obion and Forked Deer rivers was reduced from $4,500 to $2,250. (See Annual Report for 1904, p. 2351.)

Under this project appropriations and allotments aggregating $11,300 have been made, of which $9,751.05 has been expended to June 30, 1905.

The expenditures have resulted in temporary improvements to the channel, lessening the dangers to navigation at medium and higher stages. The navigability of the Forked Deer River depends largely upon the stage of water in the Mississippi.

During the calendar year ending December 31, 1904, the reported commerce on these streams amounted to 60,286 tons, having an estimated value of about $627,108, and consisting almost wholly of timber products; passengers carried, about 2,334.

For list of sundry examinations and surveys of Forked Deer River and navigable branches, see Report of Chief of Engineers for 1899, page 396. For report of latest examination of Obion and Forked Deer rivers, see Report of Chief of Engineers for 1904, page 2351 et seq.

July 1, 1904, balance unexpended	$662.46
Amount appropriated by river and harbor act approved March 3, 1905	3,000.00
	3,662.46
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	270.63
July 1, 1905, balance unexpended	3,391.83
July 1, 1905, outstanding liabilities	24.50
July 1, 1905, balance available	3,367.33

(See Appendix B B 1.)

2. Cumberland River, Tennessee and Kentucky.—The Cumberland River rises in eastern Kentucky, on the western slope of the Cumberland Mountains; flows in a tortuous course of about 688 miles through eastern Kentucky, middle Tennessee, and western Kentucky, and discharges into the Ohio River near Smithland, Ky. From Burnside, Ky., the head of steamboat navigation, to Smithland, Ky., the distance is 518 miles by the river, 203 miles being in the State of Kentucky and 315 miles in the State of Tennessee.

(*a*) *Below Nashville (193 miles).*—From 1830 to 1840 the legislatures of Tennessee and Kentucky made several appropriations for the improvement of the navigation of the Cumberland River, but little benefit to the general condition of the river seems to have been accomplished. The Cumberland Navigation Company was incorporated by

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the State of Tennessee in 1846 for improving the "navigation of the Cumberland River below the town of Nashville by means of a system of locks and dams," but nothing tangible was done to carry out the proposed improvement.

In its original condition this section of the river was considerably obstructed by rocky ledges, conglomerate, gravel, and sand bars, snags, and other surface obstructions, on account of which navigation was rendered very uncertain.

From July 17, 1832, to July 7, 1838, Congress made five appropriations for improving the Cumberland River, Tennessee and Kentucky, aggregating $155,000, $20,000 of which was to be expended below Nashville and $135,000 on the river generally, but the records show that all the appropriations for the above period were expended below Nashville.

Between 1838 and 1871 no appropriations for this river were made. The original project (open-channel work), which provided specifically for operations on this section, was adopted by the river and harbor act of March 3, 1871, based on project submitted January 20, 1871. The work proposed was as follows: To excavate the bars and rock ledges to get an additional depth of water, to contract the waterways in places to get the requisite depth, to remove snags and bowlders from the main channel, and to restrain tributary streams in well-determined channels at their junction with the river.

To increase the depth of water at the shoals in Kentucky Chute at the junction of the Cumberland with the Ohio River, a Board of Engineer officers in 1888 recommended the construction of a dike near Smithland, Ky., at an estimated cost of $129,600. The river and harbor act of September 19, 1890, allotted $30,000 from the appropriation for improving Cumberland River below Nashville, to be expended in improving the mouth of the river, as recommended.

Appropriations aggregating $305,000 were made and expended under the above project. The expenditures under the old project have resulted in lengthening the season of navigation by giving an increased depth at low water combined with greater security in the passage of obstructions.

The present project for improving the Cumberland River below Nashville was adopted July 13, 1892, by river and harbor act of that date. It contemplates the extension of the lock and dam system of the upper river over a considerable portion of the river below Nashville by the construction of 7 locks and dams, commencing at or near Harpeth shoal (Lock A) and ending at Big Eddy shoal (Lock G); the locks to be 52 feet wide and 280 feet long, with lifts varying from 8½ to 11½ feet and aggregating some 70 feet. The project also includes the improvement of the Kentucky Chute, at the mouth of the river, as recommended by the Board of Engineer officers in 1888, the necessary channel work below Lock G, and the removal of surface obstructions, snags, logs, etc., below Nashville. The total estimated cost of the entire improvement is $1,964,500.

Under this project appropriations aggregating $440,000 have been made and $402,841.58 has been expended, of which $16,550.28 was applied to maintenance.

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These expenditures have resulted in the periodical removal of snags and other surface obstructions from the navigable channel, the protection of the bank of a part of Cumberland Island in Kentucky Chute at mouth of river, and the practical completion of Lock and Dam A, whereby 6-foot navigation has been afforded all year round for a distance of 38.8 miles above the lock. The season of profitable navigation from the Ohio River to Nashville has been prolonged from forty-five to ninety days, depending on the stage of water.

The Cumberland River below Nashville is usually navigable for all steamboats plying on it for six months in each year; for boats not drawing over 3 feet, from six to eight months, and for boats drawing 16 inches or less the whole year. Navigation is practically closed for several months each year during low water. As a general rule, when the stage is below 2½ feet, navigation is closed; between 2½ feet and 5 feet it is uncertain, and above 5 feet good. A table is given on page 390 of the Annual Report of the Chief of Engineers for 1902 showing the stages at Burnside, Carthage, Nashville, and Clarksville for the years 1898–1902.

The cost of maintenance of the open-river channel in its present condition is estimated at $5,000 per annum.

The reported tonnage for calendar year 1904 was about 275,371 tons, having an estimated value of about $3,034,600; passengers carried, 7,550. The tonnage consisted mainly of railroad ties, with considerable items of other timber products, farm products, sand and gravel, and general merchandise.

It is reported that the Tennessee Central Railroad, which parallels the Cumberland River from Nashville to Clarksville, had rates in force before the completion of Lock and Dam A of from 18 cents to 26 cents per 100 pounds, and that since this lock is in operation these rates have been reduced above the lock to from 6 cents to 12 cents per 100 pounds.

Additional details and maps relating to this section are given in the report of survey, Annual Report of 1890, page 2152, and the report of the Board of Engineer officers, Annual Report of 1888, page 1626.

July 1, 1904, balance unexpended		$100,557.55
Amount appropriated by river and harbor act approved March 3, 1905		10,000.00
Received on account of sales		8.95
		110,566.50
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$72,176.61	
For maintenance of improvement	257.42	
		72,434.03
July 1, 1905, balance unexpended		38,132.47
July 1, 1905, outstanding liabilities		1,487.82
July 1, 1905, balance available		36,644.65
Amount (estimated) required for completion of existing project		1,524,500.00

(*b*) *Above Nashville (357 miles).*—This section extends from Nashville to the mouth of Rockcastle River. In its original condition it was considerably obstructed by rock reefs, ledges, snags, etc., which greatly impeded navigation between Nashville and Burnside

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(about 325 miles), while above Burnside the Smith shoals formed a serious obstruction to navigation at practically all stages.

The original scheme of improvement above Nashville, as modified and extended, contemplated open-channel work from Nashville, Tenn., to Cumberland Ford (Pineville, Ky.), 497 miles, at an estimated cost of $374,764, and was based on projects submitted January 20, 1871, and February 8, 1872.

The first appropriation specifically applicable to the Cumberland River above Nashville was made by the act of August 14, 1876.

This open-channel scheme of improvement, or old project, resulted in giving increased depths at several of the principal obstructions, thus securing a longer and safer period of navigation. Under this project and its modifications appropriations aggregating $346,000 were made and expended.

The project for the canalization of the Cumberland River above Nashville, based on reports of an examination and survey in 1882 and 1883, was adopted August 5, 1886, by river and harbor act of that date.

In its present form this scheme of improvement includes the construction of 22 locks and dams below Burnside, and 6 locks and dams at Smith shoals, above Burnside; and it is intended to provide a complete system of lockage from Nashville, Tenn., to Rockcastle River, so as to afford a channel depth of 6 feet, the locks to be 52 feet wide and 280 feet long, with lifts varying from 10 to 12 feet, at an estimated cost of $8,500,000.

The river and harbor act of March 3, 1905, appropriated $40,000 for completion of Lock and Dam No. 2, and directed that the balance on hand to the credit of the river above Nashville for general improvement and for Locks Nos. 5, 6, and 7 shall be applied upon construction of Lock and Dam No. 2. It also authorized continuing contract for the completion of Lock and Dam No. 21, to the amount of $200,000, in addition to a direct appropriation of $74,000 and the available funds to the credit of any project above said lock and dam.

The same act authorized the Cumberland River Improvement Company of Kentucky to improve the Cumberland River and tributaries, including the South Fork, above Burnside, Ky., at its own expense, by construction of necessary locks and dams under Government supervision, and to use the resulting water power with the provisions that such use shall not impede navigation, that the locks and dams shall be at least equal in size and capacity to other locks and dams constructed on the Cumberland River, and that the company may collect toll for their use for forty years after their completion at rates to be fixed by the Secretary of War.

Appropriations aggregating $2,019,000 have been made under the present project and $1,802,271.57 has been expended to June 30, 1905, of which amount $22,734.61 has been aplied to maintenance.

These expenditures have resulted in the periodical removal of snags and other obstructions; the completion and operation of Lock and Dam No. 1 (2.5 miles below Nashville); the completion of masonry required for lock walls and abutments of dams at Nos. 2, 3, 4, 5, 6, and 7 (9, 26, 44.7, 72, 89, and 106.6 miles, respectively, above Nashville); the purchase of sites for abutment at No. 8 (125.2 miles above Nashville), and for locks and abutments at Nos. 21 and 22

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(296.2 and 320.2 miles, respectively, above Nashville); the preparation of plans for the completion of Locks and Dams Nos. 2 and 2 and the selection of sites for the locks of the Smith shoals system.

The cost of maintenance of the river in its present condition, as improved by open-channel work of past years, is estimated to be about $5,000 per annum.

The Cumberland River is navigable usually from Nashville to Burnside, Ky., 325 miles, for steamboats drawing not more than 3 feet, from four to six months of each year, and for boats of greater draft from two to three months. The fall is 223 feet, or about 8 inches per mile.

From Nashville to Caney Fork River (Carthage, 116 miles) the river is navigable for steamboats of 2½ feet draft from six to eight months, and for those of greater draft four or five months. Steamboats of light draft can ascend to Burkesville, 236 miles above Nashville, for from five to seven months, and larger boats four or five months. The head of navigation is Burnside, Ky.

The completion of Lock and Dam No. 1 gives 6-foot navigation the year round for a distance of 12½ miles above Lock No. 1, or 10 miles above Nashville, and affords a good harbor at Nashville, where a number of new boats and barges have been put in commission.

The act of March 3, 1905, provided for the completion of Lock and Dam No. 2, which will form a pool extending to a point 26 miles above Nashville. The early completion of the works at Nos. 3, 4, 5, 6, and 7, where the more expensive masonry parts have already been built, is regarded of great importance, as it will provide a permanent channel for navigation from Nashville to Carthage and the Caney Fork River. It is proposed to apply the amount estimated as a profitable expenditure for the next fiscal year to the completion of Lock and Dam No. 21, under continuing contract, at an estimated cost of $200,000, as provided by the act of March 3, 1905.

The commerce on the Cumberland River above Nashville for calendar year 1904, as nearly as could be ascertained, aggregated about 242,112 tons, having an estimated value of about $5,862,365; passengers carried, 7,200. The tonnage consisted mainly of timber products, farm products, sand and gravel, and general merchandise.

For survey of the river between Nashville and Burnside, see Annual Report of 1884, page 1663; and for survey of Smith shoals, see Annual Report of 1882, page 1862.

July 1, 1904, balance unexpended		$152,709.89
Amount appropriated by river and harbor act approved March 3, 1905		124,000.00
Received on account of sales		15.80
		276,725.69
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$58,823.70	
For maintenance of improvement	702.71	
		59,526.41
July 1, 1905, balance unexpended		217,199.28
July 1, 1905, outstanding liabilities		2,131.52
July 1, 1905, balance available		215,067.76
July 1, 1905, amount covered by uncompleted contracts		15,715.00
Amount (estimated) required for completion of existing project		6,481,000.00

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Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	$200,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix B B 2.)

IMPROVEMENT OF TENNESSEE RIVER AND ITS TRIBUTARIES.

This district was in the charge of Maj. H. C. Newcomer, Corps of Engineers. Division engineer, Col. G. J. Lydecker, Corps of Engineers, until October 25, 1904, and Lieut. Col. Clinton B. Sears, Corps of Engineers, since that date.

TENNESSEE RIVER SYSTEM.

The Tennessee River is 652 miles long. It is formed by the junction of the French Broad and Holston rivers 4.5 miles above Knoxville and 188 miles above Chattanooga and flows into the Ohio at Paducah, 464 miles below Chattanooga. Together with its principal tributaries it forms a system of internal waterways capable of being navigated more than 1,300 miles by steamboats. In addition to this, its tributaries are still further navigable by rafts and flatboats for a distance of more than 1,000 miles, thus making a system of navigable waters about 2,350 miles in length, with a drainage area of about 44,000 square miles.

The river is navigable the entire year from the mouth to Riverton, Ala. Just above Riverton a lateral canal about 8 miles long is now under construction past the Colbert and Bee Tree shoals. A canal 3 miles long is projected at Little Muscle shoals just above Florence, Ala., and the Muscle Shoals Canal now surmounts the Big Muscle shoals and Elk River shoals.

Under the act of April 26, 1904, as amended by act of January 7, 1905, a lock and dam are projected at Hales bar, designed to form a pool extending 33 miles upstream to Chattanooga.

Local boat lines have headquarters at the principal towns along the river. There is no through traffic covering the entire length of the river, the longest regular boat service being found between Chattanooga and Paducah when the stage of water permits.

From commercial statistics given later in detail it will be seen that the total commerce on the Tennessee River during the calendar year 1904 amounted to about 1,607,463 tons, valued at about $30,000,000. About 22,229 tons should be deducted from this total, on account of having been duplicated in reports for different sections of the river. Of the remainder about 173,172 tons was rafted, and the movement of the balance may be thus summarized:

Distance on Tennessee River between terminal points of carriers' routes.	Freight moved.
	Tons.
Over 450 miles	13,911
200 to 280 miles	743,969
100 to 200 miles	125,891
50 to 100 miles	37,850
10 to 50 miles	399,895
Under 10 miles	91,046
Total	1,412,062

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The amount so far appropriated and allotted for the Tennessee River and the canals thereon, including the amount for operating canals, is $7,170,366.37. Of this sum $913,418.50 has been allotted for operating and care and repair of the Muscle Shoals Canal from November, 1890, when it was opened to navigation, to June 30, 1905.

1. Tennessee River.—The improvement has been carried on in three sections under separate appropriations.

(*a*) *Above Chattanooga, Tenn. (188 miles).*—In its original condition this part of the river was obstructed by rock reefs, bowlders, gravel bars, and snags. The depth of water on the bars varied from 10 to 30 inches at low water, and in some places the current was as great as 6 miles an hour. The average slope is 0.956 foot per mile, with average low-water discharge varying from about 3,000 cubic feet per second at Knoxville to about 6,000 cubic feet per second at Chattanooga.

The present project, adopted by Congress in act of August 18, 1894, is to obtain by training walls, wing dams, and dredging a low-water channel 3 feet deep from Chattanooga to the mouth of the French Broad River, at an estimated cost of $650,000. Up to June 30, 1895, the sum of $328,255.83 had been expended under a previous project, and there remained 55 obstructions having less than 3 feet depth at low water. The total amount expended under the present project up to June 30, 1905, was $152,129.35. This expenditure has resulted in the partial improvement of 10 shoals.

The river and harbor act of March 3, 1905, authorized the expenditure, in the discretion of the Secretary of War, from the appropriation therein made, of $5,000 for improvement of Little Tennessee River.

The maximum draft that can be carried, at mean low water, over the shoalest place in this section is about 18 inches. The extreme flood oscillations range from about 40.5 feet at Knoxville to about 58 feet at Chattanooga.

The commerce on this portion of the river during the calendar year 1904 amounted to about 562,677 tons, valued at about $4,473,617; the principal items in order of value being marble, forest products, general merchandise, farm products, and iron ore.

A map of this section of the river is found in the Annual Report of the Chief of Engineers for 1876, page 710, and an account of its survey in the Report of 1893, page 2333.

July 1, 1904, balance unexpended		$2,058.50
Proceeds of sales of property condemned and transferred		127.58
Amount appropriated by river and harbor act approved March 3, 1905		50,000.00
		52,186.08
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$4,266.39	
For maintenance of improvement	2,186.08	
		6,452.47
July 1, 1905, balance unexpended		45,733.61
July 1, 1905, outstanding liabilities		2,811.43
July 1, 1905, balance available		42,922.18
Amount (estimated) required for completion of existing project		455,000.00

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(*b*) *Chattanooga, Tenn., to Riverton, Ala.* (*238 miles*).—In its original condition the channel from Chattanooga to Browns Ferry was obstructed by bars, bowlders, reefs, and rocky projections. Navigation was possible during six to nine months annually. Between Browns Ferry and Florence were the Muscle shoals obstructions, which could be crossed only at unusually high water. Between Florence and Riverton the Colbert and Bee Tree shoals prevented navigation for six months of the year.

The average slope is 1.5 feet per mile from Chattanooga to Scott Point (17.5 miles), thence 0.4 foot per mile to head of Muscle Shoals Canal (158 miles), thence 2.73 feet per mile to Riverton (62.5 miles), with average low-water discharge varying from about 6,000 cubic feet per second at Chattanooga to about 10,000 cubic feet per second at Riverton.

Under a former project the Muscle shoals section was improved at a cost of $3,191,726.50 by some channel work at Little Muscle shoals and by the construction of a lateral canal in two divisions, one on the left bank about 3.5 miles long, with 2 locks, around the Elk River shoals, and the other on the right bank, about 14.5 miles long, with 9 locks, around the Big Muscle shoals. This work was done mainly from 1875 to 1890, under a project adopted originally in 1868.

The present project also dates back in part to 1868, but it has been modified in several particulars since then, so that at present it provides for a lock and dam to be built mainly by private parties at Hales bar, about 33 miles below Chattanooga, forming a pool that will extend to Chattanooga with a depth of at least 6 feet at low water, for open-channel work to secure a depth of 3 feet at low water from Hales bar to Decatur (about 126.5 miles), and for the improvement of the Colbert and Bee Tree shoals (between Florence and Riverton) by the construction of a lateral canal about 8 miles long, with 1 lock.

There has also been considerable open-channel work under former modifications of the project between Chattanooga and Hales bar and at Colbert and Bee Tree shoals.

Work under continuing contract amounting to $600,000 is now in progress at the Colbert Shoals Canal, as authorized by the river and harbor act of June 13, 1902, and additional work of this character to the extent of $400,000 was authorized by the river and harbor act of March 3, 1905. The latter act also appropriated $10,000 for the Hales bar lock and dam and authorized continuing contract work for $40,000 additional.

The total amount expended under the present project to June 30, 1905, was $1,549,466.39. This expenditure has resulted in the partial improvement of the open-river channel, extending the period of navigation during low water, at a cost of $575,301.06, and in the partial construction of the Colbert Shoals Canal, including the completion of about 95 per cent of the masonry of the lift lock, the purchase of right of way for the canal, the construction of 1,230 cubic yards of concrete river wall, and the excavation of 62,406 cubic yards of earth and 64,496 cubic yards of rock from the canal trunk, at a cost of $974,165.33 and outstanding liabilities amounting to $31,272.19.

The sum of $6,000, allotted from the appropriation for examinations, surveys, and contingencies of rivers and harbors, was also expended during the past year in the examination of foundations and preparation of plans for the Hales bar lock and dam.

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The Muscle Shoals Canal provides a permanent depth of 5 feet, except in its approaches, where additional work will be required to secure this depth at low water. The maximum draft that can be carried at mean low water over the shoalest place between Chattanooga and Riverton is about 2 feet. The extreme flood oscillations range from about 69 feet at the Suck, 12 miles below Chattanooga, to about 10 feet at Lock 4 of the Muscle Shoals Canal.

It is proposed to apply the amount estimated as a profitable expenditure for the fiscal year 1907 to the partial construction of lock gates and superintendence of work in connection with the lock at Hales bar ($40,000) authorized by the act of March 3, 1905, and to work on the Colbert Shoals Canal under continuing contract, as authorized by the act of March 3, 1905 ($200,000). The improvements at Hales bar and Colbert shoals will not be available for navigation until the works are completed.

The commerce carried on the river between Chattanooga and Florence during the calendar year 1904 amounted to about 173,406 tons, valued at about $7,204,682, the principal items, in order of value, being general merchandise, farm products, and forest products.

For details of the river from Chattanooga to Lock A, Muscle Shoals Canal, see reports of surveys in the Annual Reports of the Chief of Engineers for 1900, page 2956, and 1902, page 1743. A map of the Muscle Shoals reach is published in report of 1882, page 1840, and one of Colbert Shoals in report of 1898, page 1900.

COLBERT AND BEE TREE SHOALS.

July 1, 1904, balance unexpended	$489,123.78
Amount appropriated by river and harbor act approved March 3, 1905	200,000.00
Amount appropriated by sundry civil act approved March 3, 1905	50,000.00
Proceeds sale of property and overpayment refunded	9.80
	739,133.58
June 30, 1905, amount expended during fiscal year, for works of improvement	118,289.11
July 1, 1905, balance unexpended	620,844.47
July 1, 1905, outstanding liabilities	31,854.47
July 1, 1905, balance available	588,990.00
July 1, 1905, amount covered by uncompleted contracts	378,322.84
Amount (estimated) required for completion of existing project	1,252,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	200,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

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HALES BAR LOCK AND DAM.

Amount appropriated by river and harbor act approved March 3, 1905	$10,000.00
July 1, 1905, balance unexpended	10,000.00
Amount (estimated) required for completion of existing project	102,970.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	40,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

OPEN-CHANNEL WORK.

July 1, 1904, balance unexpended	$12,664.79
Amount appropriated by river and harbor act approved March 3, 1905	15,000.00
Proceeds sale of condemned property and property transferred	786.78
	28,451.57
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	5,908.53
July 1, 1905, balance unexpended	22,543.04
July 1, 1905, outstanding liabilities	5,966.28
July 1, 1905, balance available	16,576.76

(*c*) *Below Riverton, Ala.* (*226 miles*).—This part of the river is below most of the large tributaries. It has therefore more water than the upper river, and as the width is not too great, and the slope uniform and moderate, it is accessible to larger boats. The ruling depths were originally about 3.5 feet over the lower 196 miles, and 2 feet above this. The average slope of this section of the river is 0.34 foot per mile, with low-water discharge of about 10,000 cubic feet per second. In 1896 there were 49 shoals having less than 5 feet depth at low water, and two other shoals have since developed.

The existing project is to obtain, by dredging, a channel not less than 5 feet deep and 150 feet wide, and to protect Livingston Point and Tennessee Island from erosion, with a view to preserving the port of Paducah, Ky.

The total amount expended to June 30, 1905, was $297,663.12. This expenditure has resulted in the completion of the work at Livingston Point and Tennessee Island at a cost of $77,367.65; in the removal of snags, and in about 644,755 cubic yards of dredging at 22 localities, thus removing the worst obstructions below Hamburg. The results of dredging appear to be fairly permanent at about two-thirds of the places improved.

The maximum draft that can be carried over the shoalest place in this section, at mean low water, is about 3 feet. The extreme flood oscillations range from about 48 feet at Johnsonville to about 55 feet at Paducah, Ky.

The commerce carried on the river between Florence and Paducah during the calendar year 1904 amounted to about 871,380 tons, valued at about $18,325,000; the principal items, in order of value, being general merchandise, stone, railroad ties, cotton, and lumber.

For details of the river from Riverton to Paducah, see Annual Report of the Chief of Engineers for 1897, page 2262.

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July 1, 1904, balance unexpended		$6,383.71
Proceeds sales of condemned property		11.09
Amount appropriated by river and harbor act approved March 3, 1905		30,000.00
		36,394.80
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$1,217.46	
For maintenance of improvement	2,602.44	
		3,819.90
July 1, 1905, balance unexpended		32,574.90
July 1, 1905, outstanding liabilities		1,760.43
July 1, 1905, balance available		30,814.47

(See Appendix C C 1.)

2. Operating and care of Muscle Shoals Canal, Tennessee River.—For some details of this canal and its operation and care, also dimensions of locks, aqueduct, and drift sluice, see pages 2440–2446, Annual Report of the Chief of Engineers for 1901, with corrections given on page 1729 of report for 1902.

The canal was opened to navigation in 1890. It is in two sections, aggregating about 18 miles in length, and has 11 locks. A railroad nearly 15 miles in length is operated in connection with the maintenance of the canal.

Fifteen streams empty into the canal, none of them very large. Bars are constantly forming opposite their mouths and also at the entrances to the canal. A bucket dredge is kept on the canal in order to remove these bars as fast as they form.

The number of commercial steamboats and barges that used the canal during the calendar year 1904 was 448, counting every trip, and the freight carried was 10,560 tons, valued at $559,002. The number of lockages was 2,145.

The total amount expended during the fiscal year ending June 30, 1905, was $55,146.57.

(See Appendix C C 2.)

3. French Broad and Little Pigeon rivers, Tennessee.—The French Broad River is one of the largest tributaries of the Tennessee. It rises in North Carolina, flows generally in a northwesterly direction, and finally unites with the Holston River in the State of Tennessee, about 4.5 miles above Knoxville, to form the Tennessee River. It has a drainage area of about 5,600 square miles. Leadvale, Tenn., about 70 miles above the mouth, has generally been considered the head of navigation in Tennessee. An isolated portion of the river in North Carolina, between Brevard and Asheville, was under improvement for several years from 1877 to 1882.

In its original condition the river was obstructed by rock reefs, sand and gravel bars, and by bowlders, snags, and overhanging trees, and numerous islands in the river divided the water and diminished the depth in the navigable channels. There were 41 shoals obstructing navigation below Leadvale. The average slope below Leadvale is about 2.3 feet per mile, and the low-water discharge at Leadvale is reported as about 2,000 cubic feet per second.

The Little Pigeon River is formed by the junction of its east and south forks at Sevierville, Tenn., and flows in a northerly direction for about 5 miles, emptying into the French Broad about 29 miles

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above its mouth. The Little Pigeon is navigable at ordinary stages only about 2 miles above its mouth (to Catlettsburg), and thus practically amounts to an additional landing on the French Broad. In its original condition this portion of the river was obstructed by a bar at its mouth.

The project provides for open-river work on the French Broad to secure a navigable channel at low water from the mouth to Leadvale, sufficient to permit the passage of boats drawing about 2.5 feet, at an estimated cost of $150,000, and for the removal of the bar at the mouth of the Little Pigeon.

The amount expended to June 30, 1905, was $94,866.67. This expenditure has been applied to the improvement of navigation over fifteen of the shoal places in the French Broad, the maintenance of the navigable channel, and the removal of the bar at the mouth of the Little Pigeon. Steamboats rarely go above Dandridge, 46.5 miles above the mouth, and all the improvements are below this place.

The maximum draft that can be carried over the shoalest place at mean low water is probably about 18 inches. The extreme flood oscillation is about 30 feet, ordinary floods having a range of about 10 to 15 feet.

The commerce carried on this river during the calendar year 1904 amounted to about 258,847 tons, valued at about $2,129,246, the principal items in order of value being marble, grain, and general merchandise.

For details of the French Broad, see the report of survey in the Annual Report of the Chief of Engineers for 1900, page 3018. An examination of the Little Pigeon is reported in the Annual Report for 1891, page 2287.

July 1, 1904, balance unexpended	$459.19
Proceeds sales of condemned property	1.88
Amount appropriated by river and harbor act approved March 3, 1905	2,000.00
	2,461.07
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	325.78
July 1, 1905, balance unexpended	2,135.29
July 1, 1905, outstanding liabilities	126.19
July 1, 1905, balance available	2,009.10
Amount (estimated) required for completion of existing project	63,000.00

(See Appendix C C 3.)

4. Clinch, Hiwassee, and Holston rivers, Tennessee.—(a) Clinch River.—This river rises in the Cumberland Mountains in Virginia, and, after following a southwesterly course, empties into the Tennessee River at Kingston, 104 miles above Chattanooga. It drains an area of about 5,000 square miles. Its average slope below Clinton (60 miles from the mouth) is about 1.3 feet per mile. The ordinary low-water discharge at Clinton is about 900 cubic feet per second. There are about 193 miles of the river in the State of Tennessee.

In its original condition the channel was obstructed by rock reefs, sand and gravel bars, bowlders, snags, and overhanging trees.

The present project provides for channel excavations, removing surface obstructions, and the construction of wing dams and training

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walls, so as to secure a navigable channel 2 feet in depth at ordinary low water from the mouth of the river to Clinton, about 60 miles, and of 1.5 feet in depth from Clinton to Haynes (or Walkers) Ferry, about 66 miles. From Haynes Ferry to the State line, a distance of about 67 miles, it is proposed simply to remove the loose rock and bowlders, reduce the rock ledges, and remove snags, overhanging trees, and similar obstructions, so as to assist raft and flatboat navigation at the stages at which the river is ordinarily used.

The amount expended to June 30, 1905, was $52,472.49, which had resulted in reducing many of the reefs, removing obstructions from the channel, and building several wing dams and training walls, whereby the channel was so far improved that the river could be used at stages 2 to 3 feet lower than before the improvement was begun.

Small steamboats navigate the Clinch River as far as Clinton.

The total commerce on the Clinch River for 1904 was 100,701 tons, of which about 35 per cent was transported only from Kingston to the mouth, a distance of less than 1 mile. Of the remainder, 63,548 tons was floated down in rafts and 2,164 tons moved by steamboats. The principal items, in order of value, were general merchandise, forest products, and farm products.

For report of survey of this river see Annual Report of the Chief of Engineers for 1901, page 2542.

(*b*) *Hiwassee River.*—The Hiwassee River rises in the mountains of western North Carolina and northern Georgia, flows in a northwesterly direction, and enters the Tennessee River about 35 miles above Chattanooga. Its largest tributary is the Ocoee River, which enters it from the south about 35 miles from its mouth. The Hiwassee drains an area of about 2,725 square miles. Its average slope below the Ocoee is about 0.93 foot per mile. The low-water discharge at the mouth of the Ocoee is given as about 950 cubic feet per second.

On examination, made in 1874, the channel was found to be obstructed by rock reefs, gravel bars, snags, and overhanging trees.

The original project of improvement, based on the examination of 1874, was for a navigable channel 40 feet wide and 2 feet deep at ordinary low water to Savannah Ford, about 41.6 miles from the mouth of the river, to be secured by excavation of rock reefs and gravel bars and construction of wing dams. The sum of $36,427.07 was expended on this project.

The present project, based on a survey made in 1899, contemplates the development of a channel of not less than 116 feet width and 30 inches mean depth between the mouth of the river and the mouth of the Ocoee River by the use of spur dikes, training walls, and submerged sills, bank protection, and dredging, at an estimated cost of $71,125. There were 16 shoals having less than the desired depth at low water.

This project was adopted by the river and harbor act of June 13, 1902.

The amount expended thereon to June 30, 1905, was $10,093.85. This expenditure was applied to maintenance of the navigable channel and to work of improvement at Mathews shoals, about 9 miles from the mouth. The maximum draft that can be carried over the shoalest place at mean low water is about 2 feet. The extreme flood oscilla-

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tion at Charleston, 19 miles above the mouth, is about 32 feet, but ordinary floods do not exceed about 15 to 18 feet.

Small boats of about 100 tons capacity can navigate the river eight months in the year. Savannah Ford, 7 miles above the mouth of the Ocoee River, has at times been reached by steamboats, and is usually regarded as the head of steamboat navigation. The commerce on the Hiwassee River during the calendar year 1904 amounted to 3,003 tons, valued at $77,580.

For report of survey see Annual Report of the Chief of Engineers for 1901, page 2458.

(*c*) *Holston River.*—The Holston River is formed by the junction of its north and south forks at Kingsport, Tenn., and flows thence about 142 miles in a southwesterly direction and unites with the French Broad 4.5 miles above Knoxville to form the Tennessee River. It drains an area of about 3,811 square miles. It has an average slope of about 2.5 feet per mile, and a minimum discharge of about 650 cubic feet per second.

In its original condition the channel was obstructed by rock reefs and ledges, bowlders, snags, and overhanging trees. The present project, adopted in 1902, provides for the removal of channel obstructions and cutting overhanging trees from the mouth to Kingsport, at an estimated cost of $5,000.

The amount expended to June 30, 1905, was $3,523.90, which resulted in clearing the channel of some of the worst obstructions between the mouth and Ridleys shoals, a distance of about 137 miles.

The amount of commerce reported for the calendar year 1904 was 12,249 tons, valued at about $105,692. This was nearly all rafted. There is no regular upstream navigation of the river. Occasionally a small steamboat runs up 30 to 60 miles from the mouth during periods of high water.

For report of survey see the Annual Report of the Chief of Engineers for 1901, page 2518.

July 1, 1904, balance unexpended	$2,786.45
Proceeds sales of condemned property	8.77
Amount appropriated by river and harbor act approved March 3, 1905	6,000.00
	8,795.22
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	780.16
July 1, 1905, balance unexpended	8,015.06
July 1, 1905, outstanding liabilities	51.88
July 1, 1905, balance available	7,963.18
Amount (estimated) required for completion of existing project	[a] 56,625.00

(See Appendix C C 4.)

REPORT ON CONDITION OF MUSCLE SHOALS CANAL, TENNESSEE RIVER, MADE IN COMPLIANCE WITH SENATE RESOLUTION OF JANUARY 24, 1905.

Maj. H. C. Newcomer, Corps of Engineers, submitted report dated February 16, 1905, on the condition of *Muscle Shoals Canal, Tennessee*

[a] For Hiwassee River.

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River, with reference to right of way, to acquisition of land, and to water power, required by Senate resolution dated January 24, 1905. The report was transmitted to Congress and printed in Senate Document No. 173, Fifty-eighth Congress, third session. (See also Appendix C C 5.)

IMPROVEMENT OF OHIO RIVER BY OPEN-CHANNEL WORK AND BY CONSTRUCTION OF LOCK AND DAM NO. 37; OPERATING SNAG BOATS ON OHIO RIVER.

This district was in the charge of Col. G. J. Lydecker, Corps of Engineers, until November 18, 1904, and in the charge of Lieut. Col. E. H. Ruffner, Corps of Engineers, since that date. Division engineer, Col. G. J. Lydecker.

1. Ohio River (general open-channel improvement).—This work was commenced by the General Government in 1827, when low-water navigation over many of the bars and shoals was impossible for commercial purposes; but the improvements made and maintained since then have provided fairly convenient channels at such places for a profitable light-draft local freight and passenger service during low-water periods. The difference in level of water surface of the river varies; at Cincinnati, nearly midway between the head and mouth of the river, the average annual range during the past thirty years is 48.1 feet.

The project under which operations have been carried on has been a continuous and progressive one, the principal features of the work being the removal of snags, rocks, and wrecks from the general channel; the direct improvement of bars and shoals, by dredging and rock excavation; the construction, repair, and maintenance of low dikes and dams, to concentrate and direct the flow of water in improved channels; bank protection and the construction and repair of levees where required in the interest of navigation; the construction, repair, and maintenance of ice piers and harbors; miscellaneous improvement, including surveys, establishment, care and record of water gauges, establishment of harbor lines, regulation of encroachment and deposits on the banks of the river or in its channel, and the supervision of construction of bridges across the river. The length of river through which the work extends is but little short of 1,000 miles, and the total expenditure by the Government during the seventy-eight years it has been in progress, exclusive of liabilities outstanding June 30, 1905, is $6,608,617.43, making an annual average expenditure for improvements and their maintenance to date of $85.76 per mile.

The principal operations of the last fiscal year were as follows: The U. S. dredges *Ohio* and *Oswego* excavated 292,865 cubic yards of sand, gravel, and bowlders, and removed 501.5 tons of rocks and sunken logs, 431 piles, and 2 wrecks, resulting in improved channels with low-water depth of from 4 to 6 feet at Short Creek bar, Blair Run bar, Coon Run bar, Opossum Creek bar, Barnes Run bar, Mill Creek bar, Matamoras, W. Va., Reas Run bar, Ohio River bar at mouth of Muskingum River, and mouth of Muskingum River; 5,625.2 cubic yards of stone, 112,676 feet B. M. of oak timber, and 13,264 pounds of iron were used in repairing low dams and dikes at Browns, Marietta, Buffington, and Raccoon islands and at Eightmile and Fourmile bars; 298.3 cubic yards of stone, 63,120 feet B. M. of oak

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timber, and 11,707.5 pounds of iron were used in repairing the ice piers at Middleport and Gallipolis, Ohio. Local surveys or examinations were made at the following localities, in response to requests from river interests for special dredging or other form of improvement: Brunot Island; Waller ripple; bar above Beaver Bridge; Baker Island; Captina Island; Mustapha Island; Middleport, Ohio; bar at Evansville, Ind.; Slim Island, and Grand Chain. A contract was entered into June 14, 1905, for the extension and repair of two dikes near Mound City, Ill., at an estimated cost of $37,212.50. These dikes are intended to establish and maintain a reliable channel along the Mound City frontage of the Ohio River, as approved by the Board of Engineers for Rivers and Harbors. (Report of the Chief of Engineers, 1904, Appendix D D 6, pp. 2456–2457.) The sum of $25,000, appropriated conditionally by the deficiency act of July 1, 1902, for improvement of the river between Cairo and Mound City, has not been drawn from the Treasury, and on June 30, 1905, this amount was covered into the surplus fund of the Treasury. Surveys for harbor lines between Dams No. 4 and No. 5, Ohio River, were completed, including the necessary references, subject to the final approval of the Secretary of War. A number of examinations were made for preventing encroachments or in supervising War Department permits, the latter including plans for bridges at Mingo Junction, Ohio, and Ceredo, W. Va., both of which are complete and open for traffic, and at Steubenville, Ohio, now in process of construction.

By authority of the Secretary of War, and in accordance with the provisions of the river and harbor act of March 3, 1905, a Board of officers of the Corps of Engineers was appointed to examine the Ohio River and report upon a comprehensive system of improvement by canalization of the river by means of locks and dams, or by other methods calculated to provide for the probable demands of traffic, present and prospective.

The nature of the Ohio River is such that its improvement, whether by canalization (locks and dams) or open channel, can not bring full benefit to navigation interests until the improvement shall have become more continuous than past appropriations have permitted; the unimproved portions afford less depth of channel than the improved sections and limit the available draft for the whole river to that required for passing its shoalest parts. Dredging and snagging operations will be required at many places, even should a more or less complete system of canalization be finally adopted, and for open-channel improvement continuous work and simultaneous operations will be absolutely necessary to produce effective results. The Government plant should be largely increased in order that any great amount of work may be accomplished during the comparatively short periods to which effective operations must be limited each year on account of unfavorable river conditions. Several light-draft towboats, barges, and derrick boats for dike construction and removing rocks or other obstructions and two or more modern dredges of large capacity adapted to the varying kinds of work are all urgently needed before anything approximating satisfactory progress can be expected, nor can the service of such plant be obtained under contract on this river.

In order to provide for navigation during comparatively low-water periods in winter, many of the existing dikes and dams will require to be kept in a state of repair, as the movable dams can not safely be

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operated during a time of even light-running ice, although properly protected steamboats may be able to navigate at such time. The severe losses to floating craft during the winter of 1904–5 have shown the importance of maintaining certain of the harbors of refuge afforded by existing ice piers and the providing of others at carefully selected localities. Special surveys, designed to fill in and complete the skeleton work now outlined in connection with the investigations of the Board of Engineer officers appointed to examine and report upon the Ohio River, will be required at many points.

The commerce of the river during the past year, so far as indicated by statistics that the engineer officer in charge of the river has been able to obtain, was as follows: General merchandise, coal, etc., 10,142,551 tons; passengers, 3,951,384. The diminution in tonnage and passenger traffic was due to the unusually long duration of low water in summer and ice in winter during the fiscal year.

July 1, 1904, balance unexpended		$230,454.40
Amount appropriated by river and harbor act approved March 3, 1905		[a] 208,200.00
October 10, 1904, amount received for lost transit		200.00
June 16, 1905, amount received from sale of maps		4.25
March 16, 1905, amount received from appropriation for operating and care of canals, etc., Muskingum River		9,900.00
April 29, 1905, amount received from appropriation for operating snag boats on the Ohio River		3,742.48
		452,501.13
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$49,754.58	
For maintenance of improvement	36,806.48	
		86,561.06
July 1, 1905, balance unexpended		365,940.07
July 1, 1905, outstanding liabilities		2,240.14
July 1, 1905, balance available		[b] 363,699.93
July 1, 1905, amount covered by uncompleted contracts		47,653.10
Amount (estimated) required for completion of existing project		Indefinite.

(See Appendix D D 1.)

2. Lock and Dam No. 37, Ohio River.—The river and harbor act approved June 13, 1902, provided for commencing this work by appropriating the sum of $100,000 and authorizing its completion at a total cost not exceeding $1,050,000 under the continuing-contract system.

Previous operations relating to this improvement, including the detailed surveys and examinations incident to final selection of the site for the work, are summarized in the Report of the Chief of Engineers for 1903, page 426, and for 1904, page 454.

During the last fiscal year the work of constructing the lock and dam was advertised (August 27), bids were opened September 27, and a contract was entered into October 27, 1904. The contract, which is estimated to aggregate about $792,152, covers all temporary and permanent work, excepting the steam and air machinery, electric lighting plant, permanent buildings (above foundations), and

[a] The act appropriated $300,000, but $91,800 has been diverted for other purposes contemplated in the act.

[b] $15,873.66 of this balance pertains to ice piers at Middleport, Gallipolis, and Maysville.

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water-supply system; the cement will be furnished by the United States. A temporary office building for the use of the United States during the construction of the lock and dam was erected at a cost of $773.85 under contract (dated August 31).

Owing to the lateness of the season no work of construction was done during 1904, but a considerable amount of preliminary work was accomplished, such as building a railroad siding, receiving machinery, etc. In May, 1905, active construction work was begun and has continued, except as interrupted by high water, until the close of the fiscal year. The land on both sides of the river has been cleared except the final grubbing, excavation for lock and guide walls has been carried on by dredging, some filling has been done, the cofferdam and protection work incident thereto has been begun, and a large amount of iron work completed, some of which is now at the site of dam. Bids for 34,000 barrels of American Portland cement (a little more than half the total quantity required in the construction of the work) were received February 21, and contract for same entered into April 15, 1905, at an aggregate cost of $49,640. The total expenditure on account of the work to June 30, 1905, exclusive of outstanding liabilities, is $40,944.09, of which the sum of $17,775.70 was expended during the last fiscal year.

July 1, 1904, balance unexpended	$476,831.61
Amount appropriated by sundry civil act approved March 3, 1905	50,000.00
	526,831.61
June 30, 1905, amount expended during fiscal year, for works of improvement	17,775.70
July 1, 1905, balance unexpended	509,055.91
July 1, 1905, outstanding liabilities	387,73
July 1, 1905, balance available	508,668.18
July 1, 1905, amount covered by uncompleted contracts	835,989.12
Amount (estimated) required for completion of existing project	500,000.00

(See Appendix D D 2.)

3. Operating snag boat on the Ohio River.—The condition of the channel way of the Ohio, the necessity for continuous snag-boat work, and the benefits accruing therefrom to river commerce are plainly shown by the yearly reports of obstructions removed, which obstructions, if permitted to remain, would make navigation highly dangerous at ordinary stages and hazardous at any time.

The project for removing obstructions by a properly equipped snag boat was put in operation in 1876, the boat having been completed at a cost of $125,125.24, and the expense of operating having been borne by appropriations for improving the Ohio River until 1890. The river and harbor act of September 19, 1890, provided $25,000 yearly for this purpose, and the act of June 3, 1896, increased the yearly appropriation to $50,000.

The amount expended on this work during the fiscal year ending June 30, 1905, was $34,688.23.

As far as practicable the removal of obstructions is carried on whenever permitted by the stage of water and the absence of dangerous ice; and during the last fiscal year the regular Ohio River

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snag boat *E. A. Woodruff* was in active service from July 12 to October 25, 1904, and from April 24 to June 30, 1905, the obstructions removed being as follows: 694 snags, aggregating in weight 3,086.36 tons; 8 rocks, measuring 2,261 cubic feet; 79 wrecks, comprising 39 coal barges, 29 coal boats, 3 flat boats, 2 fuel flats, 2 wharf boats, 1 sand boat, and the remains of 3 steamboats. The snag boat also removed 5,097 cords of drift which had accumulated above the ice piers at Pomeroy and Gallipolis.

The snag boat not being available, the following obstructions within 50 miles of the head of the river were removed chiefly by the U. S. launch *Wenonah*, equipped with explosives: 8 coal boats and parts of 2 others, 4 coal barges, 1 covered barge, and 1 large rock.

The snag boat *Woodruff* is a powerful and finely equipped vessel that does admirable service during moderate stages of water, but can do little or nothing when the river is at a stage of less than 4 feet, though it is at such stages that snagging operations should be prosecuted most advantageously.

It is extremely important that snagging operations should be extended to cover these low-water periods, and to this end it is recommended that the yearly appropriation for snagging, as provided for by the act of June 3, 1896, be increased to $65.000 for the fiscal year ending June 30, 1906, the additional $15,000 to be used in the building and equipment of one light-draft combination snag and derrick boat adapted for use at even extreme low-water stages. This boat would form a part of the regular snagging plant, and would be operated from the yearly appropriation made for that purpose.

(See Appendix D D 3.)

IMPROVEMENT OF HARBOR AT PITTSBURG, PENNSYLVANIA; OF ALLEGHENY RIVER, PENNSYLVANIA; OF MONONGAHELA RIVER, WEST VIRGINIA AND PENNSYLVANIA; CONSTRUCTION OF LOCKS AND DAMS NOS. 2–7, OHIO RIVER; OPERATING AND CARE OF LOCKS AND DAMS NOS. 1 AND 6, OHIO RIVER, AND DREDGING POOL 6, OHIO RIVER.

This district was in the charge of Maj. Wm. L. Sibert, Corps of Engineers, having under his immediate orders First Lieut. Alfred B. Putnam, Corps of Engineers, the entire year and First Lieut. Edward N. Johnston, Corps of Engineers, since April 5, 1905, and First Lieut. George R. Spalding, Corps of Engineers, since June 3, 1905. Division engineer, Col. G. J. Lydecker, Corps of Engineers.

1. Monongahela River, West Virginia.—Navigation of Monongahela River, West Virginia, was in its original condition impeded at high water by swift currents, the fall per mile being about 2 feet. At low stages it was obstructed by shoals and numerous gravel and rock bars. Steamboat navigation was practicable at high stages as far upstream as Morgantown. Occasionally a boat could go as far upstream as Fairmont, and downstream navigation of flats and small rafts was practicable at medium and high stages.

The original project of the above portion of the Monongahela River is dated February 5, 1872, and contemplated the construction of Locks and Dams Nos. 8 and 9. This project was completed on November 8, 1899, with the result that boats drawing 5.2 feet of water could navigate the river in low water as far upstream as Morgantown, W. Va., the river having previously been slackwatered from its

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mouth to Lock No. 8 by the Monongahela Navigation Company. The amount expended under this project was $436,900.

The existing project, dated February 3, 1897, and approved March 13, 1897, provides for the construction of six locks and dams, Nos. 10 to 15, inclusive, between Morgantown and Fairmont, W. Va., at an estimated cost of $1,275,000 for the six. The sum of $107,463.86 was recovered from surety company on contract of C. I. McDonald for failure to complete Locks and Dams Nos. 10 to 15. The amount expended under this project at the close of fiscal year ending June 30, 1905, was $1,257,369.94. None of this was applied to maintenance.

Condition of work at end of fiscal year ending June 30, 1905:

Nos. 10 to 15, inclusive.—The locks and dams proper were completed and assigned to "Operating and care of canals," etc., in January, 1904. Additional protection has been made to abutment grounds, lock tenders' dwellings, and necessary storehouses and shops completed.

The completion of these six locks and dams extended the slack-water navigation of the Monongahela River 28 miles, from Morgantown to 4 miles above Fairmont, W. Va., with a minimum navigable depth of 7 feet. The improvement should enable the people of the territory affected to transport coal, general freight, etc., almost uninterruptedly to market. The people at Fairmont and above are, however, deprived of a reasonable use of this improved river by a bridge across the fifteenth pool belonging to the Baltimore and Ohio Railroad Company that has under it a clearance of only 26.7 feet at pool stage. The Secretary of War decided that this bridge was an unreasonable obstruction to navigation, and on September 1, 1904, ordered that changes necessary to remove the obstruction be made.

The usual variation of level of water surface is 22 feet.

In that portion of the river previously improved by Locks and Dams Nos. 8 and 9 the volume of business has materially increased over that originally existing there. A daily line of packets plies the river between Pittsburg and Morgantown, and towboats operate as necessity requires. Since the opening of Locks 10 to 15, inclusive, a small packet, capable of passing under the low bridge below Fairmont, has made daily trips between Morgantown and Fairmont. Small towboats also operate on this section of the river.

More extended information is given in Annual Reports of the Chief of Engineers for 1896 and 1898, pages 2134, respectively.

A report of survey of the Monongahela River between Geneva and Morgantown will be found in House Executive Document No. 144, Forty-second Congress, second session, and from Morgantown to Fairmont, W. Va., in House Executive Document No. 91, Forty-fourth Congress, first session.

Commercial statistics, fiscal year 1905.

Lock.	Freight.	Passengers.	Lock.	Freight.	Passengers.
	Tons.[a]			*Tons.*[a]	
No. 8	86,788	15,501	No. 12	9,429	7,180
No. 9	88,857	14,371	No. 13	7,634	8,119
No. 10	16,979	7,971	No. 14	3,989	9,405
No. 11	15,865	7,912	No. 15	1,734	22,091

[a] 2,000 pounds.

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July 1, 1904, balance unexpended	$107,568.74
Amount received account of failure to complete Locks and Dams 10–15 under C. I. McDonald contract	107,463.86
	215,032.60
June 30, 1905, amount expended during fiscal year, for works of improvement	89,938.68
July 1, 1905, balance unexpended	125,093.92
July 1, 1905, outstanding liabilities	5,032.52
July 1, 1905, balance available	120,061.40
July 1, 1905, amount covered by uncompleted contracts	1,457.50

(See Appendix E E 1.)

2. Monongahela River, Pennsylvania.—That part of the Monongahela River in Pennsylvania extends from Pittsburg to the mouth of Dunkards Creek, a distance of 89 miles. In its original condition, prior to 1840, it was navigable for steamboats only at high stages. A downstream navigation for light-draft flats and rafts was practicable at high and medium stages. The average fall per mile is about 0.9 foot, and the minimum discharge about 160 cubic feet per second.

In 1833 Congress provided for a survey of the river from Pittsburg to Brownsville, a distance of about 57 miles. This survey was not followed by an appropriation for improving the river, and the legislature of Pennsylvania, by act of March 31, 1836, incorporated and authorized the Monongahela Navigation Company to improve the river from Pittsburg, Pa., to the Virginia State line, a distance of 90½ miles. This company built 7 locks and dams, producing slack water from Pittsburg to within 2 miles of the West Virginia State line.

The river and harbor act of June 3, 1896, authorized and directed the Secretary of War to institute and carry to completion proceedings for condemnation of all the property and appurtenances of the company. The property was acquired by the United States on July 7, 1897.

The amount expended on original and modified projects prior to operations under existing projects is $3,769,073.88, including the purchase money.

The existing projects for the improvement are as follows:

Adopted by the act of June 13, 1902, providing for the rebuilding of Lock and Dam No. 2. The limiting cost is $655,961. The amount expended under this project at close of fiscal year ending June 30, 1905, is $368,210.30, none of which was applied to maintenance.

Adopted by the act of March 3, 1905, providing for the rebuilding of Lock and Dam No. 3 at a limiting cost of $589,196. The amount expended under this project at close of fiscal year ending June 30, 1905, is $10,299.14, none of which was applied to maintenance.

Adopted by the act of March 3, 1899, providing for enlargement and improvement of Lock 6, certain accessory structures at Lock 3, and for additional pieces of floating plant, at an estimated cost of $185,556. The amount expended under this project at close of fiscal year ending June 30, 1905, is $181,751.97, none of which was applied to maintenance.

Adopted by the act of March 3, 1905, providing for the acquisition of river front at Dam No. 6 and for certain improvements to Dams

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Nos. 5 and 6 by an appropriation of $7,850. No money has been expended under this project up to the close of fiscal year ending June 30, 1905.

Condition of work at end of fiscal year ending June 30, 1905:

Rebuilding Lock and Dam No. 2.—The foundations and walls of the locks were nearly completed. Work was begun on upper and lower guide walls and guard walls. The abutment and 390 feet of the foundation for dam were completed. Work was in progress for the completion of the remaining section of the foundation. The leaves for one of the upper gates were about ready for delivery at close of year.

Rebuilding Lock and Dam No. 3.—The necessary land has been purchased. Contract has been let for the construction of the lock and hired-labor work on abutment begun.

Locks 3, 6, and floating plant.—All of the work of improvement at Locks 3 and 6 contemplated in existing project, except the purchase of certain land at Lock 6, has been completed. All of the floating plant provided for in the existing project, consisting of a dredge and two dump scows and repair steamer with snagging appliances, was completed and put in service.

Locks and Dams 5 and 6.—Negotiations are under way for the securing of the river front at No. 6 by purchase or condemnation. No work has as yet been done to the improvements to Locks 5 and 6. There has been no money expended under this project at close of year.

Usual variation of level of water service, 25 feet.

The Monongahela River in Pennsylvania is navigable in fact for its entire length.

The aggregate tonnage of freight, principally coal, including iron and miscellaneous articles, on the river for thirteen years, was as follows:

Calendar year—	Tons.	Fiscal year—	Tons.
1892	4,163,304	1899	6,954,955
1893	4,142,644	1900	5,994,975
1894	4,918,089	1901	6,856,507
1895	4,555,703	1902	9,100,887
1896	5,989,159	1903	11,369,814
Fiscal year—		1904	9,268,736
1898	6,117,973	1905	9,211,752

The traffic of the river is hampered and restricted by insufficient capacity and inconveniencies at the locks. This will not be overcome until the enlargement of Locks 1, 4, and 5 is provided for.

A history of the slack-water system of this river and an estimate of the cost of its enlargement and improvement to afford adequate accommodation for a large and growing traffic are given in Annual Report of the Chief of Engineers for 1897, pages 2412 to 2424, inclusive.

A report upon the commercial value and importance of the works of the Monongahela Navigation Company is printed in Annual Report of the Chief of Engineers for 1887, page 1802.

A report of the Chief of Engineers on the subject of acquiring by purchase the locks and dams on Monongahela River, Pennsylvania, can be found in House Executive Document No. 249, Fifty-third

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Congress, third session. Testimony relative to value of improvement of Monongahela Navigation Company and to commercial importance of free navigation of said river can be found in the Annual Report of the Chief of Engineers for 1896, page 2142. Report on examination of Locks and Dams Nos. 1, 3, 4, and 5 is printed in House Document No. 209, Fifty-eighth Congress, second session.

CONSOLIDATED.

July 1, 1904, balance unexpended	$601,334.23
Amount appropriated by river and harbor act approved March 3, 1905	207,850.00
	809,184.23
June 30, 1905, amount expended during fiscal year, for works of improvement	320,078.64
July 1, 1905, balance unexpended	489,105.59
July 1, 1905, outstanding liabilities	50,314.07
July 1, 1905, balance available	438,791.52
July 1, 1905, amount covered by uncompleted contracts	437,691.58
Amount (estimated) required for completion of existing project	389,196.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	389,196.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

REBUILDING LOCK NO. 2.

July 1, 1904, balance unexpended	$594,417.85
June 30, 1905, amount expended during fiscal year, for works of improvement	306,667.15
July 1, 1905, balance unexpended	287,750.70
July 1, 1905, outstanding liabilities	25,700.62
July 1, 1905, balance available	262,050.08
July 1, 1905, amount covered by uncompleted contracts	181,131.58

REBUILDING LOCK NO. 3.

Amount appropriated by river and harbor act approved March 3, 1905	$200,000.00
June 30, 1905, amount expended during fiscal year, for works of improvement	10,299.14
July 1, 1905, balance unexpended	189,700.86
July 1, 1905, outstanding liabilities	21,113.45
July 1, 1905, balance available	168,587.41
July 1, 1905, amount covered by uncompleted contracts	256,560.00
Amount (estimated) required for completion of existing project	389,196.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	389,196.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

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LOCKS 3, 6, ETC.

July 1, 1904, balance unexpended	$6,916.38
June 30, 1905, amount expended during fiscal year, for works of improvement	3,112.35
July 1, 1905, balance unexpended	3,804.03
July 1, 1905, outstanding liabilities	3,500.00
July 1, 1905, balance available	304.03

LOCKS 5 AND 6.

Amount appropriated by river and harbor act approved March 3, 1905	$7,850.00
July 1, 1905, balance unexpended	7,850.00

(See Appendix E E 2.)

3. Operating and care of locks and dams, Monongahela River.—The slack-water system of the Monongahela River comprises 15 dams and 19 locks. Locks 1 to 4, inclusive, are double locks; 5 to 15 are single locks. The chambers of the large locks are 56 feet wide, and the shortest of these below Morgantown is 216 feet long in the clear; the six new locks above Morgantown are each 56 feet wide by 182 feet useful length. The chambers of the small locks are 50 feet wide by 160 feet long in the clear. Controlling depths at pool surfaces on the sills at the different old locks below Morgantown vary from 4 to 6.7 feet; on the new locks above that point they are uniformly 7 feet. During low stages of water a depth of 8 feet is maintained below Dam No. 4 by placing flashboards on the dams, and a depth of 7.5 feet above that point by placing flashboards on Dams 4 and 5.

The original condition and scope of this improvement is described in the preceding summary reports for improving Monongahela River, Pennsylvania and West Virginia.

The existing project is the operating and maintaining of Locks and Dams 1 to 15, inclusive.

The amount expended up to June 30, 1904, was $1,460,313.76.

The locks were operated throughout the year except when closed for limited periods for repairs and during floods and ice. The dams extend slack water to a point 4 miles above Fairmont, W. Va., a distance of 131 miles above the mouth of the Monongahela River, at Pittsburg.

The most notable work of repair during the year was that to the small lock at No. 4, seriously damaged by a passenger steamer in the spring of 1904, which lock was again put in service in November. The facilities for building derrick boats, flatboats, etc., at the boat yard at No. 4 were enlarged and several such boats were constructed.

A number of snags and wrecks were removed by the snag boat, and about 24,000 cubic yards of gravel, sand, coal, waste, etc., excavated from the channel, mostly by the United States dredge boat.

The amount expended during fiscal year ending June 30, 1905, for operating and care of the locks and dams was $234,070.41.

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Total commerce of the river.

Fiscal year.	Products.	Passengers.	Fiscal year.	Products.	Passengers.
	Tons.[a]			*Tons.*[a]	
1902	9,100,887	181,527	1904	9,268,736	116,174
1903	11,369,814	101,457	1905	9,211,752	78,458

[a] 2,000 pounds.

(See Appendix E E 3.)

4. Harbor at Pittsburg, Pa.—This harbor comprises that portion of the Ohio River lying above Davis Island dam, a length of 4.7 miles; that portion of the Allegheny River lying between its mouth and Brilliant station, Allegheny Valley Railroad, a length of 7.3 miles, and that portion of the Monongahela River lying between its mouth and McKeesport, a distance of 15.5 miles; total length of harbor, 27.5 miles. That portion of the harbor most used as such, and called the lower harbor, lies between the Davis Island dam and Dams Nos. 1 on the Allegheny and Monongahela rivers and measures 8 miles of river. In its original condition the lower harbor depths were from 3 to 4 feet on natural mean low river, and very often still lower stages caused suspension of navigation.

Since the completion of Davis Island dam, in 1885, the maximum draft which could be carried over the shoalest place was scant 8 feet at pool stage. Parts of the channel and harbor are from 10 to 12 and from 16 to 20 feet in depth. The average widths of the harbor at pool surfaces are: On the Ohio, about 1,100 feet; on the Allegheny, about 930 feet, and at different parts of the Monongahela, from about 750 to 950 feet. The capacity of the harbor is impaired by shoal places and high dumps projecting from the banks. The use for harbor purposes of that portion of the harbor in the Allegheny River is practically nullified by the low bridges on that stream. The clear heights of these bridges above their respective pool surfaces are from 27½ to 35½ feet. The least height, with chimneys down, of the packets that ply between Pittsburg and points on the Ohio, Kanawha, and Muskingum rivers is 45 feet. The average height of the Ohio River towboats, with chimneys down, is 44 feet. The height of a suitable packet for the Allegheny River is about 33 feet and of a suitable towboat about 28 feet. The result is that practically none of the coal and iron or steel products intended for southern shipments is loaded or harbored in the Allegheny River.

In 1858 the State of Pennsylvania, through a board of commissioners, made a detailed survey of the rivers at and near Pittsburg and laid down on the maps regularized high and low water lines, and referred such lines to stone monuments in the ground. No means, however, were provided for preserving the monuments nor for preventing the filling of the river riverward of these lines.

In 1894 a Board of Engineer officers recommended certain harbor lines for the harbor of Pittsburg, from the Davis Island dam to Brilliant and to Homestead. The recommended lines generally followed the actual banks as they existed at that time. These lines were approved by the Secretary of War January 29, 1895. An extension of these lines on the Monongahela River from Homestead to McKeesport was approved by the Secretary of War April 3, 1902.

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The original and existing project for improvement was adopted by the river and harbor act of March 3, 1899, and provided for dredging a channel through the lower harbor (below Dams Nos. 1 on the Allegheny and Monongahela rivers) where needed, 10 feet deep at pool and 500 feet wide below Smithfield Street Bridge, Monongahela River, and above this bridge and in the Allegheny River of a less width, and one limited by lines from ends of channel spans of adjoining bridges, except at the Pan Handle Railroad bridge, where the dredged channel under modified project is to have a width of 570 feet; for raising the old riprap dam across Brunot Island channel, Ohio River; for removing abandoned structures and unauthorized and obstructive fillings projecting from the banks beyond the harbor lines; for marking of harbor lines, and for inspecting and patrolling the harbor, all at an estimated cost of $110,662.90, exclusive of maintenance, after the first year, of $10,000 annually.

The amount expended on the work of existing project up to the close of the fiscal year ending June 30, 1905, was $127,336.97. Of this amount, $16,674.07 was applied to maintenance.

Condition of work at end of fiscal year ending June 30, 1905: The project for channel dredging on the Monongahela River, including the modification providing for wider channel at the Pittsburg, Cincinnati, Chicago and St. Louis Railroad bridge, has been finished from Lock No. 1 to shortly above the Smithfield Street Bridge. From this point downstream to lower end of the projected dredged channel near Market street the channel, proposed to be 500 feet wide, has been dredged to a width of 300 feet. In the Allegheny River, near its mouth, a channel 1,200 feet long and 180 feet wide has been made. By directing the work of sand dredgers, operating under permits of the Secretary of War, a channel was made through Garrison bar, Allegheny River, about 1,200 feet long and 150 feet wide, and by the same means a channel through a shoal in the upper end of the Ohio River was improved. The raising of the dam at Brunot Island has been completed. The marking of the harbor lines has been completed throughout the harbor by placing reference marks on monuments and substantial structures, and, where practicable, by marks on the lines.

The maximum draft that could be carried June 30, 1905, at pool-full stage over the shoalest part of the locality under improvement is 10 feet. The usual variation of level of water surface is 20 feet.

Report of Board of Engineers, dated August 10, 1903, made in compliance with requirements of section 1 of the river and harbor act of June 13, 1902, on examination of Pool No. 1, Ohio River (Davis Island pool), Pittsburg Harbor, with estimate of cost of securing increased depth and additional harbor facilities, is given in Annual Report of the Chief of Engineers for 1903, page 1688.

The principal commercial uses of the harbor are the mooring of coal fleets awaiting a rise in the Ohio for proceeding to destination on that river or on the lower Mississippi, the mooring of timber rafts and boat bottoms coming down the Allegheny River on rises, the delivery of coal and other materials to mills, furnaces, steel plants, and yards, and the accommodation of the several packet lines plying on the three rivers and whose routes terminate at the harbor. Besides coal, considerable quantities of steel rails, cotton ties, sheet iron, wire, nails, etc., are shipped by barges to the lower-river markets.

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Commercial statistics.

Calendar year—	Products.	Passengers.	Calendar year—	Products.	Passengers.
	Tons.[a]			*Tons.*[a]	
1900	8,141,451	884,415	1903	12,240,360	702,269
1901	10,916,489	817,800	1904	9,873,448	604,477
1902	12,252,405	996,500			

[a] 2,000 pounds.

More extended information as to establishment of harbor lines at Pittsburg is given in Annual Report of the Chief of Engineers for 1895, page 2420; extension of harbor lines down Ohio River in Annual Report of the Chief of Engineers for 1904, page 2554; up Monongahela River, for 1903, page 1698; modifications of harbor lines in Annual Reports of the Chief of Engineers for 1896, page 2215; for 1899, page 2449; for 1903, pages 1702, 1706, and 1709; for 1904, pages 2551 and 2553; project for dredging, marking harbor lines, inspection, surveys at Pittsburg Harbor, in Annual Report of the Chief of Engineers for 1899, page 2399.

July 1, 1904, balance unexpended	$8,029.92
Amount appropriated by river and harbor act approved March 3, 1905	10,000.00
	18,029.92
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	9,703.99
July 1, 1905, balance unexpended	8,325.93
July 1, 1905, outstanding liabilities	729.65
July 1, 1905, balance available	7,596.28

(See Appendix E E 4.)

5. Operating and care of Dams Nos. 1 and 6, Ohio River.—Davis Island dam (Dam No. 1) is a movable dam, and is the first of a series for the improvement of the upper portion of the Ohio River. The chamber of the lock is 110 feet wide and 600 feet long in the clear. The improvement was completed in 1885, at a cost of about $940,000. The dam was built to secure a low-water depth of 6 feet, and has proved a great benefit to commerce in general, and especially to coal interests, by allowing the harborage of coal at Pittsburg in large quantities while awaiting stages of water suitable to the passage of boats down the river.

Apart from usual repairs and renewals of horses, props, and Chanoine wickets, no material alterations were made to the movable dam during the fiscal year ending June 30, 1905. The bear-trap gate continued in service, but its condition is such as to render it liable to collapse at any time. Plans were prepared for its reconstruction, and on June 26 contract was awarded to the Baker Contract Company for removal of old gate, remodeling its piers and foundations, and the erection of a new gate, at a cost of $19,500.

The reconstruction of the back-channel dam at Davis Island dam was completed in October, 1904. The structure is a fixed concrete dam with a movable crest of the Chittenden drum type.

When Davis Island dam was built the esplanade was constructed at an elevation of only 17 feet above the pass sill, and as a consequence the power plant and other buildings were flooded by even ordinary

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freshets. To avoid this a concrete wall 8 feet in height above the level of the land wall was built and filling and grading behind this wall nearly completed.

Lock and Dam No. 6 was placed in operation in August, 1904. The operation of this lock and dam is satisfactory in every particular except that the bear traps warp very badly in raising and lowering. The A-frame dam has not been maneuvered. Considerable scour having developed around piers, both above and below the bear-trap foundation, about 2,000 tons of riprap was laid to protect the piers and foundation.

The existing project is the operating and maintenance of Dams Nos. 1 and 6.

The amount expended up to June 30, 1904, was $360,836.21.

The amount expended during fiscal year ending June 30, 1905, for operating and care of the locks and dams was $104,138.95.

Traffic through Dams Nos. 1 and 6, Ohio River, for the fiscal year 1905, as measured by the commerce through Dam No. 1, Ohio River:

Fiscal year.	Freight.
	Tons.[a]
1905	3,083,359

[a] 2,000 pounds.

(See Appendix E E 5.)

6. Construction of Locks and Dams Nos. 2 to 7, inclusive, Ohio River, in Pennsylvania.—A general description of the Ohio River is contained in the Annual Report of the Chief of Engineers for 1896, page 2062. The system of improvement of this river by movable dams was approved by Congress in the appropriation act for the year 1875–76 (construction of dam at Davis Island—first dam below Pittsburg). The act of September 19, 1890, provided for the construction of a dam at or near Beaver, Pa., known as No. 6. The above represent practically the original projects for the slack-water system of the Ohio. The project for Dams Nos. 2, 3, 4, and 5 is contained in Annual Report for 1896, page 2120; that for Dam No. 7 in Annual Report for 1899, page 2361.

These projects contemplate securing a 6-foot stage of water, and were adopted by Congress June 3, 1896.

Lock No. 6 was completed August 17, 1904. The river and harbor act of March 3, 1905, provided for the completion of Locks Nos. 2, 3, 4, and 5, and a modification thereof, and of No. 6 so as to secure a navigable depth of 9 feet at pool stage. For this purpose $500,000 was appropriated and contracts authorized involving expenditures not to exceed $1,281,376 in addition to moneys already appropriated.

The amount expended on these works to June 30, 1905, is as follows:

Dams 2 to 5:	
Dam 2	$672,630.13
Dam 3	553,102.06
Dam 4	451,298.29
Dam 5	526,457.76
	2,203,488.24
Dam 6	1,048,258.27
Dam 7	16,116.34
Total	3,267,862.85

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Of this amount $68,188.56 was expended in maintenance, viz, for rebuilding a portion of the land wall and underpinning a portion of the river wall of Lock No. 5.

Local benefits have been derived from the completion of Lock No. 6. Full benefits from the construction of any one lock will not be obtained until all of the locks between such lock and Pittsburg are completed.

The condition of the work is as follows:

Lock and Dam No. 2, below Glenfield.—The lock masonry and 500 feet of navigable pass, the crib substructure of remainder of dam, practically all of the concrete foundations, piers, and abutment, are completed for the 6-foot stage. Nearly all of fixed irons for dam and bear-trap weirs are in place. Movable irons and wickets of Chanoine weir are in position and movable parts of bear-trap leaves one-third completed. The necessary steps have been taken to raise masonry of piers and abutment of dam and to alter movable parts to meet requirements of the 9-foot project. The use of this lock and the navigation pass were obstructed by a high bar, known as Merrimans bar. A channel approaching the pass and the lock has been dredged to a width of between 200 and 400 feet. The walls of the power house are practically finished and those of the lock houses one-third competed.

Lock and Dam No. 3, at Glenosborne.—The masonry of lock and the foundation walls for power house and lock houses have been completed. Four hundred feet of navigation pass and the crib foundation for 200 feet more are constructed. Contracts have been let for the construction of power house and for the completion of the dam. Bids have been advertised for the construction of the bear traps and the lock gates.

Lock and Dam No. 4, at Legionville.—The masonry of lock and the foundation walls of lock houses and power house have been completed. A section of the navigable pass 250 feet long has been completed. Approaches to the navigable pass were dredged. Contracts were let for the completion of the dam and the construction of the power house. Bids for building the bear-trap leaves and the gates have been advertised for.

Lock and Dam No. 5, above Rochester.—The masonry of lock and a 397-foot section of the navigable pass are completed. Contracts have been let for the completion of the dam, for the construction of a power house, and for lock keepers' houses. Preparations have been made to lower the lower lock sill so as to provide a 9-foot depth over the same at pool stage. Bids for the construction of bear-trap leaves and for the gates have been advertised for.

Lock and Dam No. 6, below Beaver.—This lock and dam were practically completed and put in operation August 17, 1904. A bar, however, exists in the river above this lock. Specifications have been prepared, on which bids will be asked, for removing the same.

Lock and Dam No. 7, below Industry.—The site of this dam has been secured. Plans for the entire work are in preparation.

Practically all of the completed movable parts constructed for the 6-foot project, Dams 2 to 5, can and have been utilized for the 9-foot project on the weirs where shorter movable parts are required.

For commercial statistics, see report for operating and care of Dams Nos. 1 and 6, Ohio River.

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CONSOLIDATED.

July 1, 1904, balance unexpended	$768,297.45
Amount appropriated by river and harbor act approved March 3, 1905	500,000.00
	1,268,297.45
June 30, 1905, amount expended during fiscal year, for works of improvement	518,160.30
July 1, 1905, balance unexpended	750,137.15
July 1, 1905, outstanding liabilities	14,868.71
July 1, 1905, balance available	735,268.44
July 1, 1905, amount covered by uncompleted contracts	954,321.39
Amount (estimated) required for completion of existing project	2,233,376.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	1,281,376.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

DAMS NOS. 2, 3, 4, AND 5.

July 1, 1904, balance unexpended	$717,375.86
Amount appropriated by river and harbor act approved March 3, 1905	500,000.00
	1,217,375.86
June 30, 1905, amount expended during fiscal year, for works of improvement	479,305.90
July 1, 1905, balance unexpended	738,069.96
July 1, 1905, outstanding liabilities	14,851.56
July 1, 1905, balance available	723,218.40
July 1, 1905, amount covered by uncompleted contracts	954,321.39
Amount (estimated) required for completion of existing project	1,281,376.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	1,281,376.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

DAM NO. 6.

July 1, 1904, balance unexpended	$41,939.25
June 30, 1905, amount expended during fiscal year, for works of improvement	36,755.72
July 1, 1905, balance unexpended	5,183.53
July 1, 1905, outstanding liabilities	17.15
July 1, 1905, balance available	5,166.38

DAM NO. 7.

July 1, 1904, balance unexpended	$8,982.34
June 30, 1905, amount expended during fiscal year, for works of improvement	2,098.68
July 1, 1905, balance unexpended	6,883.66
Amount (estimated) required for completion of existing project	952,000.00

(See Appendix E E 6.)

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7. Dredging pool 6, Ohio River.—An allotment of $20,800 was made June 12, 1905, from the appropriation of $300,000 made by act of March 3, 1905, for the general improvement of the Ohio River, for the removal of about 32,000 cubic yards of material from the bar in upper approach to Lock No. 6. Specifications are in course of preparation and it is intended to do the work by contract after public advertisement.

No money has been expended during the year.

Amount allotted from appropriation for improving Ohio River, act of March 3, 1905	$20,800.00
July 1, 1905, balance unexpended	20,800.00

(See Appendix E E 7.)

8. Construction of locks and dams above head of Sixmile Island, and at Springdale, Allegheny River, Pennsylvania.—Prior to the completion, in 1885, of the Davis Island dam in the Ohio River, 5 miles below its head, it was impossible to navigate the Allegheny River with steam craft of lightest draft during low-water periods, which frequently continued for months at a time. Since then a navigable depth of 8 feet has been afforded by that dam, when raised, to Garrison ripple, 2 miles up the stream. Herr Island dam, located one-half mile below Garrison ripple, was designed to extend slack-water navigation about 4 miles to the city limits of Pittsburg, and at the same time form the first step toward the radical improvement of the Allegheny.

The original project, adopted September 29, 1890, contemplated a lock and fixed dam, but the dam was subsequently changed to a movable one at the request of various local interests. The then estimated cost of the improvement was $600,000, exclusive of cost of site, for which $32,689.25 was paid.

The river and harbor act of June 3, 1896, provided for the further extension of slack water to Natrona, 22 miles above Herr Island dam, by the construction under continuing contracts of 2 additional locks and dams at a limiting cost, including the completion of Herr Island dam, of $1,132,000. The river and harbor act of March 3, 1905, authorized contracts for the completion of these locks and dams at an additional expenditure not to exceed in the aggregate $281,226.63.

Under the general project approved March 13, 1897, it was provided that Dams Nos. 2 and 3 should be fixed timber structures and the locks concrete. The lock at Herr Island is also of concrete construction. The Herr Island dam comprises a 500-foot navigable pass of Chanoine wickets and 2 bear-trap weirs, each 94 feet long. Of the three structures provided for under the project, Herr Island lock and dam has been completed, and Lock and Dam No. 3 is practically completed.

The expenditures on the works to the close of the year ending June 30, 1905, were $1,120,042.81.

The condition of the work at the expiration of the fiscal year ending June 30, 1905, was as follows:

Lock and dam at Sixmile Island (No. 2).—The lock walls, guide walls, guard crib, and abutment are practically completed, and construction of the dam commenced.

Lock and dam at Springdale (No. 3).—The lock and dam and lock master's dwelling are practically completed.

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The completion of Herr Island dam, which extends Pittsburg Harbor up the Allegheny River for a distance of 4 miles, with a navigable depth of 8 feet, is of immense benefit to the manufacturing plants along the banks of the Allegheny River within this reach, connecting them with the harbor of Pittsburg and with the coal fields of the Monongahela River. Little benefit will be derived from the work done in the construction of Locks and Dams Nos. 2 and 3 until the said structures are both completed.

The usual variation of level of water surface is 30 feet.

For the calendar year 1904 the commerce reported on that part of the river under improvement for slack-water navigation was 2,155,547 tons of freight and 8,513 passengers.

July 1, 1904, balance unexpended	$173,269.11
June 30, 1905, amount expended during fiscal year, for works of improvement	161,311.92
July 1, 1905, balance unexpended	11,957.19
July 1, 1905, outstanding liabilities	437.36
July 1, 1905, balance available	11,519.83
July 1, 1905, amount covered by uncompleted contracts	216,546.47
Amount (estimated) required for completion of existing project	281,226.63
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	281,226.63
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix E E 8.)

9. Operating and care of Locks and Dams Nos. 1 and 3, Allegheny River, Pennsylvania.—No. 1 is a movable dam and was the first to be completed of a series of three dams authorized by Congress for the Allegheny River. The structure was opened to navigation on January 1, 1903. Its pool extends slack water to the head of Six-mile Island, 6 miles above the mouth of the river.

Dam No. 3 was opened to navigation November 29, 1904. Its pool extends slack water to Natrona, a distance of 8 miles.

The existing project is the operating and maintenance of Locks and Dams Nos. 1 and 3.

The amount expended up to June 30, 1904, was $21,438.55.

The locks and dams were operated throughout the year whenever conditions permitted or required.

The amount expended during the fiscal year ending June 30, 1905, for operating and care of the locks and dams was $27,235.94.

Traffic through Locks and Dams Nos. 1 and 3, Allegheny River, for the fiscal year 1905, as measured by the commerce through Lock and Dam No. 1, Allegheny River.

Fiscal year.	Tons.[a]
1905	1,230,352

[a] 2,000 pounds.

(See Appendix E E 9.)

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10. Allegheny River, Pennsylvania.—In its original condition the Allegheny River abounded in obstructions, such as bowlders, snags, islands, bars, and wide-spreading shoals, all of which rendered navigation at best hazardous, and practicable only at such high stages of water as would enable craft to clear the obstructions. Necessarily this condition resulted in frequent losses to river interests, and because of these obstructions navigators were deprived of a considerable portion of what should have been the navigable period.

The project adopted in 1878 and 1880, and which still continues, contemplates only the removal of the bowlders and snag obstructions and the construction of low dams and dikes to close secondary channels and concentrate the low-water flow on shoals.

The amount expended under this project to the close of the year ending June 30, 1905, was $259,996.32, fully one-half of which was applied to maintenance. The work done has not increased the depth of water, generally speaking, except where dikes or dams have been built, but the removal of the obstructions has made it possible to utilize the entire flow of the stream, so that now navigators may operate safely on from 1 to 2 feet lower stages than formerly.

The present condition of the channel is generally satisfactory, having been largely cleared of the more objectionable obstructions, but to maintain this condition it is necessary to annually remove any bowlders or snags brought in by the tributaries or carried along by ice and freshets. The dikes and dams are also becoming old and require frequent repairs.

During the past fiscal year slight repairs were made to Hickory, Pithole, and Nicholsons Island dams and Redbank and Cowanshannock dikes, and some channel obstructions were removed.

Except on the lower 25 miles of the river the principal traffic consists in the downstream transportation of timber and lumber rafts, new coal-boat bottoms, barges, and flats, usually loaded with tan bark, lumber, posts, railroad ties, and other timber products, and the towage of gravel, sand, stone, etc. Steamboating is not now conducted to a great extent above Kittanning, principally because of the obstructive low bridges along that section. The annual tonnage of the river above slack-water improvements in course of construction is about 400,000, extending over 230 miles from Tarentum, Pa., to Olean, N. Y.

July 1, 1904, balance unexpended	$6,822.94
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	1,819.26
July 1, 1905, balance unexpended	5,003.68
July 1, 1905, outstanding liabilities	3.00
July 1, 1905, balance available	5,000.68

(See Appendix E E 10.)

ESTIMATE OF COST OF WORK REQUIRED TO COMPLETE THE PROJECT FOR LOCKS AND DAMS IN ALLEGHENY RIVER MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED JUNE 13, 1902.

Maj. W. L. Sibert submitted report, dated November 29, 1904, with *estimate of cost of work required to complete the project for locks and dams on Allegheny River, Pennsylvania*, required by the river and harbor act approved June 13, 1902. An estimate of $256,521.50

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is submitted. The report was transmitted to Congress and printed in House Document No. 167, Fifty-eighth Congress, third session. (See also Appendix E E 11.)

CONSTRUCTION OF LOCKS AND MOVABLE DAMS IN OHIO RIVER BETWEEN THE PENNSYLVANIA STATE LINE AND CINCINNATI, OHIO, AND IMPROVEMENT OF KANAWHA AND LITTLE KANAWHA RIVERS, WEST VIRGINIA.

This district was in the charge of Maj. George A. Zinn, Corps of Engineers. Division engineer, Col. G. J. Lydecker, Corps of Engineers.

1. Movable dams in Ohio River between the Pennsylvania State line and Cincinnati.—A general description of the Ohio River is contained in the Annual Report of the Chief of Engineers for 1896, page 2062. The system of improvement of this river by movable dams was approved by Congress in the act of March 3, 1875 (construction of dam at Davis Island—first dam below Pittsburg). The act of September 19, 1890, provided for the construction of a dam at or near Beaver, Pa., known as No. 6. The above represent practically the original projects for the slack-water system of the Ohio. The project for Dams Nos. 8 to 18, inclusive, is contained in Annual Report of the Chief of Engineers for 1899, page 2361, and that for Dams Nos. 19 and 26, in Annual Report of the Chief of Engineers for 1902, page 1867.

Congress, in the river and harbor act of March 3, 1905, made provision for 9-foot navigation in the pools formed by Dams Nos. 2, 3, 4, 5, and 6, and for an examination of and report on the river by a Board of Engineers, with regard to the method and means of improvement which will meet the demands of traffic, present and prospective.

When completed the present project will provide for 6-foot navigation from Dam No. 6 to below Cincinnati, Ohio.

The adopted estimate of the cost of the locks and dams is $850,000 to $950,000 each. It has, however, become evident from experience elsewhere on the river that greater care must be exercised in preparing the foundations of these structures than was contemplated when the adopted estimate of cost was made. For this reason, as well as on account of the general increase since that time in the prices for labor and material, it is desirable that a formal revision of this estimate should be presented to Congress. From present information the district officer, in reports to this office, has placed the average cost of Locks and Dams Nos. 8, 11, 13, 18, and 19 at about $1,020,000 each, varying, of course, at the different localities.

As the difference in cost at the different localities is considerable, it is desirable that appropriations should not be confined to any particular dam, but that the acts should be so worded that a surplus at one locality, where the cost is less than the average, may be applied to make up the deficiency at another, where the average estimate is insufficient.

Continuing contracts have been authorized for carrying on part of the work on locks for Dams Nos. 8 and 11 and constructing Dams Nos. 13 and 18.

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The following is a statement of the condition of the works:

Dam No. 8.—Work on the lock and guide walls was commenced July 25 and good progress made. At the close of the year the foundation for the upper guide wall and 240 linear feet of the wall were completed. The foundations for the upper gate track and for 170 linear feet of river wall are well under way. This work is being done under contract, about 10 per cent of which is completed.

Dam No. 11.—On July 17 work was commenced by the contractor on the lock and guide walls, but only fair progress was made. About 75 per cent of the lower gate recess, 330 linear feet of foundation for land wall, and 50 linear feet of foundation for lower guide wall were built. Twenty-five feet of the land wall was carried to its proper height. Not over 5 per cent of the work contracted for is completed.

All the land necessary for this site was purchased.

Dam No. 13.—Progress on the lock at this site has been unusually slow, and unless greater activity is shown the contract, which was entered into June 21, 1901, will not be completed by the close of the present working season. The following is the condition of the work at the close of the fiscal year: 619 linear feet of the river wall, 640 linear feet of the land wall, and the upper gate recess and track are completed. The lower gate recess lacks about 25 per cent of completion, and the sheet piles are driven for the track foundation. Foundation for the power house is built. About 70 per cent of the contract is completed.

An additional piece of land required as a site for lock houses, etc., was acquired.

Dam No. 18.—The lock and guide walls were completed and considerable filling and paving placed in the lock yard. This work lacks about 10 per cent of completion.

A contract was entered into May 18, 1905, for constructing the movable dam. Work was commenced on June 1, but high water interfered with its progress.

Work at this locality is in good condition for early completion should the necessary funds be made available.

Dam No. 19.—All the land for this site was purchased and marked with concrete monuments.

According to the river and harbor act of March 3, 1905, work at this locality is contingent upon the completion of the survey (examination) above referred to. Operations are suspended.

Dam No. 26.—The river and harbor act of March 3, 1905, appropriates $35,000 for purchase of site, but stipulates that no part of same shall be expended until further action by Congress. Accordingly no work will be undertaken.

The amount expended on the above works to June 30, 1905, is as follows:

Dam No. 8	$99,503.91
Dam No. 11	87,797.23
Dam No. 13	294,810.25
Dam No. 18	265,291.70
Dam No. 19	17,011.64
Total	764,414.73

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The canalization of this part of the river is not far enough advanced to benefit navigation, and therefore has had no effect upon freight rates.

For commercial statistics see reports for improving Ohio River and operating and care of Davis Island dam.

July 1, 1904, balance unexpended	$1,329,022.60
Amount appropriated by river and harbor act approved March 3, 1905	295,000.00
Amount appropriated by sundry civil act approved March 3, 1905	100,000.00
	1,724,022.60
June 30, 1905, amount expended during fiscal year, for works of improvement	361,837.33
July 1, 1905, balance unexpended	1,362,185.27
July 1, 1905, outstanding liabilities	7,643.81
July 1, 1905, balance available	[a] 1,354,541.46
July 1, 1905, amount covered by uncompleted contracts	795,868.35
Amount (estimated) required for completion of existing project	2,258,400.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	[b] 653,400.00

(See Appendix F F 1.)

2. Little Kanawha River, West Virginia.—A description of the original condition of the river and its availability for purposes of commerce is given in the Annual Report of the Chief of Engineers for 1875, page 740.

The original project provided for removing rocks, snags, and overhanging and fallen trees above Burning Springs, W. Va., at a cost of $7,300, as adopted by Congress on August 14, 1876. The act of Congress of June 14, 1880, made provision for the construction of a lock and dam about 2 miles above Burning Springs. This lock was opened to navigation on December 2, 1891, and has since been maintained under the indefinite appropriation for operating and care of canals and other works of navigation. Funds are appropriated from time to time for maintaining the present channel by the removal of obstructions which have reformed.

The amount expended to June 30, 1905, is $214,387.04, of which $904.70 was applied to maintenance under the act of June 13, 1902.

The four locks and dams owned by the Little Kanawha Navigation Company and the Government lock and dam afford 4-foot navigation from Parkersburg to Creston, W. Va., 48 miles. Owing to the bad condition of the former structures, this depth is not maintained during the low-water season. The maximum draft which can be carried at mean low water over the shoalest place in that part of the river under improvement is 6 inches. Flatboat navigation extends to Burnsville, W. Va., about 120 miles above Parkersburg.

Lack of funds prevented the removal of obstructions during the low-water season of 1904. The river and harbor act of March 3,

[a] $160,000 to be applied to existing contracts at Dams Nos. 8 and 11.

[b] For Locks Nos. 8 and 11, $160,000; for Locks and Dams Nos. 13 and 18, $493,400; total, $653,400.

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1905, providing $1,000 for maintenance, preparations were in progress at the close of the fiscal year for beginning work on the removal of obstructions from the channel.

A statement of the commerce is contained in the report for operating and care of lock and dam on Little Kanawha River, West Virginia.

As the most important part of the river is controlled by a corporation and as tolls are charged on all freight passing its locks and dams, the improvements conducted by the Government have little effect on freight rates. Should, however, the navigation become reasonably continuous and the tolls be removed, there is no doubt that the freight rates would be reduced in this section.

Congress, in the act of March 3, 1905, provided $75,000 for the purchase of the locks and dams owned by the Little Kanawha Navigation Company, and adopted a project for their repair at an estimated cost of $88,000 if purchased at the price stated. At the close of the year no definite action had been taken by the company toward transferring its holdings on this river to the Government.

Reports on an examination of the river between Lock No. 5 and Burnsville and on the locks and dams not owned by the Government are contained in the Annual Report of the Chief of Engineers for 1904, pages 2597 to 2617.

July 1, 1904, balance unexpended		$281.35
Amount appropriated by river and harbor act approved March 3, 1905		164,000.00
		164,281.35
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$33.00	
For maintenance of improvement	31.29	
		64.29
July 1, 1905, balance unexpended		164,217.06
July 1, 1905, outstanding liabilities		18.75
July 1, 1905, balance available		164,198.31
Amount (estimated) required for completion of existing project		88,000.00

(See Appendix F F 2.)

3. Operating and care of lock and dam on Little Kanawha River, West Virginia.—The lock and dam known as No. 5 was built under the appropriation for improving the Little Kanawha River, West Virginia, being a part of the original project as given in the Annual Report of the Chief of Engineers for 1875, page 740.

The amount expended for operating and care of this work to June 30, 1905, is $38,687.46, of which $3,792.06 was expended during the past year.

The lock was operated during the entire year except for one hundred and sixty-two days, owing to low and high water and ice. Such repairs as were found necessary were made to the lock and dam. These structures were in reasonably good condition at the close of the year. The new storehouse was completed.

The lock and dam provides a navigable depth of 4 feet at mean low water to Creston, W. Va., but, owing to the leaky condition of the dams owned by the Little Kanawha Navigation Company, the depth of the lower stretch of the river is often less.

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During the calendar year 1904 the commerce that passed Lock No. 5 amounted to 66,415 tons, of which 57,953 tons consisted of timber products (saw logs, ties, etc.).

(See Appendix F F 3.)

4. Kanawha River, West Virginia.—A description of the condition of the river, the projects, and the general work accomplished (the locks and dams being in operation) are contained in the Annual Report of the Chief of Engineers for 1900, page 490.

The amount expended under the original project is $50,000; that expended under the present project to June 30, 1905, is $4,124,526.88.

A project for the expenditure of the balance available from the funds appropriated June 4, 1897, provides for betterments to the existing works, constructing additional necessary buildings for shops, etc., procuring additional land, providing steam power for operating lock machinery, and dredging. During the past fiscal year sinks, pumps, concrete floors (in cellars), and window blinds were placed in and on the lock houses; two new lock houses built at No. 6; buildings (offices, shops, sheds, etc.) constructed at Locks Nos. 2–8, and fences erected where needed. Considerable work was accomplished in grading Government land, placing sewers for draining same, laying brick walks, and building retaining walls at No. 11. A contract was entered into for constructing guide cribs at Locks Nos. 2, 3, and 11, and work commenced. Some original dredging—straightening, widening, and deepening the channel—was done.

The maximum draft which can be carried at the shoalest part of the slack-water system at mean low water is 6 feet. Loup Creek shoal, about 90 miles above Point Pleasant, W. Va., is the head of navigation. On March 9, 1905, the river reached a stage of 28.5 feet at Charleston.

For commercial statistics, see report for operating and care of locks and dams on Kanawha River, West Virginia.

The improvement of this river having been gradual, it is difficult to give the exact effect the improvement has had upon freight rates. There is no doubt, however, that the freight rates, where transportation by water is available, are regulated thereby. The rates for transportation by water have not changed materially, although the cost of floating plant has greatly increased.

A report of the examination of the unimproved section of the river, about 4½ miles between Lock No. 2 and the falls, is contained in the Annual Report of the Chief of Engineers for 1904, page 2587.

July 1, 1904, balance unexpended	$131,000.45
Amount received from sales	275.32
	131,275.77
June 30, 1905, amount expended during fiscal year, for works of improvement	32,036.49
July 1, 1905, balance unexpended	99,239.28
July 1, 1905, outstanding liabilities	1,110.09
July 1, 1905, balance available	98,129.19
July 1, 1905, amount covered by uncompleted contracts	38,092.35

(See Appendix F F 4.)

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5. Operating and care of locks and dams on Kanawha River, West Virginia.—Under the projects for improving the Kanawha River ten locks and dams were built, two fixed dams and eight movable (Chanoine type), extending slack-water navigation for a distance of 90 miles from the Ohio River. The maintenance of these works is provided for by the indefinite appropriation for operating and care of canals and other works of navigation.

The location of each lock and dam, and year in which completed, are given in the Annual Report of the Chief of Engineers for 1899, page 428.

The total amount expended in operating and care of these works to June 30, 1905, is $656,986.50, of which $61,880.27 was expended during the past year. As $1.15 of the amount expended during the fiscal year 1904 was refunded, it was deducted from the total.

Ice interrupted navigation about twenty-five days at the movable and forty-five days at the fixed dam. As the rainfall was unusually light during the calendar year 1904, it was with difficulty that the pool levels were maintained during the fall months. The movable dams were operated without serious accident.

As the length of service of the works on this river increases, the cost of maintenance becomes greater. The repairs necessary to keep the structures in good condition were made.

The commerce for the calendar year 1904 amounted to 1,233,153 tons, with a valuation of $7,899,233. Of the foregoing, 1,094,700 tons consisted of coal and 82,674 tons of timber products, which are valued at $1,204,170 and $481,607, respectively.

(See Appendix F F 5.)

IMPROVEMENT OF MUSKINGUM RIVER, OHIO, OF BIG SANDY RIVER AND ITS FORKS, WEST VIRGINIA AND KENTUCKY, AND OF KENTUCKY RIVER, KENTUCKY.

This district was in the charge of Lieut. Col. E. H. Ruffner, Corps of Engineers, having under his immediate orders Lieut. Paul S. Bond, Corps of Engineers, since September 4, 1904. Division engineer, Col. G. J. Lydecker, Corps of Engineers.

1. Muskingum River, Ohio.—The original condition of the waterway and its availability for purposes of commerce are given in the Annual Report of the Chief of Engineers for 1900, Part 1, page 488.

The report is limited to work carried on under an appropriation of $102,000 by act of August 11, 1888, for the construction of a lock at Taylorsville and the reconstruction of the lock at Zanesville, Ohio; an appropriation of $6,000 included in the sundry civil act of July 1, 1898, for the repair and extension of the levee at Zanesville, Ohio, and an appropriation of $10,300 by act of June 13, 1902, for continuing improvement, and appropriations of $8,000 for continuing improvement and $110,000 for the rebuilding of Lock and Dam 11, contained in the river and harbor act approved March 3, 1905. This act stipulates that no part of said $110,000 shall be expended unless the Secretary of War shall have satisfactory assurance that the State of Ohio or other agency will expend not less than $200,000 upon that part of the Ohio canal system which connects the river above the lock with Lake Erie. By act of Congress approved August 18, 1894, the reconstruction of the Zanesville lock

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was indefinitely postponed and the money originally appropriated for it was diverted to other purposes. The amount expended on the original and modified projects prior to operations under existing project is $117,339.45.

The existing project for expenditure of the appropriations in the river and harbor act of March 3, 1905, and the balance unexpended from former appropriations is to raise the crest of Dam No. 3 1 foot and build a lock master's dwelling at Lock No. 10, at an estimated aggregate cost of $8,000, and to rebuild Lock and Dam No. 11, at an estimated cost of $110,000; up to the close of the fiscal year ending June 30, 1905, no expenditures had been made under this project. The work in progress during the fiscal year consisted in completing the construction of a lock master's dwelling at Lock 4, under the appropriation of June 13, 1902, and preparation of project and plans for the work to be done under the appropriations of March 3, 1905.

The minimum miter-sill depth is the controlling mean low-water depth of the system; this is 6 feet at all the locks except the lower sills of Locks 1 and 4, where it is 3 feet and 5 feet, respectively. The usual variations of level of water surfaces is 38 feet at Lock 1 and 24 feet at Lock 10. The head of slack-water navigation is 8.2 miles above Dam 10, or 84 miles above the mouth of river; at ordinary stages the stream is navigable for light-draft boats to Dresden, Ohio, 7 miles above the head of slack water.

The commercial statistics for this work can not be separated from the general commerce of the river, and are reported under the head of operating and care of locks and dams on Muskingum River.

July 1, 1904, balance unexpended	$3,225.67
Amount appropriated by river and harbor act approved March 3, 1905	118,000.00
Received from sale of property at public auction	47.30
	121,272.97
June 30, 1905, amount expended during fiscal year, for works of improvement	2,073.05
July 1, 1905, balance unexpended	119,199.92
July 1, 1905, outstanding liabilities	32.88
July 1, 1905, balance available	119,167.04
July 1, 1905, amount covered by uncompleted contracts	1,357.00

(See Appendix G G 1.)

2. Operating and care of locks and dams, Muskingum River, Ohio.—The slack-water system comprises ten locks and dams. The locks have an available length of 163 feet, with a width of 36 feet and a depth over the sills at mean low water of from 6 to 8 feet, except at the lower sill of Lock 4, where the depth is 5 feet, and at the lower sill of Lock 1, at the mouth of the river, where the depth is about 3 feet. The original condition and scope of this improvement is described in the Annual Report of the Chief of Engineers for 1901, Part 1, pages 485 and 486.

The operating and maintaining of the locks and dams and maintaining of navigable widths and depths of channels devolves upon the indefinite appropriation for "Operating and care of canals and other works of navigation." The amount expended for this purpose up to the close of the fiscal year ending June 30, 1905, was $1,540,096.81. An additional sum of $17,190.44 was expended in

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building a protection wall at Zanesville and altering certain bridges at Taylorsville and Marietta. The expenditures during the fiscal year ending June 30, 1905, amounted to $55,048.57.

The system was in good navigable condition at the close of the year, but some parts are decayed, worn-out, and must be renewed.

The total commerce for the calendar year 1904 was approximately 60,146 tons freight, valued at $3,250,000, and 74,000 passengers.

(See Appendix G G 2.)

3. Big Sandy River and Levisa and Tug forks, West Virginia and Kentucky.—In their original condition this river and its forks were much obstructed by rocks, bars, snags, and leaning trees. During the low-water period of each year navigation was practically suspended.

The original project, providing for the removal of rocks, snags, and overhanging trees from the main stream and the Tug and Levisa forks, which unite at the town of Louisa, Ky., to form the main stream, was for "improving Big Sandy River from Catlettsburg, Ky., to the head of navigation," and was adopted in 1878. (Annual Report of the Chief of Engineers for 1875, pp. 756–769.) This improvement was for the purpose of aiding light-draft steamboat, push-boat, and rafting navigation on the main river and on the Tug and Levisa forks.

In 1880 the appropriations for the forks were made distinct from that for the main river, and three works resulted. At the same time the project of 1878 for the improvement of the Big Sandy proper was so modified as to provide for the construction of a lock and dam in that stream at Louisa, Ky., immediately below the junction of the Tug and Levisa forks. A concurrent resolution of Congress of April 14, 1898, required surveys and the preparation of more complete plans and estimates for the improvement of the Big Sandy and the Tug and Levisa forks of the same in West Virginia and Kentucky, with probable cost of same. A report was submitted, and is printed as House Document No. 456, Fifty-fifth Congress, second session, and found on page 2159 of the Annual Report of the Chief of Engineers for 1898.

The river and harbor act of March 3, 1899, adopted a portion of the extended improvement recommended and authorized the letting of contracts for completion of two locks and dams on the Big Sandy River between Louisa and the mouth, at a cost not to exceed $450,000.

The river and harbor act of June 13, 1902, authorized the construction of a lock on each of the forks, next above their junction, the completion of the locks and dams in the Big Sandy River, and the raising of the crest of the dam at Louisa. An appropriation of $175,000 was made and authority given for the expenditure of $175,000 additional. Of this amount, $50,000 was appropriated by the sundry civil act of March 3, 1903, and $85,000 by that of March 3, 1905. These locks have been placed under contract, and work on them is progressing. The cost of the dams for these locks will be about $100,000 each, not provided for in any existing legislation. The cost of the additional locks and dams on the two forks is estimated at $225,000 each, not provided for in any existing legislation. The river and harbor act of March 3, 1905, appropriated $43,000 for maintenance and for improving the mouth of the river by regulating works, estimated to cost $40,000.

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The three locks already constructed provide a minimum depth of 6 feet on their lower miter sills, except at Lock No. 1, at Catlettsburg, Ky., where the depth on the lower miter sill depends upon the stage of the Ohio River, and it may be so slight that navigation will be stopped. The depth on this miter sill is uncertain, and will remain so until a dam is placed in the Ohio River below Catlettsburg, or until suitable regulating works at the mouth of the Big Sandy River are provided. The proposed height of the Ohio pool is such as to give a minimum depth of 7.3 feet on the lower miter sill of Lock No. 1. The sand bars in the mouth of the Big Sandy River are sometimes above the lower miter sill of the lock, and because of low water in the Ohio, due to the fact that there is no Ohio dam, regulating works at the mouth of the Big Sandy are required pending the construction of said dam. These works are already provided for by existing legislation, as hereinbefore mentioned. The crest of the dam at Louisa will be raised as soon as funds become available.

Up to June 30, 1905, the expenditures on the main stream had aggregated $955,957.15, with the following result:

Under the project for removing obstructions a good channel had been opened and maintained, and under modified projects (1880 and 1891) a lock and movable dam at Louisa, Ky., had been completed and opened to navigation. Under the provisions of the act of March 3, 1899, the survey had been made and two locks and movable dams in the main river had been completed and opened to navigation. Under the provisions of the act of June 13, 1902, the construction of locks on each of the forks next above their junction had been commenced.

Up to June 30, 1905, $30,241.21 had been expended on Tug Fork, and $30,194.22 on Levisa Fork, resulting in the material improvement of navigation, and giving increased facilities for push boats at low water and for rafts and steamboats at moderate stages for a distance of about 100 miles on each fork.

The work heretofore done has removed most of the dangerous snags and overhanging trees from the river and its forks. The minimum draft that can be carried over the shoalest portions of the forks at mean low water is uncertain and changeable, owing to the constant movement of the bottom, and can not be definitely stated. At times navigation by the shallowest craft can be carried on only by the building of splash dams in the streams. In the main river navigation at low water is provided by the locks already built, as above mentioned. The variation of the water surface at Catlettsburg is 60 feet and at Louisa 50 feet.

The commerce consists largely of timber, cross-ties, and staves, and varies somewhat with the condition of the streams, being greatest during wet seasons and least during times of long-continued dry weather. In general, it is about 125,000 tons for Tug Fork and 175,000 tons for Levisa Fork, a total of 300,000 tons per annum. The statistics in detail are given in the report of the local officer.

The head of the projected slack-water system is at the mouth of Pond Creek (just above Williamson, W. Va.), on Tug Fork, and at Pikeville, Ky., on Levisa Fork. These places are also the heads of

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present navigation and are located 58 miles and 88.5 miles, respectively, above Louisa, Ky., by river.

Commercial statistics.

Fiscal year—	Tons.	Calendar year—	Tons.
1890	268,582	1897	406,900
1891	277,303	1898	415,400
1892	455,926	1899	328,272
1893	466,723	1900	300,000
1894	297,800	1901	349,862
1895	545,910	1902	350,935
1896	471,382	1903	290,401
1897	414,500	1904	152,077

The above is the commerce of the three streams, Big Sandy proper from its mouth at Catlettsburg, Ky., to Louisa, Ky., a distance of 26 miles, and of the Levisa and Tug forks, which unite at Louisa, Ky., to form the main stream.

July 1, 1904, balance unexpended		$285,365.31
Amount appropriated by river and harbor act approved March 3, 1905		43,000.00
Amount appropriated by sundry civil act approved March 3, 1905		85,000.00
		413,365.31
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$163,010.76	
For maintenance of improvement	42.25	
		163,053.01
July 1, 1905, balance unexpended		250,312.30
July 1, 1905, outstanding liabilities		2,802.54
July 1, 1905, balance available		247,509.76
July 1, 1905, amount covered by uncompleted contracts		188,634.30
Amount (estimated) required for completion of existing project		3,980,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905		40,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix G G 3.)

4. Operating and care of locks and dams on the Big Sandy River, West Virginia and Kentucky.—There are three locks and movable dams in operation on this river. Lock and Dam No. 1, at the mouth of the river at Catlettsburg, Ky., were placed under operation and care on February 1, 1905. Lock and Dam No. 2, at Kavanaugh, Ky., 13 miles above Catlettsburg, were placed under operation and care on May 10, 1905. Lock and Dam No. 3, at Louisa, Ky., 26.5 miles above Catlettsburg, and just below the junction of the forks, were placed under operation and care on January 1, 1897. A brief description of the three locks and dams is given in the report of improvement of Big Sandy River.

The project involves the operating and care of the three locks and dams with such funds as may be annually allotted.

The amount expended for this purpose to June 30, 1905, was $26,862.89, the work having continued since July 1, 1897.

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On June 30, 1905, all the locks and dams were in good order and condition and available for the purposes of navigation.

The expenditures during the fiscal year ending June 30, 1905, were $3,822.88, with the following results: Lock and Dam No. 3 have been kept in good condition and have been operated satisfactorily. The buildings, grounds, and walks are in good repair. At Locks and Dams Nos. 1 and 2 the expenditures have been applied to maintenance of the buildings and grounds in good condition, and the adjustment and repair of the machinery of the locks and dams. As these two works were but lately received from the contractors, considerable work remains to be done before the buildings and grounds are in a satisfactory condition.

Commercial statistics for this work are given in the report of improvement of Big Sandy River.

(See Appendix G G 4.)

5. Kentucky River, Kentucky.—At the time the United States assumed control of the Kentucky River the improvement that had been made by the State of Kentucky, which included five locks and fixed dams, was found to be in a dilapidated and almost worthless condition, the pools being filled with snags and navigation entirely suspended.

The original project, adopted in 1879 (Annual Report of the Chief of Engineers for 1879, pp. 1398–1422), provided for repairing and rebuilding the five old locks and dams, removing snags, logs, and other obstructions, and extending 6-foot slack-water navigation by locks and dams upstream to Three Forks, a distance of about 261 miles from the mouth of the river in the Ohio, at Carrollton, Ky.

The amount expended to June 30, 1905, was $2,666,054.22. The result of this expenditure was the repairing and rebuilding of five old locks and dams built by the State of Kentucky; the completion of Locks and Dams Nos. 6, 7, 8, 9, and 10, and a dam at Beattyville; the partial completion of Lock and Dam No. 11, and a considerable amount of snagging in the pools.

The first dam in the series is 4 miles from the Ohio River, and during the extreme low water in that stream the depth below the lock is reduced to about 2½ feet. Above Lock No. 1 the minimum depth is 5.5 feet to Lock No. 9 (which is at present the head of slack-water navigation), a distance of 157 miles. Above Lock No. 9 no boats can run at low stages of the river.

During the year there was an increase in the length of navigable river of 23½ miles, made by the completion of Lock and Dam No. 10, which extended the slack water to Lock No. 11, 200 miles from the mouth of the river. In March a freshet, the highest since the completion of Locks Nos. 9 and 10, cut new channels for the river behind these two locks, putting both locks and dams out of operation, restoring the pools to their original state, and reducing the navigable river by 43 miles. The usual variations of level of water surface are from 25 to 40 feet, and occasionally much more.

The five old State locks have available lengths of from 145 to 147 feet, with widths of 38 feet. The newer locks, from No. 6 up, have available lengths of 150 feet, with widths of 52 feet. Single narrow boats somewhat longer can be passed through the locks by swinging to clear the lower gates.

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There is at present very little commerce other than timber on the part of the river under improvement. The timber business is not benefited by the improvement made. It is probable that the locks and dams are a detriment to this business, for while they form fine harbors for holding logs at the mills, they delay the running of logs and rafts, and many logs are damaged by going over the upper dams.

There are not likely to be any decided changes in the volume or character of the commerce benefited until the improvement is carried to the head of the river, where it is hoped that coal lands may be developed and the product shipped by water. The development of coal, with the resulting traffic, is the specific purpose to which the expenditure will be applied. It can be stated that the project for the improvement of the Kentucky River has had, so far, no effect on freight rates.

The cost of the complete improvement will exceed by a large sum the limit of authority granted by existing legislation, as stated in the Annual Report of the Chief of Engineers for 1899, page 2514. This limit of $1,349,000 will be reached while the locks and dams required above Lock No. 11 are still untouched or incomplete.

The washouts at Nos. 9 and 10 indicate that expensive precaution must be taken to protect the upper locks and dams against freshets. There will be a larger additional amount expended on No. 11, at least $50,000, for this purpose than was deemed necessary last year, and this will reduce the amount of any balance remaining for Lock and Dam No. 12.

The completion of Lock and Dam No. 11 will probably nearly exhaust this limit of authority granted, leaving a possible small balance available for beginning Lock No. 12.

The river and harbor act of March 3, 1905, authorized the Secretary of War, in his discretion, to use so much of the funds theretofore appropriated as might be necessary to repay the county court of Clark County, Ky., for the cost of constructing the county bridge over Twomile Creek, and of repairs to the county road made necessary by construction of Lock and Dam No. 10.

The commercial statistics will be found in the report upon operating and care of locks and dams on Kentucky River.

July 1, 1904, balance unexpended	$458,443.45
Amount appropriated by river and harbor act approved March 3, 1905	50,000.00
Received from sale of property at public auction	95.50
Overpayment refunded	.46
	508,539.41
June 30, 1905, amount expended during fiscal year, for works of improvement	186,442.65
July 1, 1905, balance unexpended	322,096.76
July 1, 1905, outstanding liabilities	301.50
July 1, 1905, balance available	321,795.26
July 1, 1905, amount covered by uncompleted contracts	189,706.20
Amount (estimated) required for completion of existing project	1,885,000.00

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Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905 ..... $174,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix G G 5.)

6. Operating and care of locks and dams on Kentucky River, Kentucky.—The maintenance of these works devolves upon the indefinite appropriation of July 5, 1884, for operating and care of canals and other works of navigation.

The total amount expended to June 30, 1905, was $1,235,642.96. The amount expended during the fiscal year ending June 30, 1905, was $89,203.42. With this sum the locks were operated and the channels maintained in navigable condition, with the exception of Locks Nos. 9 and 10, where a washout around these locks occurred March 13, 1905, Lock No. 9 being at present the head of slack-water navigation.

The minimum draft that can be carried over the shoalest part of the system is 5.6 feet on the upper miter still at Lock No. 4.

The usual variations of the level of water are slight, except during freshets, which have attained a height of 21 feet above pool stage at Lock No. 4.

Minor repairs were made to the various locks, dams, and appurtenant structures. New isolated concrete approach piers were constructed at Locks Nos. 1, 4, and 5, and a new concrete lower miter sill is now in process of construction at Lock No. 2.

The commerce, in tons of freight, at the different locks for the last four years has been as follows:

Locks.	Calendar year—			
	1901.	1902.	1903.	1904.
No. 1	122,185	84,498	125,722	126,284
No. 2	108,517	57,612	113,674	114,007
No. 3	103,761	57,738	104,592	101,280
No. 4	92,131	56,671	104,596	102,122
No. 5	147,134	95,853	126,695	127,618
No. 6	137,345	87,973	126,881	122,430
No. 7	135,473	93,101	111,023	131,651
No. 8	147,062	113,680	132,236	149,389
No. 9			42	149,236
Average for 8 locks	124,201	80,888	118,177	121,848
Average for 9 locks				124,891

(See Appendix G G 6.)

IMPROVEMENT OF FALLS OF THE OHIO RIVER, OF WHITE RIVER, INDIANA, OF WABASH RIVER, INDIANA AND ILLINOIS, AND OF CERTAIN RIVERS IN KENTUCKY.

This district was in the charge of Capt. Harry Burgess, Corps of Engineers. Division engineer, Col. G. J. Lydecker, Corps of Engineers.

1. Falls of the Ohio River at Louisville, Ky.—Improvements under this title have included the enlargement of the basin immediately above the locks of the Louisville and Portland Canal, the enlargement of the head of the canal, and straightening, deepening, and controlling the water flow in the Indiana Chute channel.

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The work of enlarging the basin above the canal locks was completed in 1893.

The original conditions at the other localities are more conveniently and fully described under separate headings, as follows:

Head of Louisville and Portland Canal.—Previous to 1883 the approach to the canal at its upper end, above the Louisville Bridge Company's bridge at Fourteenth street, was so narrow as to constitute a source of much expensive delay to the large quantity of traffic which came down the river on ordinary rises. The canal proper from Ninth to Fourteenth streets was only 100 feet wide and curved between the two points, so that progress was slow and accidents frequent and unavoidable. The greater part of the dike marking the north side of the approach to the canal was submerged when the river reached a stage of 8.4 feet, upper-canal gauge; and at stages of 9 feet or more a strong current set out from the shore, thus carrying many vessels against the dike and, at high enough stages, over it onto the rock ledges. This approach was 1,800 feet long and varied in width from 400 feet at the upper end to 100 feet opposite Ninth street. Its area was wholly insufficient for the required breaking and rearrangement of tows preparatory to entering or leaving the canal.

Indiana Chute.—This is the main channel of the river, by which commerce passes over the falls when the stage of water is such as to permit navigation via that route. Originally it was very crooked, with swift currents and whirls, filled with dangerous rocky points projecting from the sides and bottom, and it could be navigated only at stages of 11 feet or more, upper-canal gauge. Even at such stages the services of special skilled pilots of long local experience and having intimate knowledge of the channel conditions were essential for reasonably safe passage through it.

Projects.—The original project for the enlargement of the head of the Louisville and Portland Canal was adopted in 1883, and proposed the enlargement of the canal beginning at a point a short distance below the railroad bridge at Fourteenth street and extending eastwardly to the cross dam, so as to not only straighten and widen the canal proper, but also provide ample space for the necessary rearrangement of tows about to enter or leave the canal. This was slightly modified in 1885, so far as the location of the new north wall was concerned. A revision of the project was made by a Board of Engineer officers January 28, 1890, and approved by the Chief of Engineers January 31, 1890. This revision modified the area formerly proposed to be excavated, and determined the number and kinds of structures, etc., to be erected. As approved, it provided for enlarging the canal on its northerly side from a point 725 feet below the railroad bridge at Fourteenth street, where the width of the canal was abruptly increased from 90 feet to 210 feet; this latter width is then gradually increased through a distance of nearly 2,800 feet to 325 feet at the head of the canal proper, at which point the enlargement is expanded into a capacious basin or harbor 1,200 feet wide and practically parallel to the Kentucky shore. The structures proposed were a new retaining wall on the north side of the canal; a movable dam about 800 feet long; a fixed dam extending from the movable dam at the westerly end of the basin to the south abutment of the movable dam in the Middle Chute opening of the cross dam; the excavation of

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rock within designated limits to the same grade as the canal bottom; the construction of certain walls and slope revetment on the south side of the canal, and the removal of the old structures within the limits of the proposed enlargement. Under date of March 31, 1899, a further modification of some of the details of the project was considered by a Board of Engineer officers and their recommendations approved by the Chief of Engineers April 8, 1899. These later modifications, together with the work outlined in the report approved January 31, 1890, constitute the existing project toward the completion of which operations are now directed. The totals of estimates under the original project and the several revisions are as follows:

Project of 1883, page 1539, Annual Report of the Chief of Engineers for 1883	$1,335,363.00
Revision approved January 31, 1890, page 2217, Annual Report of the Chief of Engineers for 1890	710,230.40
Modification approved April 8, 1899, page 2545, Annual Report of the Chief of Engineers for 1899	300,391.92
A revision of the latter estimate was made November 13, 1900, approved by the Chief of Engineers November 17, 1900, and amounted to	398,359.12

The foregoing relates particularly to the improvements at the head of the Louisville and Portland Canal.

Prior to January 31, 1890, there was no specific comprehensive project for the systematic improvement of the Indiana Chute channel, although much work, consisting of the removal of some of the more dangerous rock ledges, had been done under estimates and allotments from appropriations for improving Ohio River. On the date just mentioned the project submitted by a Board of Engineer officers for the radical improvement of this chute was approved by the Chief of Engineers. This project had for its object the widening and deepening of the channel by rock excavation to specified grades within certain limits and the control of water flow in the channel by means of dikes, etc., so as to make this channel available for descending navigation drawing 6½ feet at stages of 8 feet, upper-canal gauge. However, only a part of the work necessary for the purpose in view was included in the estimate accompanying the report of the Board, it being stated:

> As the exact knowledge of the results of that work (i. e., the work estimated for in the Board's report) would be of great importance in fixing the details of location and cross section of the additional works that will be required, it would be as well to leave the determination of the additional work above the bridge to a later day.

The estimates for work on this chute since the adoption of a specific project therefor are as follows:

Project approved January 31, 1890	$138,610.97
Modification approved April 8, 1899	74,320.98
Revision of estimate, approved by the Chief of Engineers November 17, 1900	129,651.99

A consolidation of the projects for the enlargement at the head of the canal and the improvement of the Indiana Chute was authorized by the Chief of Engineers June 28, 1897, and since that date funds have been provided for work at both localities under one title of appropriation. Therefore combining the separate estimates outlined above gives the following as the estimates under the consoli-

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dated projects, but it must be remembered that the project of 1883 did not provide for any work on Indiana Chute:

Project, 1883	$1,335,363.00
Revision, 1890	848,841.37
Modification, 1899	374,712.90
Revision of estimates, November 17, 1900	478,011.11

The aggregate of estimates to date is $1,659,639.78.

Work under that part of the combined project applicable to the Indiana Chute having been completed, a Board of Engineer officers was assembled to determine, as anticipated in the project of 1890, what further work was essential to provide the requisite depth necessary to facilitate the passage of traffic through this channel. The report of the Board was submitted December 16, 1901, and approved by the Chief of Engineers December 30, 1901. The items of additional work found to be necessary to produce the desired result and the estimated cost thereof are as follows:

Submerged dam at Whirlpool Point (large stone), 2,500 cubic yards, at $3	$7,500
Raising movable dam north of canal wall	2,500
Removing old dam and building movable dam, 1,000 feet, at $75	75,000
Longitudinal contracting dikes (concrete), 22,300 cubic yards, at $12	267,600
Submerged dams below bridge (concrete), 3,000 cubic yards, at $20	60,000
Rock excavation, 3,200 cubic yards, at $3.50	11,200
Contingencies, 10 per cent	42,380
Total	466,180

For this latter work the Board prescribed the order in which it should be done, and stated that it was possible that a part of the work might become unnecessary if certain results were produced by the submerged dam at Whirlpool Point, and in that event about $125,000 would probably be saved from the estimated cost.

The estimate for this additional work on the Indiana Chute does not affect the former estimate for work to be done at the head of the canal, except in so far as it provides $2,500 for increasing the height of the movable dam north of the canal wall.

The "amount (estimated) required for completion of project," as shown in the money statement following, is made up as follows:

Balance of estimate approved November 17, 1901	$86,389.79
Balance of cost of work recommended in Board's report of December 16, 1901, approved December 30, 1901, by the Chief of Engineers	391,180.00

It seems desirable to state that surveys made during the past fiscal year have afforded data for a careful computation of the item for excavation of rock in the enlargement of the head of the canal, and that the balance remaining from the former estimates made several years ago will not be sufficient for completion of existing project.

Following is a brief synopsis of expenditures under the allotments and projects summarized above:

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Expended from allotments, 1881 to January 31, 1890		$116,049.80
Expended under project of 1883, for enlargement of head of canal, to January 31, 1890		347,380.68
Reserved, Office Chief of Engineers, United States Army		1,874.20
Expended under project for enlarging canal basin at locks		133,000.00
Expended under revised project of January 31, 1890, to June 30, 1897:		
On enlargement at head of canal	$298,856.35	
On Indiana Chute channel	103,602.81	
		402,459.16
Expended under appropriations for enlargement at head of canal and Indiana Chute, in accordance with project of January 31, 1890, to March 31, 1899		208,659.75
Expended under appropriations for enlargement at head of canal and Indiana Chute, in accordance with the modified project of March 31, 1899 (approved April 8, 1899), to June 30, 1905, not including outstanding liabilities		372,419.80
Total		1,582,843.39

The results derived from the expenditures to date for those portions of the work completed have been of marked advantage to traffic and greatly facilitate its movement. The enlargement of the basin immediately above the new locks was completed in 1893 and increased the width of the canal at that locality from 90 feet to 215 feet throughout a distance of 800 feet. At the head of the canal the work of enlargement has been entirely completed from a point 725 feet below the Fourteenth Street Railroad Bridge to a point 2,800 feet above that bridge. Beyond this point, in the basin east of the north canal wall, the excavation to grade within the prescribed limits is about 97 per cent completed, a clear width of 415 feet excavated to grade being at this date available.

In the Indiana Chute above Fourteenth Street Bridge the channel width has been increased from 200 feet to 400 feet, and all rock within these limits excavated to the grades prescribed in the project. At Wave rock and Willow Point all excavation and the dikes have been completed. The depth of water over Wave rock and Willow Point approximates very closely the depth anticipated—i. e., 8 feet, when there are 8 feet on the upper canal gauge. But the depth on the upper portion of the chute is still unsatisfactory; hence the necessity for the additional work recommended in the Board's report of December 16, 1901, and approved by the Chief of Engineers December 30, 1901. The additional work includes structures designed so as to produce the desired depth of 8 feet by forcing a sufficient volume of water into that part of the chute above the Fourteenth Street Bridge and controlling its flow therein. The chute can now be navigated with ease by heavy-draft coal boats at stages of 11.5 feet or more, upper canal gauge, but as coal barges reach Louisville on an 8-foot stage and coal boats on a 9½-foot stage, the necessity becomes apparent for providing sufficient depth in the open-river channel in order to facilitate the passage of commerce without the heavy, unavoidable incidental expense due to breaking, rearranging, and passage of tows through the canal locks and, not infrequently, the loss of opportunity to continue without interruption the journey on the stage of water prevailing on arrival of the tow at this place, the stage in many instances being of such short duration as to pass before the tows can

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be passed through the canal, reasssembled, and regain the crest of the wave.

The amount reported in the money statement below as having been expended for maintenance was applied to the repair of damage done by ice to Wave rock and Willow Point dikes during the winter of 1903–4. The break in the Wave rock dike was entirely completed, stone bedded in natural cement mortar being used for the purpose, and the paving on the crest of the dike grouted. Repairs to the Willow Point dike were limited to the pavement only.

A summary of the work done follows:

Concrete (rubble)	cubic yards	2,526.6
Concrete (in bags)	do	180.4
Stone filling	do	280.1
Excavation	do	192.5
Grouting	square yards	1,563.1

Commercial statistics are embodied in the following report for operating and care of Louisville and Portland Canal, and a comparative statement of same will be found in Appendix H H 2 of this report.

References to more detailed information, special reports, sketches, etc., are given on page 488, Annual Report of the Chief of Engineers for 1904.

July 1, 1904, balance unexpended		$7,916.75
Amount appropriated by river and harbor act approved March 3, 1905		80,000.00
Net amount allotted from appropriation for maintenance of river and harbor improvements, act of April 28, 1904		14,545.06
		102,461.81
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$7,965.08	
For maintenance of improvement	14,545.06	
		22,510.14
July 1, 1905, balance unexpended		[a] 79,951.67
July 1, 1905, outstanding liabilities		1,532.67
July 1, 1905, balance available		78,419.00
Amount (estimated) required for completion of existing project		477,569.79

(See Appendix H H 1.)

2. Operating and care of Louisville and Portland Canal.—This canal was constructed by a private corporation, acting under a charter granted by the Kentucky legislature in 1825 and subsequent acts of the same body extending the time for completion and increasing the capital stock. It was completed and the first boat passed through it December 22, 1830. At that time there were three combined lift locks, each with a lift of about 8¾ feet, a width of 50 feet, and length of 200 feet. The width of the canal proper was from 64 to 68 feet at normal stages, with a depth of nearly 3 feet at extreme low stages of the river. There was no dam at the head of the canal. The United States became a stockholder in the corporation in 1826, and gradually increased its holdings until all of the outstanding stock and bonds passed into its possession.

[a] In addition to this, $15,000 has been allotted from appropriation of March 3, 1905, for general improvement of Ohio River for removal of rocks at entrance of Louisville and Portland Canal.

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In 1860 an enlargement and extension of the canal, which included new locks, was begun under the corporate management, and resulted in the width of the canal being increased to 90 feet, with three basins or passing places, and the construction of two new combined lift locks with a total lift of about 26 feet. Each of the chambers of the new locks has a width of 80 feet and an available length of 350 feet. The new locks were opened to navigation February 6, 1872.

The United States assumed charge of the work of enlargement of the canal and construction of a dam at the head of the canal subsequent to the allotment of funds for that purpose in 1868, but the operation of the canal and collection of tolls remained under control of the corporate management until June 11, 1874, upon which date the entire control of the canal was assumed by the United States, pursuant to the act of Congress of May 11, 1874, which provided that the canal should be held "free of all tolls and charges, except such as are necessary to pay the current expenses of said canal and keep the same in repair." Tolls were entirely abolished after midnight July 1, 1880, and since that date the expenses of operation and maintenance of the canal have been borne directly by Treasury funds made available by the act of March 3, 1881, and the indefinite appropriation for "Operating and care of canals and other works of navigation," act of July 5, 1884.

The general project for operation and care of the canal by expenditures under allotments from the act of July 5, 1884, contemplates the operation of the canal locks, the operation of the dredging plant to keep the canal clear of deposit brought into it by high water, and the repair of existing structures, so as to maintain the whole system in good serviceable condition. On account of the continuity of the work, no fixed estimate of cost has been made. The funds are provided under estimates submitted annually at the beginning of each fiscal year and allotments therefor from the act of July 5, 1884.

The approved project, estimate, and allotment for the fiscal year 1905, in addition to the provisions for ordinary current repairs, supplies, miscellaneous work of maintenance, operation of locks and dredging plant, included items for four dump scows, repairs to middle gates, new locks, building new guard gates, old locks, repairs to miter sill at lower gates, new locks, repairs to towboat *Major Mackenzie*, and repairs to certain parts of the cross dam. The estimate for the fiscal year amounted to $104,399, and was made available by allotment July 15, 1904.

In reporting the total of expenditures made in connection with this work it seems best, for the purpose of clearness in showing the general application, to subdivide the total to date into amounts for each period indicated, as follows:

From allotments and appropriations, September, 1868, to June 30, 1882, for completion of new locks, enlargement of canal, and for cross dam at head of canal, payment of bonds, etc	$1,463,200.00
From tolls collected by United States, June 11, 1874, to midnight July 1, 1880, for operation and maintenance	417,069.38
From allotments from act of March 3, 1881, for operation and maintenance	214,062.91
From allotments from act of July 5, 1884, for operation and maintenance	1,723,878.47
Total	3,818,210.76

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The canal is available to commerce at all stages of the river less than 12.7 feet, upper canal gauge, and affords free navigation around the falls of the Ohio River at stages of water when the passage thereover can not be made by the open-river channel.

The zero of the upper gauge corresponds to reference 35 and the bottom of the canal at its head to reference 34, canal datum. The lowest recorded reading of the upper gauge is 1.7 feet; the highest reading on the same gauge is 46.7.

Under the regulations prescribed by the Secretary of War for the use, administration, and navigation of this canal, the maximum draft of vessels that can be passed through the canal is limited to the depth of water above zero of the gauge at the time the boat enters the canal.

During the fiscal year ending June 30, 1905, 4,727 boats, barges, and small craft passed through the canal, carrying 732,607½ tons of freight. During the same period 1,482 boats, barges, and small craft passed over the falls via the open-river channel, carrying 509,642½ tons of freight, the aggregate that passed Louisville via both routes being 6,209 boats, barges, and small craft, carrying 1,242,250 tons of freight.

As compared with the previous year, both the number of vessels and the freight carried show a decrease. However, this is readily accounted for by unusually unfavorable conditions, consisting of low water, followed by a long period of severe weather, producing much ice to hinder a resumption of navigation when the stages of water would ordinarily have permitted.

For a more extensive comparative statement of commerce, see the report on this work by district officer.

References to more extended information concerning original condition, purchase, and progress of the improvement of this canal are given on page 491, Annual Report of the Chief of Engineers for 1904.

(See Appendix H H 2.)

3. Wabash River, Indiana and Illinois.—At the time the United States began the work of improving this river it was badly obstructed by bars, accumulations of snags, rocky reefs, and numerous secondary channels or cut-offs, which lessened the flow of water through the main channel. Navigation was impracticable except at high stages of water. A lock and dam had been built at Grand Rapids by the Wabash Navigation Company, and a few improvements made at other places also by private enterprise, but as none of them was of a substantial character they rapidly deteriorated and became useless.

The original project and outline of improvements proposed is found in the report of Maj. G. Weitzel, Corps of Engineers, U. S. Army, January 4, 1872, page 472, Annual Report of the Chief of Engineers, United States Army, 1872. The first appropriation for work under this project was made by Congress June 10, 1872. This project proposed the improvement of the river from its mouth to Lafayette, Ind., by special works at twelve designated localities, the construction of a new lock and dam at Grand Rapids, and the general work of snagging and dredging. The estimated cost of the work proposed amounted to $312,672.62. Work at various places other than those mentioned in the project has been added from time to time, but no general revision of the original estimate has been made.

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The river and harbor act of March 3, 1881, made separate appropriations for work above Vincennes and for work below Vincennes, thus dividing the original project, and subsequent to that date funds have been provided separately for each section.

From the commencement of the work in 1872 to March 31, 1881, the expenditures, all of which were for work below Vincennes, amounted to $324,845.44. Those for work since that date are given under their respective headings, as follows:

(*a*) *Below Vincennes.*—Subsequent to 1881 work was continued under the original project, but the estimates were modified from time to time as necessity therefor arose, as in the cases of the dam for closing the New Harmony cut-off, the lock and dam at Grand Rapids, etc. Levee work at Grayville, Ill., was added in 1887, and completed, as proposed, at a cost of $25,000. In 1898 a plan and estimate, amounting to $50,000, for additional work at New Harmony was approved, but at the same time it was urged that if the improvement of the river was to be continued the old project should be abrogated, a comprehensive survey of the river made, and a new project formulated, based upon data furnished by the survey and of sufficient scope to meet existing needs of commerce. The survey was authorized and funds therefor provided by the river and harbor act of June 13, 1902. The report on the survey, proposed plan for improvement, estimate of cost, and action taken in connection therewith may be found on page 2729, Annual Report of the Chief of Engineers, United States Army, 1904. The aggregate of the items of the original estimate applicable to this part of the river, and of the several subsequent estimates constituting the estimate of cost of existing project adopted by Congress, is $755,000.

The expenditures to March 31, 1881, amounted to $317,845.44, in addition to the $7,000 paid to extinguish the franchise of the Wabash Navigation Company and acquire their property, those for the levee work at Grayville from 1887 to 1892, $25,000, and those for other work since 1881 on this part of the river, $363,793.10, or an aggregate of $713,638.54 for work below Vincennes to June 30, 1905.

Previous to 1885 a fairly good channel for boats having a draft not exceeding 2½ to 3 feet was maintained, but as the river and harbor act of July 5, 1884, made specific appropriation for a lock and dam at Grand Rapids, near Mount Carmel, Ill., the suspension of operations elsewhere became necessary in view of the fact that the funds available since that date were not sufficient to complete the lock and dam and at the same time maintain the former works for bank protection and to concentrate the water flow and clear the channel of obstructions. Consequently the work formerly done deteriorated rapidly, the structures being destroyed by ice and high water or rendered useless by the water cutting its way around them. The channels, cut through rock reefs and shoal places, became choked with snags, stumps, and bowlders, thus leaving the river without any permanent improvement excepting that resulting from the lock and dam at Grand Rapids. Through navigation at low water is impracticable. Boats drawing 20 inches can pass from Mount Carmel to Vincennes (a river distance of about 34 miles) at all stages, but can reach Mount Carmel, 92.7 miles from the mouth of the river, only when the gauge at the lock reads 7.5 feet or more.

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Commercial statistics will be found in the report for operating and care of lock and dam at Grand Rapids, Wabash River, Appendix H H 4.

The only work in progress during the fiscal year was the completion of the map, in 65 sheets, of the survey of the river below Vincennes; the completion of an index map of four sheets, which latter were traced, and snagging operations below Mount Carmel, Ill., such operations being on a limited scale on account of the small amount of funds available for such work.

References to more extended information are given on page 494, Annual Report of the Chief of Engineers, 1904.

July 1, 1904, balance unexpended	$4,301.20
Refundment from overpayment	.26
	4,301.46
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	2,939.74
July 1, 1905, balance unexpended	1,361.72
July 1, 1905, outstanding liabilities	191.08
July 1, 1905, balance available	1,170.64
Amount (estimated) required for completion of existing project	40,000.00

(*b*) *Above Vincennes.*—At the time this section of the river became the object of separate appropriations there had been no revision of the estimate in the original project for the improvement of the river from its mouth to Lafayette, and the amount appropriated in the act of March 3, 1881, was in excess of the estimate for items in that project applicable to this part of the river. However, under the project matured after the appropriation had been made (see p. 2001, Annual Report of the Chief of Engineers, United States Army, for 1881), and subsequent modifications, the estimates to June 30, 1905, amounted to $95,500.

The expenditures on the work of existing project to June 30, 1905, amounted to $95,238.42.

The funds available during the past sixteen years have not been sufficient to maintain the former works for channel rectification and to keep the river clear of snags, bars, and similar obstructions. During the more recent years not enough funds have been available for snagging purposes alone. Therefore it can not be said that any permanent improvement of this section of the river has been effected or that navigation is practicable, except at high stages of water.

The only commercial statistics available are those collected at the lock at Grand Rapids (see Appendix H H 4). References to more extended information may be found in the Annual Report of the Chief of Engineers for 1904, page 495.

July 1, 1904, balance unexpended	$261.58
July 1, 1905, balance unexpended	261.58

(See Appendix H H 3.)

4. Operating and care of lock and dam at Grand Rapids, Wabash River.—This lock and dam was built from funds derived from appropriations for improving Wabash River, Indiana and Illinois, and opened to navigation in November, 1893. The available length of the lock is 214 feet; width, 52 feet; depth on lower miter sill at low

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water, 3.5 feet; depth on upper miter sill at normal pool stage, 5.08 feet. At such stage the pool above the lock affords slack-water navigation about 12 miles, and the maximum draft that can be carried is about 2 feet. Conditions beyond the pool are mentioned in the report for improving Wabash River, Indiana and Illinois.

The expenses of operating the lock were paid from the appropriations for improvement of the river until March 1, 1897, since which date they have been paid from annual allotments from the indefinite appropriation for "Operating and care of canals and other works of navigation," act of July 5, 1884.

The first and subsequent annual projects proposed the operation of the lock and the maintenance of it and the appurtenant structures in good serviceable condition. The expenditures under these projects to June 30, 1905, amounted to $26,374.09.

The project for the fiscal year 1905 provided for the operation of the lock, removal of deposit from the lock and approaches thereto, and minor repairs to the fences, buildings, etc., on the Government grounds, at an estimated cost of $4,800, which amount was made available by allotment July 15, 1904. The amount expended during the fiscal year ending June 30, 1905, not including outstanding liabilities, is $1,675.94.

During past fiscal year 1,397 boats, barges, etc., and 8,025 tons of freight passed the lock.

A comparative statement of traffic and commerce passing this lock during the past eight years will be found in the report on this work by the district officer.

(See Appendix H H 4.)

5. White River, Indiana.—Originally this tributary to Wabash River was badly obstructed by rocky reefs, remains of old structures, and a very great number of snags. It could be navigated only at high stages of water.

The original project is based upon the report of "examination of White River and its forks in Indiana," submitted December 31, 1878. The first appropriation for the improvement was made in the act of March 3, 1879. In this act the work of improvement was limited to "White River, Indiana, from Wabash River to Portersville, and to the falls on the West Fork, according to Report of the Chief of Engineers, without constructing locks and dams." A minimum depth of 2 feet at low water was sought. In 1886 the estimate was reduced. The river and harbor act of August 18, 1894, provided for a resurvey of the river.

Subject to the modifications mentioned, the original project constitutes the existing project of this date. The estimate of cost is $120,000. The amount expended to June 30, 1905, not including outstanding liabilities, is $119,296.18. As a result of these expenditures the lower 13 miles of the river is navigable all the year for boats having a draft not exceeding 3 feet. Above this, to the junction of the two forks, boats drawing 18 inches can navigate for about six months of the year. Low-water navigation on the forks is impracticable even for the smallest boats. This information is derived from the report on the resurvey made in 1895–96, since which date operations have been suspended, the funds available not being sufficient for either work of improvement or maintenance of former structures for

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controlling the flow of water and bank protection or to keep th channel clear of snags.

No statistics as to the volume or character of commerce moved o this river during the past year are available.

The report upon the resurvey of the river, Annual Report of th Chief of Engineers for 1897, page 2483, contains data concerning th volume and character of commerce that would be benefited by o involved in the further improvement of the river. This report also contains estimates of cost of improvement under alternative plans, and a recommendation that "the further improvement of the White River should be postponed until the improvement of the Wabash has been such as to afford an outlet for any traffic which may then be developed on White River."

References to more extended information concerning this river may be found in Annual Report of the Chief of Engineers for 1904, page 497.

July 1, 1904, balance unexpended	$703.82
July 1, 1905, balance unexpended	703.82

(See Appendix H H 5.)

6. Green River above the mouth of Big Barren River, Kentucky.—Originally this part of Green River was much obstructed by snags, large bowlders, and overhanging trees. Dam No. 4, Green River, afforded slack water for about 18 miles above the confluence of Green and Barren rivers. The fall in that part of the river above slack water and below Mammoth Cave, Kentucky, a distance of about 29 miles, was approximately 27 feet.

The original project is that submitted under date of August 11, 1891 (printed in Annual Report of the Chief of Engineers for 1891, p. 2481). It proposes the extension of slack-water navigation from the upper limits of Pool No. 4 to Mammoth Cave by the construction of two locks and dams, at an estimated cost of $361,346.40 for both. No revision of the project and estimate has been made, except as provided by the river and harbor act of March 3, 1905, for work of snagging and clearing banks of Nolin River, which will be affected by slack water from Dam No. 6, Green River, for which $5,000 has been allotted.

The amount expended to June 30, 1905, exclusive of outstanding liabilities on that date, is $265,052.66.

As a result of these expenditures one of the locks and dams, No. 5, has been completed and opened to navigation, thus extending slack water to a short distance above Brownsville, the county seat of Edmonson County, Ky., and through a part of the rich mineral district bordering the river which previously had no conveniently accessible transportation route. The site for the second lock has been decided upon, the necessary land purchased, and a contract made for the construction of the masonry of the lock, dam, and abutment. Operations under this contract are now in progress.

Commercial statistics are given in the report for operating and care of locks and dams on Green and Barren rivers, Kentucky, Appendix H H 7.

References to more extended information may be found in Annual Report of the Chief of Engineers, United States Army, 1904, page 498.

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July 1, 1904, balance unexpended	$177,516.36
Amount appropriated by river and harbor act approved March 3, 1905	5,000.00
	182,516.36
June 30, 1905, amount expended during fiscal year, for works of improvement	81,895.82
July 1, 1905, balance unexpended	100,620.54
July 1, 1905, outstanding liabilities	428.69
July 1, 1905, balance available	100,191.85
July 1, 1905, amount covered by uncompleted contracts	63,613.80

(See Appendix H H 6.)

7. Operating and care of locks and dams on Green and Barren rivers, Kentucky.—The original system of slack-water navigation on these rivers, including 4 locks in Green River and 1 lock in Barren River, with a total length of pools of approximately 200 miles, was completed by the State of Kentucky in 1841. The State retained control and management of the system until 1868, when it was leased to the Green and Barren River Navigation Company for a term of thirty years. The act of the Kentucky legislature approved February 20, 1886, ceded the entire system to the United States, upon condition that the unexpired portion of the lease to the navigation company be purchased by the United States. The river and harbor act of August 11, 1888, appropriated $135,000 "for the purchase of the improvements known as the Green and Barren River improvements." The deed from the Green and Barren River Navigation Company relinquishing all of their rights, privileges, etc., having been duly approved by the Attorney-General of the United States, and the purchase money paid to said company, the Government assumed control of the river, the improvements therein, and the property formerly owned by the State December 11, 1888.

The condition of the improvements and of the rivers at that date was as follows: Lock and Dam No. 1, Green River, required many repairs; the walls of Lock No. 2 were cracked and in bad condition generally, the land wall especially so, it being held in position by anchorage to cribs filled with stone; the river wall had yielded outward. Lock No. 3, Green River, was broken entirely, the river wall having yielded outward and fallen into the river. Lock and Dam No. 4, Green River, was in fairly good condition, with the exception of needed repairs to the quoins and gates; the walls of Lock No. 1, Barren River, were so badly cracked that a part of one of them, the land wall, leaned toward the lock chamber about 6 inches and was liable to fall at any time; the entrances to the locks were obstructed with deposit and the pools with great numbers of snags, overhanging trees, etc.; the appurtenant structures at the locks and the lock tenders' dwellings were in bad condition and inadequate. No snagging or dredging plant was available.

Excepting the funds for rebuilding Lock No. 2, Green River, which were provided by specific appropriations, the funds for the restoration of former structures, the operation of the locks, and maintenance of the system in good navigable condition have been provided by allotments from the indefinite appropriation for "Operating and care of canals and other works of navigation," act of July 5, 1884, under estimates submitted annually at the beginning of each fiscal year.

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The first project for work on these rivers under the latter act was approved January 4, 1889, and proposed the restoration, so far as practicable, of the former structures to good serviceable condition, the construction of new ones where required, the operation of the locks, the removal of snags, landslides, and deposit from the entrances to the locks, etc., and such has been the general object of each subsequent annual estimate and project.

In addition to the items for the usual work of operation and maintenance the project and estimate for the fiscal year 1905 provided for the specific work of completing repairs to Dam No. 1, Green River, completing a new cottage and a new office and warehouse building at Lock No. 2, Green River, and completing a new office and warehouse building at Lock No. 3, Green River. The estimate for the year amounted to $81,454.71, which was made available by allotment July 25, 1904.

Expenditures during the fiscal year, not including outstanding liabilities June 30, 2905, amounted to $74,388.02.

The aggregate of expenditures under the project of January 4, 1889, and subsequent annual projects to June 30, 1905, is $1,147,595.78.

The result of these expenditures is the thorough repair of the several locks of the former system and their appurtenant structures and the restoration of through navigation in the pools from Lock No. 1, Green River, to Bowling Green, Ky., on Barren River, a distance of 172 miles, for boats not exceeding 35 feet in width, 138 feet in length, and draft not exceeding 5 feet. At extreme low water in the open river below Lock No. 1, Green River, there is a depth of only 1 foot on the lower miter sill of that lock, which is located 8 miles above the mouth of the river. The system now includes 6 locks and dams, Lock No. 5 having been built from funds provided by specific appropriations therefor and opened to navigation January 17, 1900.

Following is a synopsis of traffic and commerce through the locks during the fiscal year 1905:

	Boats.	Freight.
GREEN RIVER.		*Tons.*
Lock No. 1	4,321	466,015
Lock No. 2	2,939	303,274
Lock No. 3	2,157	257,181
Lock No. 4	2,219	157,208
Lock No. 5	1,723	107,848
BARREN RIVER.		
Lock No. 1	1,525	38,486

A comparative statement of the traffic and commerce on these rivers during the past seventeen years will be found in the report on this work by the district officer. From these it will be noted that, notwithstanding the unfavorable conditions which prevailed a part of the year, the traffic and commerce passed through the locks show a decided increase, the gain at several of the locks being very marked.

References to more extended information may be found in Annual Report of the Chief of Engineers for 1904, page 500.

(See Appendix H H 7.)

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8. Rough River, Kentucky.—Originally this river was much obstructed by snags, sunken saw logs, stumps, bowlders, and bars in the bed of the stream, and by overhanging trees on its banks. Backwater from Dam No. 2, Green River, affected 8 miles of the river above its confluence with Green River. The width of the river varied from about 100 to 200 feet, and the movement of commerce was limited to periods of high water. A timber-crib lock and dam had been built on the river about 7 miles above Livermore, Ky., by the Rough Creek Navigation and Manufacturing Company, but at the time the United States undertook the improvement of the river the structures had been abandoned and were completely in ruins, and all rights, powers, and privileges granted said company by the State legislature annulled.

The original project is found in the report of Maj. James C. Post, Corps of Engineers, U. S. Army, dated January 27, 1885, page 1894, Annual Report of the Chief of Engineers, United States Army, for 1885, and was adopted by Congress in the river and harbor act of September 19, 1890, and has for its object the extension of slack-water navigation to Hartford, Ky., by the construction of a lock and dam and clearing the stream of snags, overhanging trees, and other obstructions. A revision of the project, so far as it relates to the estimate, dimensions of lock and dam, and the number and kind of other structures necessary in connection with the lock, was made August 31, 1891. A further modification in 1895 substituted concrete for stone in the construction of the lock and provided for minor changes in the dimensions previously proposed.

The existing project is the same as that outlined in the preceding paragraph, the revised estimate of August 31, 1891, amounting to $105,556.05. Expenditures on the work of existing project up to the close of the fiscal year ending June 30, 1905, not including outstanding liabilities, amounted to $103,175.11. With the balance available it is proposed to construct a derrick boat for use in snagging operations, etc.

The lock, dam, and appurtenant structures have been completed. The lock was opened to navigation December 12, 1896. The maximum depth that can be carried at the upper end of the pool above the lock at normal pool stage is about 4 feet; the depth on the upper miter sill at such stage is 6.8 feet. The available length of the lock is 123 feet and available width 27 feet. At low water the head of navigation is a short distance above Hartford, Ky., or about 29½ miles above the mouth of the river and 21½ miles above the lock. Beyond this navigation is practicable only at high stages of the river, and consists principally of rafts and rowboats.

Commercial statistics are given in the report for operating and care of lock and dam on Rough River, Kentucky (Appendix H H 9).

References to more extended information may be found in Annual Report of the Chief of Engineers, 1904, page 501.

July 1, 1904, balance unexpended	$2,324.89
July 1, 1905, balance unexpended	2,324.89
July 1, 1905, outstanding liabilities	17.27
July 1, 1905, balance available	2,307.62

(See Appendix H H 8.)

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9. Operating and care of lock and dam on Rough River, Kentucky.—This lock and dam was built with funds provided in appropriations for improving Rough River, Kentucky, and opened to navigation December 12, 1896. The lock has an available length of 123 feet, width of 27 feet, and depth on upper miter sill at normal pool stage of 6.8 feet. At such stage the pool above the lock affords slack-water navigation 21½ miles, to a short distance above Hartford, Ky., for boats with draft not exceeding 4 feet.

The expense of operating the lock was paid from the appropriation for improvement until June 30, 1897; since that date the expenses of operating, care, etc., have been borne by the indefinite appropriation for operating and care of canals and other works of navigation, act of July 5, 1884, the funds being made available by allotment for projects and estimates submitted annually at the beginning of each fiscal year.

The project for the fiscal year 1905 proposed to operate the lock and maintain existing structures in good serviceable condition at an estimated cost of $1,300, which amount was made available by allotment of July 14, 1904. Expenditures during the year amounted to $1,037.24.

The amount expended since July 1, 1897, to June 30, 1905, not including outstanding liabilities, is $6,604.99.

Traffic through the lock during the past fiscal year included 697 boats of various kinds, carrying 55,333 tons of freight. A comparative statement of traffic and commerce on this river during the past fourteen years will be found in the report on this work by the district officer.

(See Appendix H H 9.)

LAKE RIVERS AND HARBORS.

IMPROVEMENT OF RIVERS AND HARBORS ON LAKE SUPERIOR.

This district was in the charge of Maj. Chas. L. Potter, Corps of Engineers. Division engineer, Col. O. H. Ernst, Corps of Engineers, until April 5, 1905, and Lieut. Col. W. H. Bixby, Corps of Engineers, since that date.

1. Harbor at Grand Marais, Minn.—This harbor is an elliptical bay, whose major axis is about one-half mile and whose minor axis is about one-fourth of a mile in length. It has an opening on the south side, which was originally about 1,000 feet in width. Before improvement there was a maximum depth of 14 feet over a very limited area, the general average depth being only 8 or 9 feet. It is the only harbor of refuge on the north shore between Agate Bay and the international boundary line, a distance of 125 miles.

The approved project of April, 1879, is to build two breakwater piers, each 350 feet long, from the east and west points of the bay, or one pier 700 feet long from the east point, and dredge an anchorage area of about 26 acres to a depth of at least 16 feet, all at an estimated cost of $139,669.40. For reasons explained in the report of the local officer (Annual Report of the Chief of Engineers for 1898, p. 2217), this estimate was increased to $163,954.63.

Two breakwaters, each 350 feet long, have been constructed from the east and west points of the bay, the work being completed on August 13, 1901.

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The amount expended on the project up to the close of the fiscal year ending June 30, 1905, not including outstanding liabilities, was $165,172.24, of which about $4,200 was for maintenance. The work done has resulted in a more protected harbor and a 16-foot anchorage area of about 26 acres.

The minimum mean low-water depth June 30, 1905, over the shoalest part of the locality under improvement was 15 feet.

The usual variations of water level extend from about 0 to +1 foot above low-water datum.

The commerce of the port has increased from 25 entrances and clearances made by 4 tugs and 5 schooners, with 60 tons of cargo, valued at $6,000, in 1878, to 1,134 clearances and entrances, nearly all steamers, with 64,240 tons of cargo, valued at $1,179,902, in 1904.

The value of the commerce of the harbor from 1878 to 1904, both inclusive, is estimated at $4,977,878.

The freight tonnage in 1904 was 82 per cent greater than in 1903, and numerous private improvements have been added to the village during the last few years.

July 1, 1904, balance unexpended	$316.41
Amount appropriated by river and harbor act approved March 3, 1905	2,000.00
	2,316.41
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	138.65
July 1, 1905, balance unexpended	2,177.76

(See Appendix I I 1.)

2. Harbor at Agate Bay, Minnesota.—This important harbor, situated on the north shore of Lake Superior, 27 miles northeast of Duluth, Minn., is a shipping port for iron ore and lumber and a harbor of refuge.

Before improvement there was ample depth for navigation, but the harbor was exposed to storms from the southwest and to reverse swells from severe northeast storms.

The approved project of January 4, 1887, was to construct two breakwater piers on a line toward each other from the eastern and western points of the bay, to be 1,000 and 900 feet long, respectively, leaving an opening of 1,340 feet between their extremities and inclosing an area of 109 acres.

By letter of the Chief of Engineers, March 23, 1899, the total ultimate length of the easterly breakwater was increased by 50 feet.

The original estimate of cost was $213,000, which was increased to $244,208 in Annual Report of 1887 on account of higher prices.

The amount expended on the approved project up to the close of the fiscal year ending June 30, 1905, not including outstanding liabilities, was $245,205.62, of which about $11,000 was applied to the maintenance of the improvement.

The project was completed on November 1, 1901, and fulfills very effectually the purpose for which it was designed.

The depth at the entrance is over 50 feet, and vessels drawing 20 feet can reach the ore piers in safety.

The usual variation of water level extends from about 0 to about +1 foot above low-water datum.

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The vessel freight of this harbor has increased from 236,000 tons of 2,240 pounds, valued at $524,800, in 1885, to 5,350,293 tons of 2,000 pounds, valued at $13,532,524, in 1904.

The total valuation of the commerce of this port for twenty years, 1885 to 1904, inclusive, is estimated at $107,721,424.

July 1, 1904, balance unexpended	$1,858.63
Amount appropriated by river and harbor act approved March 3, 1905	2,000.00
	3,858.63
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	790.06
July 1, 1905, balance unexpended	3,068.57

(See Appendix I I 2.)

3. Harbor at Duluth, Minn., and Superior, Wis.—Previous to the Annual Report of 1897 this harbor was reported on under the separate heads of Duluth, Minn., and Superior, Wis., respectively.

The act of June 3, 1896, unified these harbors under the above title and provided for continuous contracts for its improvement to the amount of $3,130,553.

This harbor consists of the Duluth Canal, the Wisconsin Entrance, Superior Bay, Allouez Bay, St. Louis Bay, and St. Louis River to the limits of the cities of Duluth and Superior, about 20 miles from the original natural entry, which before improvement was obstructed by shifting bars with but 9 feet of water over them. The bays were broad expanses of shallow water, averaging only 8 or 9 feet, except along a natural channel through them where the depth was greater, but variable.

The project adopted by the act of March 3, 1881, previous to the present one, was for 16-foot navigation. This was practically completed July 1, 1897, and resulted in giving a good 16-foot navigation through the natural or Wisconsin Entry; through the artificial Duluth Canal; over the Duluth Basin of 104 acres; along and parallel to the principal dock lines of Duluth and Superior in Superior and St. Louis bays, and up the St. Louis River to New Duluth, near the head of navigation of the river, with well-defined channels of from 85 to 300 feet in width.

The present project, authorized by the act of June 3, 1896, and by the modifications of August 14, 1896, and May 9, 1901, provides for the widening and deepening to a navigable depth of 20 feet of the existing channels, for new channels in Allouez Bay and St. Louis River, for extensive turning and anchorage basins of a navigable depth of 20 feet at the junctions of two or more channels, for widening the Duluth Canal, and for rebuilding the piers at the Duluth Canal and Wisconsin Entrance and finishing them off with concrete superstructures built of monolithic blocks.

The estimated cost of the work was $3,130,553, but this referred only to the deepening of the channels and basins by dredging. This has been done at much less than the estimated cost, permitting the purchase of lands to the extent of $106,561.19, the rebuilding of the Duluth Canal piers at a cost of over $650,000, including price of land, and leaving a balance of about $275,000 toward the rebuilding of the piers at the Wisconsin Entrance now under construction.

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The amount expended on the existing project to the close of the fiscal year ending June 30, 1905, exclusive of outstanding liabilities, was $3,283,331.14, of which $275,000 was expended for maintenance.

The work done under the existing project up to the close of the past fiscal year has been as follows:

The dredging of channels and basins, which was in operation for six seasons under continuous contract, was completed in 1902, and 21,697,243 cubic yards of material removed. Since then some shoals have been removed.

All the land necessary for the widening of the Duluth Canal has been acquired by deed of gift, purchase, or condemnation, at a cost of $53,919.05.

The land needed for the improvement at the Wisconsin Entrance, the mouth of the Nemadji River, and on a marshy island in the St. Louis River was obtained by condemnation proceedings, at a cost of $42,795.94.

A small parcel of land at the end of Grassy Point and certain lands in Spirit Lake were purchased at a cost of $3,146.20.

A site for a boat yard on Minnesota Point, near the Duluth Canal, was acquired by purchase and condemnation, at a total cost of $7,200, and the vacation of a portion of a street was effected through the city authorities, which was found necessary in order to carry out a proper system of improvement. This property has now been improved by building a bulkhead and a landing pier, dredging a slip, filling the yard with sand, moving the four Government buildings, which had been occupying leased ground at the foot of Seventh avenue for the last seven years, and by fencing in, paving a roadway, and surfacing and seeding for grass. The cost of this improvement has been about $17,750.

New piers were built for the Duluth Canal. These piers have been equipped with 67 iron lamp-posts, and the city has undertaken to furnish the electric current for lighting same.

Concrete walls inclosing the Government lands at the Duluth Canal were built and the tracts filled to grade, requiring the deposit of about 50,000 cubic yards of material.

The construction of an engineer building on the Government land north of the canal for offices and a watchman's house will be carried out during the present season and the coming winter, at a probable cost of $20,000, and will be occupied about May 1, 1906. The present leased quarters for offices will then be given up, for which an annual rental of $1,260 is now paid. The parking of the canal grounds will follow the construction of the engineer building.

The dredging operations, which were completed November, 1902, have given 17 miles of dredged channels from 120 to 600 feet in width and basins of an aggregate area of about 360 acres, all of a depth of 20 feet or over, at low-water datum, which must be maintained thereafter by dredging, as needed.

The piers at the Wisconsin Entrance were placed about thirty-two years ago in water of an average depth of 8 to 10 feet, the object then being to secure a depth of 12 feet in the channel. With the growth of commerce the channel depth has been increased to 24 feet, and the crib bottoms are now many feet above the bottom of the channel. Owing to this and other causes considerable displacement has resulted

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and the present piers are to be replaced by new ones, to consist of a novel design of concrete construction, from 21 feet below water to 10 feet above water. The plan adopted was proposed in 1902, and the work of construction was begun in the spring of 1903, and is now in progress. About one-half of the south pier, or one-fourth of the entire work, was completed last season. A description of the plant and methods employed will be found in Appendix A A A, page 3779, of the Annual Report of the Chief of Engineers for 1904.

The work for this season has been interrupted for a time by the loss of a protection dike during a severe storm in May, necessitating the building of a more substantial breakwater. It is expected that the laying of concrete will be resumed later in the season.

The estimated cost of this work is $925,000. The balance available from the appropriations authorized by the act of June 3, 1896, was $275,000.

The remainder of the estimated cost has been provided for by appropriations and authorized contracts in the river and harbor acts of June 13, 1902, and March 3, 1905.

The usual variation of water level extends from about 0 to +1 foot above low-water datum.

The head of navigation is at the foot of the rapids just above the village of Fond du Lac, on the St. Louis River, about 20 miles from Lake Superior.

The improvements made are in excellent condition, and the expenditure has been amply justified by the immense commerce which it has readily accommodated.

The additional work proposed is for the purpose of extension of benefits by increasing facilities of navigation and making present improvements more permanent in character.

The lake commerce of this port, Duluth-Superior, during the last season of navigation amounted to 16,617,017 tons (of 2,000 pounds), valued at $157,233,209, and from the beginning of improvements by the United States in 1867 to 1904, inclusive, the vessel freight entering and departing has amounted to 155,547,901 tons (of 2,000 pounds), valued at $2,144,080,679.

It is believed that the tonnage of Duluth-Superior Harbor is now exceeded by that of but two ports in the United States—New York and Philadelphia.

Fifty-three per cent of the freight passing the Sault locks in 1904 was for Duluth-Superior Harbor.

For a comparison between the cost of improvements and the volume of commerce it may be stated here that the total amount of money expended by the Government on the improvement of this harbor from the commencement of work in 1867 up to 1904, inclusive, is $4,831,514.14. The vessel freight received and shipped at this port during the same period was 155,547,901 tons, and its market value was $2,144,080,679. From this it appears that the cost of Government improvements has been less than one-fourth of 1 per cent of the value of the freight transported.

Effect of project on freight rates: It may not be possible to give exact figures showing the effect of the improvement of this harbor on

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freight rates, but the following statements have a bearing on the question:

The average rate on freight passing through the St. Marys Falls canals in 1904 was 0.81 mill per mile per ton, and the average haul was 843.5 miles, as shown by the official records. If the same freight had been carried by rail, the rate would probably have been as much as 3 mills per ton-mile, making a difference of 2.2 mills per ton-mile.

Assuming this difference to apply to freight for Duluth-Superior Harbor, and that the average haul is 900 miles, in round numbers, the saving in cost of transportation by water would be $1.98, or about $2 per ton, and for the 16,617,017 tons received and shipped at this harbor in 1904 the saving in cost amounts to $33,000,000 in that one year.

The saving in cost of this large sum has, of course, been made possible by the Government improvements, not only at this harbor, but at St. Marys River and at other points between here and the Lake Erie ports, and it is not known just how much of the above saving should be credited to the Duluth-Superior improvements.

It has been estimated [a] that the amount of saving in freight rates on Lake Superior commerce during a single year is within $5,000,000 of the entire amount appropriated by the United States for all harbors and waterways on the lakes above Niagara Falls from the formation of the Government; and that if the commerce between Lake Michigan and Lake Erie be included, the annual saving greatly exceeds the amount thus appropriated.

Taking this view of it, it is easy to see that with any reasonable proportion of such saving in transportation accredited to the improvements at this harbor, which forms an essential and necessary part of the whole waterway, the cost of such improvements must be only a small fraction of the saving in freight rates effected thereby.

The time has arrived in the history of this harbor when the maintenance of its improvements, it is believed, should be provided for annually. With 49 miles of harbor frontage, 17 miles of 20-foot channels, and the handling of 17,000,000 tons of vessel freight annually, there is necessity for the closest inspection, by a special patrol provided with a steam tug, to prevent injurious deposits, encroachments of wharves and other private structures, the enforcement of rules regarding the rafting of logs, the anchorage of vessels, the opening of draws, and the care of United States property. These, with the discovery and removal of shoals, repairs to Government piers, the care of parks, and the collection of complete and reliable commercial statistics, which has already proven of great value, it is thought could best be cared for by Congressional action authorizing allotments or appropriations to be made annually on estimates to be submitted by the engineer officer in charge.

[a] Alfred Noble, in the Development of the Commerce of the Great Lakes, a presidential address, Am. Soc. C. E., June 9, 1903.

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July 1, 1904, balance unexpended		$240,874.73
Amount appropriated by river and harbor act approved March 3, 1905		270,000.00
		510,874.73
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$167,985.37	
For maintenance of improvement	25,000.00	
		192,985.37
July 1, 1905, balance unexpended		317,889.36
July 1, 1905, outstanding liabilities		25,000.00
July 1, 1905, balance available		292,889.36
July 1, 1905, amount covered by uncompleted contracts		75,000.00
Amount (estimated) required for completion of existing project		300,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905		150,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix I I 3.)

4. Harbor at Portwing, Wis.—The harbor of Portwing, formed by the mouth of Flag River, is situated on the south shore of Lake Superior, about 33 miles from the head of the lake.

Before improvement the depth at entrance was small and variable.

Previous to Government operations the harbor had been improved by private parties to some extent. The entrance had been jettied, but imperfectly and with only partial success, and dredging was necessary every spring for removing a sand bar. Within the harbor much dredging had been done to accommodate the lumber business.

In accordance with the provisions of the act of Congress approved March 3, 1899, a report upon a survey of this harbor and a project for its improvement were submitted on November 20, 1899.

This project provided for the construction of two parallel piers of piling, filled in with slabs and topped with large rock. These piers were to be located 200 feet apart and to be 800 feet and 825 feet long, respectively. A channel 150 feet wide and 15 feet deep was to be dredged between the piers and for 500 feet along the slough. The estimated cost of the improvement was $44,992.

By act of Congress approved June 13, 1902, this project was adopted, and the sum of $25,000 was appropriated, provided the United States should, before the commencement of operations, be given clear title, without cost, to all lands needed for the improvement.

This provision was complied with by a deed to the United States, dated July 9, 1902, conveying 7 acres of land at the harbor entrance.

Under the approved project work was begun June 1, 1903. The east pier was built in that season. In the same season and the following, dredging was done to the extent of 39,374 yards, which nearly exhausted the funds appropriated. This dredging gave an entrance channel 15 feet deep at low water, 100 feet wide, and extending from deep water in the lake through to a distance of 100 feet inside of the inner end of the east pier. A small portion of the proposed turning slip was also dredged 30 feet wide and to a distance of 50 feet.

The river and harbor act approved March 3, 1905, appropriated $19,992 for completing the improvement and for maintenance. A

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contract for building the west pier has been let, and work on same commenced June 28, 1905. Further dredging will be done after the pier is built.

The east pier has already been effective in reducing shoaling very materially. In the following spring after it was built there was an available depth of 14 feet previous to further dredging. The present season has shown a sand bar advancing from the west at the shore line, narrowing the channel to 70 feet at that point. The west pier will prevent the formation of this bar hereafter, and when the channel is completed it is expected that the cost of maintenance of the entrance will be small. At present the least depth of water through the entrance is 14½ feet at low water.

It is proposed to expend the present appropriation in completing the approved project, and the balance, if any, for maintenance.

No additional improvement is considered advisable under present conditions of the harbor and its commerce, but provision should be made for maintenance.

The amount expended on this work to the close of the fiscal year ending June 30, 1905, exclusive of outstanding liabilities, was $25,099.33—all for improvement.

The usual variation of water level extends from about 0 to +1 foot above low-water datum.

Private dredging has extended a navigable channel to a distance of about 2,500 feet southerly from the main entrance, giving access to a lumber wharf which extends along its entire length and to a small commercial wharf. Navigation is limited to this improved stretch of Flag River.

A more detailed description of the harbor may be seen in House Document No. 114, Fifty-sixth Congress, first session, and in Bulletin No. 14, Survey of the Northern and Northwestern Lakes, page 65, and in Supplement (to latter) No. 2, page 5.

The vessel freight of this harbor has increased from 64 arrivals and departures, with 31,127 tons (of 2,000 pounds), valued at $305,000, in 1901, to 466 arrivals and departures, with 44,394 tons (of 2,000 pounds), valued at $568,133, in 1904.

The total freight for this port for four years—1901 to 1904, inclusive—was 168,213 tons (of 2,000 pounds), valued at $2,311,587.

July 1, 1904, balance unexpended		$3,523.93
Amount appropriated by river and harbor act approved March 3, 1905		19,992.00
		23,515.93
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$3,000.00	
For maintenance of improvement	623.26	
		3,623.26
July 1, 1905, balance unexpended		19,892.67

(See Appendix I I 4.)

5. Harbor at Ashland, Wis.—Ashland Harbor is located at the head of Chequamegon Bay, and originally had no protection from the waves which rolled into the bay nor from waves generated within the bay itself by storms.

The original project, approved December 7, 1888, and modified February 9, 1889, was for the construction of a pile, slab, and rock breakwater 8,000 feet long, and for dredging a channel in front of the

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wharves of the city. The act of March 3, 1899, added to this project by authorizing an extension of the breakwater to the shore, thus requiring the ultimate construction of 10,200 feet of breakwater. The emergency river and harbor act of June 6, 1900, provided that the appropriation already made should be expended in building a shore spur 4,700 feet in length from a point 2,600 feet east of the prolongation of the present breakwater and parallel thereto. This again changed the project, adding greatly to the total length of breakwater to be constructed and largely to the total expense.

Under this project and its two modifications there have been constructed 7,454 feet of breakwater on the original line and 842 feet on the line fixed by the act of June 6, 1900.

Of the 7,454 feet on the original line 91 feet is detached and uncompleted work near shore and 7,363 feet is completed breakwater in one piece.

The total amount expended on this project and its modifications up to the close of the fiscal year ending June 30, 1905, not including outstanding liabilities, is $313,544.22, of which amount $127,000 has been applied to the maintenance of the improvement.

The work done gives a protected area of about 1,600 acres and affords safe anchorage and dockage for a distance of 3 miles along the city front.

The pile, slab, and rock breakwater on the original line is in very poor condition and has required large expenditures for maintenance.

The work of revetting this structure with riprap so as to form a permanent rubble-mound breakwater, with the old structure for a hearting, was begun in May, 1903, and 1,766 feet, or 24 per cent, of the main breakwater has thus been strengthened.

A new contract has been entered into for continuing this rock work, although not yet approved. With the money available and the low price obtained it is expected to revet about 3,516 feet, and this with what is already done would amount to 5,282 feet, or 72 per cent of the entire length of the main breakwater, but will not complete that percentage of the entire work, as the water is much deeper at the west end of the breakwater, requiring more riprap for the same length of work. This contract is to be completed by December 1, 1906.

This work of maintenance, by strengthening the breakwater, is deemed of more importance at the present time than further improvement by extensions of breakwater or channels, and should be prosecuted continuously until the entire 7,363 feet of main breakwater is revetted.

A channel was dredged by the United States in 1897, and extended in 1903, along the harbor front from the natural deep water near Ellis avenue and the Commercial dock westerly to the Barker & Stewart lumber docks, a distance of about 4,360 feet. This channel has a width of from 90 to 140 feet, in which the maximum draft that can be carried is 18 feet at mean low water.

See map in Report of Chief of Engineers, United States Army, for 1903, page 1812.

The usual variation of level of the water surface extends from about 0 to +1 foot above low-water datum.

The commerce of this port consists principaly of iron ore and lumber exported, and coal, mineral oil, and general merchandise imported.

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The commerce has increased, during the seventeen years the harbor has been under improvement by the United States, from 892 arrivals and clearances, with cargo tonnage of 1,400,000 tons (of 2,000 pounds) in 1887, to 1,887 arrivals and clearances, with cargo tonnage of 3,435,328 tons (of 2,000 pounds), valued at $18,725,768, in 1904; the total commerce from 1887 to 1904, inclusive, being estimated at 55,266,276 tons (of 2,000 pounds), valued at $443,289,690.

July 1, 1904, balance unexpended	$9,853.76
Amount appropriated by river and harbor act approved March 3, 1905	60,000.00
	69,853.76
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	8,897.98
July 1, 1905, balance unexpended	60,955.78
Amount (estimated) required for completion of existing project	326,500.00

(See Appendix I I 5.)

6. Harbor at Ontonagon, Mich.—The entrance to Ontonagon River, which forms the harbor, had but 7 feet depth in 1867, at which time the project for securing 12 feet depth by building parallel piers on either side of the mouth, extending to the 18-foot curve of depth in Lake Superior, and dredging a channel between the piers, was adopted. The west pier was built to a length of 2,675 feet and the east pier to a length of 2,315 feet. This brought the outer end of the west pier very nearly to the 18-foot curve of depth, as proposed.

As far as new work is concerned the project has been completed since 1889, and further expenditure will be needed only for keeping a 12-foot channel open by dredging and for the repairs to the piers.

The amount expended on this improvement up to the close of the fiscal year ending June 30, 1905, not including outstanding liabilities, is $357,764.17, of which sum $73,000 has been spent for maintenance of the improvement.

The latest dredging was done in May and June, 1905. Unusual shoaling of the entrance was found early in the spring, forming serious obstructions to navigation. The sum of $3,000 appropriated by the act of March 3, 1905, being insufficient to afford relief, an allotment of $5,000 from the emergency appropriation for river and harbor works (act of March 3, 1905) was authorized and dredging was done to the extent of 36,310 yards, at a contract cost of 20 cents per yard, or $7,262. The county authorities appropriated $500, and expended this sum in continuing the dredging done by the Government, and the Ontonagon Lumber and Cedar Company expended about $100 in dredging near their property.

The result of this work was to give a channel through the bar in the lake 120 feet wide and 15 feet deep at low water, a channel between the entrance piers 60 feet wide and 14 feet deep, and a channel on the west side of the inner harbor 75 feet wide and 12 feet deep. The east side of the inner harbor has a depth of 11 feet up to the Commercial dock remaining from the dredging done in 1903.

The channels thus dredged afforded immediate and much-needed relief, but are too narrow to fully answer the needs of navigation.

The east pier is generally in good condition, the west pier badly decayed near the outer end.

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The usual variation of water level extends from 0 to +1 foot above low-water datum.

A large saw mill was built in 1904 on the site of the former saw mill of the Diamond Match Company, which was destroyed in the fire of 1896, when the village was nearly wiped out.

A bridge was built across the Ontonagon River, 2,200 feet above the highway bridge, by the Chicago, Milwaukee and St. Paul Railway Company in the fall of 1904 and following winter. Authority for this bridge was granted by the legislature of the State of Michigan, and the plans were approved by the Secretary of War. The construction was done under the supervision of the engineer officer in charge of the district.

In 1867 there were 449 arrivals and departures, with 5,000 tons of cargo, and in 1904 there were 278 arrivals and departures, with 16,900 tons (of 2,000 pounds) of cargo, valued at $906,500.

The commerce of this port since the commencement of operations by the United States is estimated at 2,735,754 tons (of 2,000 pounds), valued at $72,796,024.

The amount of freight received and shipped in the calendar year 1904 was more than twice that of 1903.

July 1, 1904, balance unexpended	$335.36
Amount appropriated by river and harbor act approved March 3, 1905	3,000.00
Amount allotted from appropriation for maintenance of river and harbor improvements, act of March 3, 1905	5,000.00
	8,335.36
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	7,971.53
July 1, 1905, balance unexpended	363.83

(See Appendix I I 6.)

7. Waterway across Keweenaw Point, from Keweenaw Bay to Lake Superior, Michigan.—This work was formerly reported on as the Portage Lake and Lake Superior canals, across Keweenaw Point, Michigan.

In accordance with the provisions of the river and harbor act of September 19, 1890, the United States purchased and assumed the charge and care of these canals on August 3, 1891.

At the time of the purchase by the United States there was a very poor 13-foot navigation; the channel was narrow and crooked, with many sharp bends; it was poorly marked and lighted; the entrance piers were in a very bad condition, the revetments were decayed or entirely gone, and there was a tax on the commerce through the canals in the shape of a tonnage charge.

The original project, adopted January 24, 1887, was—

1. For a 16-foot channel of 70 feet bottom width from bay to lake.
2. A renewal of the canal revetments.
3. A reconstruction of the piers at the Lake Superior entrance and their extension to 30 feet depth of water.
4. The extension of the pier at the Keweenaw entrance to a 20-foot depth of water.
5. At the proper time to increase the channel depth to 20 feet, with a corresponding width, which should not be less than 120 feet.

The sum expended in the purchase of the canals, lands, etc., and on items 1 and 2 of the original project was $850,000.

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The act of June 3, 1896, authorized continuing contracts to complete items 1, 2, 3, and 4 of the above project to the amount of $1,115,000.

By modification approved March 15, 1898, the width and depth were to be increased to 120 feet and 20 feet, respectively, as originally contemplated.

The total amount expended on the original project and its modifications up to the close of the fiscal year ending June 30, 1905, not including outstanding liabilities, was $1,295,604.95, of which about $22,500 was expended for maintenance.

With the termination of the dredging contract in 1903 the funds appropriated for the improvement of this waterway were practically exhausted.

The project at this time was not fully completed, there being two localities where the width was less than 120 feet, and some revetment work remained to be done. The cost of completion was estimated at $45,000.

It should be remembered that the appropriations made and authorized June 3, 1896, amounting to $1,115,000, were for the original project, which provided for a 16-foot channel 70 feet wide. When the project was modified in 1898, increasing the depth to 20 feet and the width to 120 feet, there was no increase made in the estimate of cost, as it was thought by the officer in charge that with the lower prices resulting from the continuing appropriations the additional width and depth could be obtained with the $1,115,000 already provided for. This, it will be seen by the foregoing, was almost realized, lacking only $45,000, and the said amount appropriated and expended ($1,115,000) is about $715,000 less than the original estimate for the modified project.

The act of March 3, 1905, appropriated $45,000 for continuing improvement.

Under this provision bids were opened June 27, 1905, and a contract is about to be entered into for dredging which will give a full width of 120 feet, with a depth of 20 feet at low water, throughout the waterway.

In addition to the work necessary to complete the approved project, which will be accomplished the present season, the district officer has represented as a further need of navigation the establishment near the lower end of the canal of a harbor of refuge similar to that known as the "Lily Pond," near the upper end. The work would be simple, involving only an enlargement of the canal and the construction of revetment, and is recommended as of great value to navigation. An estimate can be submitted without further investigation.

The maximum draft that can be carried through the waterway at present is 20 feet at low water.

The usual variation of water level extends from about 0 to +1 foot above low-water datum.

During the navigation season of 1904 the commerce through this waterway amounted to 2,295,922 tons (of 2,000 pounds) of freight, valued at $59,008,949, and 26,237 passengers. The decrease in freight tonnage under that of the preceding year amounted to 2 per cent.

There was also a local business of about 100,000 tons of freight, valued at about $1,000,000.

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From the commencement of operations for improvement by the United States in 1891 to the close of the calendar year 1904 it is estimated that the total vessel freight entering and departing aggregated 18,651,690 tons (of 2,000 pounds), valued at $572,483,209.

Amount appropriated by river and harbor act approved March 3, 1905	$45,000.00
June 30, 1905, amount expended during fiscal year, for works of improvement	367.27
July 1, 1905, balance unexpended	44,632.73

(See Appendix I I 7.)

8. Operating and care of waterway across Keweenaw Point, from Keweenaw Bay to Lake Superior, Michigan.—During the fiscal year ending June 30, 1905, the sum of $15,000 from the permanent indefinite appropriation of July 5, 1884, was expended in maintaining, by dredging, a 20-foot stage of water, in repairs to entrance piers and to revetments, in superintendence and general operation of the canals, guarding against encroachments on the channels by private parties and corporations, on surveys and mapping of the waterway, the collection of commercial statistics, etc.

An allotment of $11,500 from the same source for the same purpose has been made for the fiscal year ending June 30, 1906.

(For further details, see the report on this work by the district officer.)

(See Appendix I I 7.)

9. Harbor at Marquette, Mich.—This harbor, which had a natural depth of 18 feet or more, afforded no protection to vessels from easterly or northeasterly storms, and projects were approved in 1867 and 1888 for the construction of a breakwater composed of cribs filled with rock and projecting from the shore into the bay a distance of 3,000 feet. This breakwater was finished in 1894 practically as projected, but since its commencement extensive repairs have been made to the superstructure.

The amount expended up to the commencement of operations upon the new project was $469,732.44.

A project for a concrete superstructure was approved February 27, 1890. Its estimated cost was $232,936.71.

Work on this concrete superstructure was begun in the spring of 1895, and has been prosecuted since, with the exception of two years when no funds were available. The latest work has been done under the provisions of the act of Congress approved June 13, 1902, which contains the following clause:

> Improving harbor at Marquette, Michigan: Continuing improvement and for maintenance, twenty-six thousand dollars: *Provided*, That a contract or contracts may be entered into by the Secretary of War for such materials and work as may be necessary for the completion of said project, to be paid for as appropriations may from time to time be made by law, not to exceed in the aggregate eighty thousand dollars, exclusive of the amounts herein and heretofore appropriated: *And provided further*, That of the sum provided for improvement and maintenance an amount not exceeding seven thousand five hundred dollars may be expended in connecting the Presque Isle breakwater with the shore.

The sundry civil act of March 3, 1903, appropriated $80,000 in accordance with the foregoing act. With this sum the entire amount of the estimated cost has been appropriated.

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The amount expended on the new project up to the close of the fiscal year ending June 30, 1905, not including outstanding liabilities, was $188,176.84, of which $8,000 was spent for maintenance. The work done has resulted in the protection of the ore, coal, lumber, and commercial docks from storms, and has shown the efficiency of the concrete breakwater.

The concrete superstructure is now built to a length of 2,920 feet, which is 97 per cent of the entire length. It is 100 feet short of the end of the old breakwater, there not being money enough to build a pierhead at the southerly terminus.

Some reasons why this work can not be completed within the limit set by law are: (*a*) The diversion of $7,500 for the harbor of refuge at Marquette Bay by the act of June 13, 1902; (*b*) owing to the disadvantage of having small appropriations, at two-year intervals, for a large work, it has cost more than it otherwise would; (*c*) the cost of maintenance of the old breakwater during the construction of the new superstructure has been considerable, and the new superstructure suffered damage from a storm in December, 1904, of unusual severity. Repairs of the latter are now in progress, which are estimated to cost between $4,000 and $5,000.

It is now estimated that to complete the existing project a further appropriation of $15,000 will be necessary, and this sum would be expended in building a pierhead.

For the maintenance of the breakwater the sum of $10,000 should be appropriated.

A preliminary examination and a survey of Marquette Harbor and vicinity "with a view to ascertaining whether further harbor of refuge facilities are needed, and if so, at what point," authorized by the river and harbor act approved June 13, 1902, were made by the district officers, who express the opinion that greater refuge facilities are needed in this vicinity; that Marquette Harbor is the best place for such improvement, and that the additional shelter should be secured by extending the present breakwater for a distance of 1,500 feet, at an estimated cost of $303,000. The reports on this subject were transmitted to Congress by the Secretary of War December 16, 1903, and printed in House Document No. 161, Fifty-eighth Congress, second session. They are also printed in the Annual Report of the Chief of Engineers for 1904, Appendix I I, page 2786. The document is accompanied by a map of the harbor.

If provision be made by Congress for this extension, no pierhead will be required at the present end of the breakwater, and a smaller sum of about $8,000 will be needed to continue the regular form of concrete superstructure over the gap of 100 feet which now remains.

Between the breakwater and the ore docks to the west there is generally from 20 to 30 feet of water, except at the northerly 400 feet of the harbor, where the depth at low-water datum is only 14 to 18 feet.

The vessel commerce of this port has increased from 780 arrivals and clearances during the fiscal year ending June 30, 1872, with a registered tonnage of 370,000 tons, to 2,064 arrivals and clearances in 1896, carrying 1,832,061 tons (of 2,000 pounds) of freight, and 1,811 arrivals and clearances in 1904, carrying 2,414,534 tons (of 2,000 pounds), valued at $9,080,817. The total commerce from 1867 to 1904, inclusive, is estimated at 30,583,819 tons (of 2,000 pounds), valued at $139,798,748. This includes Marquette Bay.

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July 1, 1904, balance unexpended		$43,604.13
Amount appropriated by river and harbor act approved March 3, 1905		3,000.00
		46,604.13
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$33,000.00	
For maintenance of improvement	3,954.72	
		36,954.72
July 1, 1905, balance unexpended		9,649.41
July 1, 1905, outstanding liabilities		250.00
July 1, 1905, balance available		9,399.41

(See Appendix I I 8.)

10. Harbor of refuge, Marquette Bay, Michigan.—Marquette Bay, also known as Presque Isle Harbor, is a small bay within the city limits of Marquette, north of Marquette proper, and distant 1½ miles therefrom.

Before improvement the locality was fully exposed to storms from the east and northeast, and comparatively little shipping was done.

A resolution of Congress approved March 20, 1896, directed the Secretary of War to make a survey and submit an estimate for a breakwater in this bay. The results of this survey, with estimates amounting to $20,000 for breakwater 500 feet long and $50,000 for construction of one 1,000 feet long, are published in House Document No. 318, Fifty-fourth Congress, first session.

The project adopted by the act of June 3, 1896, is to build a breakwater 1,000 feet in length off Presque Isle Point.

This breakwater was completed to its full length in July, 1900.

The act of Congress approved June 13, 1902, provided that a portion of the appropriation for Marquette Harbor "not exceeding seven thousand five hundred dollars may be expended in connecting the Presque Isle breakwater with the shore."

Under this provision the gap between the breakwater and shore was closed, in the fall of 1902, by a timber pier 216 feet long, and 100 linear feet of shore revetment constructed.

No additional work is proposed except for maintenance.

The total amount expended on the project up to the close of the fiscal year ending June 30, 1905, not including outstanding liabilities, was $57,290.58, of which $2,200 was expended for maintenance.

The work done has enabled vessels to lie in safety at the ore pier and other docks in the vicinity, and shipping has increased greatly.

This harbor is largely used for commercial purposes, but to little or no extent as a harbor of refuge.

Vessels drawing 19 feet can reach the ore pier at mean low water.

The usual variation of water level extends from 0 to +1 foot above low-water datum.

The lake commerce of this port has increased from 1,110 arrivals and departures, with 1,095,243 tons of freight, in 1897, to 650 arrivals and departures, with 1,232,450 tons (of 2,000 pounds), valued at $3,521,433, in 1904. The total commerce from 1897 to 1904, inclusive, being estimated at 11,348,440 tons (of 2,000 pounds), valued at $28,526,749.

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July 1, 1904, balance unexpended	$209.42
Amount appropriated by river and harbor act approved March 3, 1905	1,000.00
July 1, 1905, balance unexpended	1,209.42

(See Appendix I I 9.)

11. Harbor of refuge at Grand Marais, Mich.—Originally the entrance to this harbor was obstructed by a bar having but 9 feet depth of water upon it. The project for its improvement, adopted August 5, 1881, and modified December 21, 1894, has for its object a deep and safe channel into the harbor, making it a harbor of refuge. This object is to be attained by building parallel piers 500 feet apart projecting into the lake to a depth of 22 feet, and dredging out an 18-foot channel between them, connecting the deep water of the lake with that of the harbor, and by closing up the natural entrance, 5,770 feet in width, by a solid pile dike, driven with a slope toward the waves and strongly braced. The proposed length of each pier was 1,800 feet. The estimated cost of the entire project was $484,000. The west pier has now reached a length of 1,912 feet, the east pier 1,545 feet, and the pile dike is completed.

This dike was built in 1895–1897 to close the natural entrance, to protect the harbor from storms, and prevent the movement of sand into the harbor. The expected formation of a sand beach along the line of the dike is partially realized, but much of the dike is still exposed to waves, and is failing from age, decay, and the action of ice. The work of strengthening the dike by depositing an embankment of rock against it on the harbor side was begun in 1904, and about $14,000 was expended, of which amount the sum of $5,000 was an allotment from emergency appropriation, act of June 13, 1902.

Bids for continuing this repair work on a slightly different plan have been opened, and an award of contract recommended, and it is expected to complete the work of reenforcing the dike this season at an additional cost of about $30,000. The portion of dike to be strengthened by this work is about 3,600 feet long. It is hoped that no further work than this will be necessary on the dike, but it is possible that the riprap will settle into the sand bottom by the action of waves and require additional rock.

The last dredging was done in 1904 and gave an average depth of 18½ feet at low-water datum and a least depth of 16 feet (where some lumps were left by the dredge) for a width of 180 feet to 190 feet. This will provide sufficient depth for coasting vessels and lumber carriers, such as trade at that port, and would admit any of the larger vessels when running light, but not when loaded.

In front of the entrance to the harbor the 22-foot curve of depth has advanced lakeward between 400 and 500 feet since the project for improvement was adopted, and this fact will entail some additional expense for pier extension to deep water. This would now require an addition of 360 feet to the west pier and 704 feet to the east pier. This would bring the total cost of these extensions up to $119,168—about $36,000 more than the original estimate. It is hoped, however, that the original estimate will finish the west pier and build all that is necessary of the east pier. The west pier is now advanced 344 feet farther into the lake than the east pier.

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The usual variation of water level extends from 0 to +1 foot above low-water datum.

The sand movement in front of the entrance is generally from the west toward the east, and it is important that the west pier be extended to deep water soon, in order to shut off the encroachment of sand upon the channel from that direction. The extension of the east pier should be built after the completion of the west pier, and it is quite possible that its full extension will not be necessary.

It is proposed to expend about $30,000 of the last appropriation for maintenance in completing the reenforcement of the pile dike as above described. The remainder of said appropriation ($20,000) it is proposed to expend toward building the west pier of the entrance out to the 22-foot depth of water, and in extending the east pier for a distance of about 385 feet, which it is hoped may be sufficient for a good many years, with a small amount of dredging occasionally to remove shoals.

The commerce of this port has increased from 1,910 tons in 1887 to 656 arrivals and clearances, with 90,497 tons of freight, valued at $691,650, in 1896, and 1,535 arrivals and clearances in 1904, with 82,575 tons (of 2,000 pounds), valued at $1,821,054.

The total commerce from 1880 to 1904, inclusive, is estimated at 1,155,874 tons (of 2,000 pounds), valued at $15,736,645.

The amount expended on the project up to the close of the fiscal year ending June 30, 1905, not including outstanding liabilities, was $405,883.62, of which $50,000 was expended for maintenance.

July 1, 1904, balance unexpended	$22,603.64
Amount appropriated by river and harbor act approved March 3, 1905	50,000.00
	72,603.64
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	22,763.94
July 1, 1905, balance unexpended	49,839.70
Amount (estimated) required for completion of existing project	63,401.68

(See Appendix I I 10.)

IMPROVEMENT OF RIVERS AND HARBORS ON THE NORTHERN AND WESTERN SHORES OF LAKE MICHIGAN.

This district was in the charge of Maj. J. G. Warren, Corps of Engineers. Division engineer, Col. O. H. Ernst, Corps of Engineers, until April 5, 1905, and Lieut. Col. W. H. Bixby, Corps of Engineers, since that date.

1. Manistique Harbor, Michigan.—The original depth at the mouth of the Manistique River was 8 feet. By private enterprise 3,000 linear feet of slab piers had been built and a channel dredged to a depth of 11 feet before any appropriation had been made by the Government.

The original project, adopted in 1880, provided for increasing the depth of the channel to 13 feet below datum for a width of 150 feet, by dredging. The amount expended on this project is $3,955.05.

The present project, adopted by the river and harbor act of March 3, 1905, is estimated to cost $270,000, and provides—

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(*a*) On the east side of the harbor mouth: For construction of a pier connecting the shore with the old breakwater, the renewal of the superstructure of the latter with concrete, and its extension westwardly a distance of 350 feet.

(*b*) On the west side of the harbor mouth: For the construction of 1,200 feet of pier between the existing west pier and the 17-foot contour of the lake.

(*c*) For dredging to a depth of 19 feet below datum (581.28 feet above mean tide at New York, N. Y.), except over the area inside the present 17-foot contour on the west side of the entrance.

The estimate of cost does not include the acquisition of land and existing structures required in connection with the proposed work, which should be transferred to the United States without expense before the improvement is begun.

The amount expended under this project to June 30, 1905, is $372.26.

The expenditures under existing project have been for a survey, and no result in the way of increased depth and width has been obtained.

No soundings have been taken since 1903. It is thought that there has been no material change since then and that the maximum draft which could be carried June 30, 1905, was about 15 feet. The usual mean annual variation of level of water surface is about 1 foot.

The commerce affected by the project is in lumber, coal, and general merchandise; car ferries call at this harbor during the entire year. The volume of commerce which will be benefited is considerable. The value of the commerce affected is not known.

It is believed that the project will have a material effect in controlling freight rates on bulk commodities such as coal, grain, and ore; it is impracticable to estimate the amount of reduction in rates thereby effected.

For references for more extended information and for report on examination and survey, see Annual Report for 1904, Part 3, page 2869.

Commercial statistics for 1904.—Arrivals of vessels, 149; exports and imports, 319,152 tons.

July 1, 1904, balance unexpended	$2,044.95
Amount appropriated by river and harbor act approved March 3, 1905	25,000.00
	27,044.95
June 30, 1905, amount expended during fiscal year, for works of improvement	372.26
July 1, 1905, balance unexpended	26,672.69
July 1, 1905, outstanding liabilities	117.00
July 1, 1905, balance available	26,555.69
Amount (estimated) required for completion of existing project	245,000.00

(See Appendix J J 1.)

2. Gladstone Harbor, Michigan.—The harbor of Gladstone is a natural one, and the main channel is from 24 to 42 feet in depth. The portion of this harbor under improvement was obstructed by shoals.

The original project, which is the existing project, was adopted by act of March 3, 1905, and provides for dredging to a depth of 21

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feet below datum of so much of the harbor as lies outside of a line drawn perpendicular to the axis of the ore dock through its outer end. Estimated cost, $14,000. The total amount expended on existing project to June 30, 1905, is $133.43.

The expenditures have been for dredging. The work has not progressed sufficiently to be of any material benefit to commerce.

No soundings have been taken since 1903. It is thought that there has been no material change since then and that the maximum draft which could be carried June 30, 1905, was about 20 feet. The usual mean annual variation of level of water surface is about 1 foot.

The commerce affected by the project is mostly coal, grain, flour, and general merchandise, and is general in character. The volume of commerce is large; its value is not known.

It is believed that the project will have a material effect in controlling freight rates on bulk commodities such as coal, grain, and ore; it is impracticable to estimate the amount of reduction in rates thereby effected.

For report on examination and survey, see Annual Report for 1904, Part 3, page 2861.

Commercial statistics for 1904.—Arrivals of vessels 210; exports and imports 494,236 tons.

Amount appropriated by river and harbor act approved March 3, 1905	$14,000.00
June 30, 1905, amount expended during fiscal year, for works of improvement	133.43
July 1, 1905, balance unexpended	13,866.57
July 1, 1905, amount covered by uncompleted contracts	11,050.00

(See Appendix J J 2.)

3. Menominee Harbor and River, Michigan and Wisconsin.—Prior to act of June 13, 1902, the harbor and river constituted two works; by this act they were consolidated.

(*a*) *Harbor.*—Original depth of channel, about 5 feet; width, 200 feet. Project adopted in 1874 to obtain a depth of 15 feet; modified in 1899 for increasing the depth to 20 feet. Amount expended on original and modified projects, $234,344.77.

(*b*) *River.*—Original navigable depth, 5 feet. Project adopted in 1890 to obtain a depth of 17 feet. Expended on original and modified projects, $114,414.15.

(*c*) *Harbor and river.*—The existing project, adopted by act of Congress approved June 13, 1902, provides for increasing the depth to 20 feet, at an estimated cost of $60,000.

The act of March 3, 1905, provides for modifying the existing project. The improvement of all that portion of the Menominee River above and to the westward of Ogden Street Bridge will accordingly be omitted.

The amount expended on the work of existing project up to the close of the fiscal year ending June 30, 1905, was $41,183, of which amount $2,931.31 was applied to maintenance.

The existing project, as modified, was completed in 1903. Since then the expenditures have been for maintenance.

The maximum draft that could be carried June 30, 1905, over the shoalest part of the locality under improvement was about 19 feet. The mean annual variation of level of water surface is about 1 foot.

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The Menominee River is navigable for a distance of about 2 miles from its mouth.

The volume of commerce, while large, is not increasing. Its value is not known.

It is believed that the project has a material effect in controlling freight rates on bulk commodities, such as coal, grain, and lumber. It is impracticable to estimate the amount of reduction in rates thereby effected.

For references to more extended information, maps, and reports on examinations and surveys, see Annual Report for 1904, page 519.

Commercial statistics for 1904.—Arrivals of vessels, 805; exports and imports, 312,256 tons.

July 1, 1904, balance unexpended	$12,356.32
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	1,209.21
July 1, 1905, balance unexpended	11,147.11
July 1, 1905, amount covered by uncompleted contracts	2,587.44

(See Appendix J J 3.)

4. *Oconto Harbor, Wisconsin.*—The original depth at the mouth of the river, about 3 feet, was increased by private enterprise to 4 feet before work was begun by the United States.

With funds appropriated by Congress in 1881 and 1882 operations were begun in 1882 for the formation of a channel 100 feet wide and 9 feet deep extending from Green Bay up the river for a distance of about 2 miles. In 1897 the project was modified so as to omit 3,800 feet of the upper end of the channel, upon which no work had been done. The estimated cost of the modified project was $115,610. The amount expended to June 30, 1905, was $92,354.65, of which amount $7,785.18 was applied for maintenance of the improvement.

The 9-foot channel was completed to the required width in 1899 except for a distance of about 600 feet.

The maximum draft that could be carried June 30, 1902, was about 7.5 feet. No soundings have been taken since then. One thousand feet above the westerly end of the Government improvement the Oconto River has a navigable depth of about 3 feet.

Mean annual variation in level of water surface is about 1 foot.

The volume of commerce benefited is very small, and it is of a purely local character.

It is believed that the project has no material effect in controlling freight rates.

For references for more extended information, maps, and reports on examinations and surveys, see Annual Report for 1904, page 520.

Commercial statistics for 1903.—Arrivals of vessels, 217; exports and imports, 43,003 tons.

July 1, 1904, balance unexpended	$3,650.23
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	4.88
July 1, 1905, balance unexpended	3,645.35

(See Appendix J J 4.)

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5. Green Bay Harbor, Wisconsin.—This work consists of tw improved channels—first, from the mouth of Fox River northerl to the 17-foot contour in Green Bay; second, Fox River below De pere to the southerly limits of the city of Green Bay. The inter vening pool in Fox River connecting these channels has a natura depth of from 25 feet to 40 feet and requires no improvement. Th outer channel was originally circuitous and narrow, with an avail able depth of 11 feet. The original navigable depth of the inne channel was also 11 feet.

The original projects for the improvement of these channels wer adopted in 1866 and 1892, respectively, to obtain a depth in each o 13 feet; subsequent modifications provided for increasing their depths to 17 feet. The width of the outer channel varies from 20(feet to 500 feet; width of inner channel, 150 feet. These channels were completed by the expenditure of $405,945.18.

The existing project, adopted by Congress by act approved June 13, 1902, provides for increasing the depth of the outer channel to 20 feet, at an estimated cost of $105,600. It also provides for maintenance of existing works.

The amount expended on the work of existing project up to the close of the fiscal year ending June 30, 1905, was $107,827.68, of which amount $5,480.96 was applied to maintenance.

The expenditures during the fiscal year resulted in the removal from the outer channel of shoals having a depth of less than 19 feet over them.

The maximum draft that could be carried June 30, 1905, was about 19 feet in the outer channel and 16 feet in the inner channel.

The mean annual variation in level of water surface is about 1 foot.

Connecting with the upper end of the inner channel at Depere, Wis., Fox River is navigable by canals and slack-water navigation to Portage, Wis., a distance of 156 miles.

The commerce of Green Bay is large and of a general character. Its value is not known.

It is believed that the project has a material effect in controlling freight rates on bulk commodities, such as coal, grain, and lumber; it is impracticable to estimate the amount of reduction in rates thereby effected.

For references for more extended information, maps, and reports on examinations and surveys, see Annual Report for 1904, page 521.

Commercial statistics for 1904.—Arrivals of vessels, 1,370; exports and imports, 1,524,214 tons.

July 1, 1904, balance unexpended	$5,708.71
Amount appropriated by river and harbor act approved March 3, 1905	10,000.00
	15,708.71
October 1, 1904, amount allotted from appropriation for maintenance of river and harbor improvements, act of June 13, 1902, returned to Treasury of United States	2,671.61
	13,037.10
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	2,679.07
July 1, 1905, balance unexpended	10,358.03

(See Appendix J J 5.)

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6. Sturgeon Bay and Lake Michigan Ship Canal, Wisconsin, and harbor of refuge connected therewith.—Prior to act of June 13, 1902, the canal and harbor constituted two works. By this act they were consolidated.

(*a*) *Canal.*—In its natural condition Lake Michigan was separated from Sturgeon Bay, an arm of Green Bay, by a neck of land about 1⅞ miles wide, having a maximum elevation above the lake level of about 28 feet. The Sturgeon Bay and Lake Michigan Ship Canal and Harbor Company from 1872 to 1881 constructed across this neck a canal, without locks or gates, 7,200 feet long, 100 feet wide at water surface, and 14 feet deep, and in continuation of the canal dredged a channel in Sturgeon Bay 6,100 feet long, of about same dimensions as the canal. Of the 14,400 linear feet of canal banks 8,437 feet was provided with pile revetments. The United States assumed possession of the canal April 25, 1893.

The project adopted in 1894 and modified in 1896 provides for completing the revetments, widening the canal to 160 feet, except the westerly 1,000 feet, which is to be 250 feet wide between revetments, with a channel width of 200 feet and a channel 15 feet deep, and was completed during fiscal year ending June 30, 1903.

(*b*) *Harbor.*—Before the construction of this harbor was undertaken the Lake Michigan entrance to the Sturgeon Bay and Lake Michigan Ship Canal was entirely unprotected from storms from northeast to southwest.

The project for constructing a harbor of refuge at this point was adopted in 1873 and modified in 1879 and 1880. The modified project, as carried out and completed in 1884, consisted of two piers, each 1,344 feet long, 850 feet apart at the shore line, protecting the lake entrance to the canal and converging so as to make the harbor entrance 335 feet wide, and inclosing an area of about 10 acres, with a depth of at least 17 feet.

The amount expended on the foregoing projects is $349,119.26.

(*c*) *Canal and harbor.*—The existing project adopted by act of Congress approved June 13, 1902, provides for maintenance and for increasing the depth of channel to 21 feet from Lake Michigan to Sturgeon Bay; estimated cost, $222,000.

The amount expended on existing project up to the close of the fiscal year ending June 30, 1905, is $207,979.56, of which $1,060.37 was applied to maintenance.

The expenditures during the fiscal year resulted in the formation of a channel 21 feet deep, with the exception of that portion in the vicinity of the bridge across Sturgeon Bay, where the projected depth can not be obtained until the bridge has been rebuilt; also in repairs to the north pier, harbor of refuge.

The existing project is completed with the exception of dredging about 500 feet of channel in the vicinity of the bridge. The funds available are sufficient for completion of project.

The maximum draft that could be carried June 30, 1905, between Lake Michigan and the bridge was about 19 feet, but on account of shoal water in the draws of the bridge the maximum draft that could be carried between Lake Michigan and Green Bay was about 15 feet.

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Mean annual variation in level of water surface is about 1 foot.

It is believed that the project has a material effect in controlling freight rates on bulk commodities, such as coal, grain, and lumber. It is impracticable to estimate the amount of reduction in rates thereby effected.

For references to more extended information, maps, and reports on examinations and surveys, see Annual Report for 1904, page 523.

The river and harbor act of March 3, 1905, contains the following item:

Improving Sturgeon Bay and Lake Michigan Ship Canal, Wisconsin, and harbor of refuge connected therewith: The Secretary of War is hereby directed to ascertain and determine whether for the purpose of completing the project submitted in House Document Numbered One hundred and seventeen, Fifty-sixth Congress, second session, it is necessary to remove, relocate, or change the bridge across Sturgeon Bay, at the city of Sturgeon Bay, and if so, whether and to what extent the owners thereof have acquired vested or other rights in its present location, so as to entitle them to damages by such removal, relocation, or change, and in case the said Secretary of War shall determine that such removal, relocation, or change is necessary to complete said project, and that the said owners have acquired vested or other rights in the present location of said bridge, he is hereby authorized and directed to acquire, by condemnation or otherwise, such property as may be necessary, and the sum of fifty thousand dollars, or so much thereof as may be necessary, is hereby appropriated for that purpose.

Commercial statistics for 1904.—Number of vessels passing through canal, 2,453; tonnage, 1,348,691; estimated value of cargoes, $18,329,399.15; number of vessels seeking shelter, 173; tonnage, 45,223; number of passengers passing through canal, 12,316; decrease in value of cargoes in 1904 compared with 1903, $606,973.20.

July 1, 1904, balance unexpended		$75,640.07
Amount appropriated by river and harbor act approved March 3, 1905		50,000.00
		125,640.07
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$47,268.96	
For maintenance of improvement	1,060.37	
		48,329.33
July 1, 1905, balance unexpended		77,310.74
July 1, 1905, amount covered by uncompleted contracts		2,049.96

(See Appendix J J 6.)

7. Operating and care of Sturgeon Bay and Lake Michigan Ship Canal, Wisconsin.—Under an allotment from the indefinite appropriation of July 5, 1884, for operating and care of canals and other works of navigation, there was expended during the fiscal year ending June 30, 1905, $6,965.43.

Repairs were made to the revetments at various places where needed and to the buildings and plant pertaining to the canal. The premises in the vicinity of the office and watchhouses were graded and otherwise improved and the canal operated and cared for in accordance with the approved project.

Navigation through the canal opened April 11, 1904, closed by ice December 16, and resumed April 3, 1905.

For commercial statistics, see report upon improvement of Sturgeon Bay and Lake Michigan Ship Canal and harbor of refuge connected therewith.

(See Appendix J J 7.)

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8. Ahnapee (Algoma) Harbor, Wisconsin.—Previous to the improvement of this harbor the depth of water at the mouth of the Ahnapee River was only 3 feet, and the present harbor was not available for purposes of commerce.

The original project, adopted in 1875, provided for the formation of a small artificial harbor, connected with the lake by a channel 100 feet wide and 13 feet deep, by pier construction, dredging, and rock removal.

Amount expended on original and modified projects prior to operations under existing project, $180,033.50.

The project adopted by Congress, by act approved March 3, 1899, provides for extending the 13-foot channel, for a width of 50 feet, a distance of 800 feet by rock removal and dredging. Estimated cost, $19,266.

The extension of channel provided for by project of 1899 is only partially completed. Its depth is 10 feet, least width 30 feet for a distance of 520 feet.

The amount expended up to June 30, 1905, was $20,662.45, of which $13,000 was for rock removal and dredging under existing project and $7,662.45 for maintenance. The expenditures during the fiscal year have been for dredging for maintenance of channel.

The maximum draft that could be carried June 30, 1905, was about 12 feet. The mean annual variation in level of water surface is about 1 foot.

Ahnapee, or Wolf, River, is navigable for a distance of about 2 miles from its mouth for crafts drawing 4 feet, but there are no vessels plying on it.

The volume of commerce benefited is small and of a local character. It is believed that the project has no material effect in controlling freight rates.

For references for more extended information, maps, and report on examination and survey, see Annual Report for 1904, page 524.

Commercial statistics for 1904.—Arrivals of vessels, 800; exports and imports by all ways of transportation, 300,094 tons, about two-thirds of which is by way of the harbor.

July 1, 1904, balance unexpended	$9,199.69
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	3,675.64
July 1, 1905, balance unexpended	5,524.05
Amount (estimated) required for completion of existing project	6,266.00

(See Appendix J J 8.)

9. Kewaunee Harbor, Wisconsin.—The original entrance to the Kewaunee River was not more than 20 feet wide, with a depth of about 3 feet at its shoalest point, and was obstructed by submerged bowlders. The present harbor was therefore not available for purposes of commerce.

The original project for its improvement, adopted in 1881, which is the existing project, provided for an artificial entrance channel 15 feet deep, located about 2,000 feet south of the river mouth, protected by two parallel piers 200 feet apart, extending from the shore to the 19-foot contour in the lake. Estimated cost, $200,000. The project was completed in 1898, at a cost of about $150,000.

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The amount expended up to June 30, 1905, was $169,525.57, of which amount $19,525.57 was for maintenance.

The expenditures during the fiscal year have been for maintenance, and consisted of repairs to the piers and dredging in channel.

The maximum draft that could be carried June 30, 1905, was about 15 feet. The mean annual variation in level of water surface is about 1 foot.

Connecting with the westerly end of the improved channel Kewaunee River has a navigable depth of 4 feet for a distance of about 6½ miles, but there is no regular commerce on the river.

The additional work proposed is for maintenance of piers and channel.

The volume of commerce is quite large, and is of a general character. A line of car-ferry steamers calls at this harbor. The value of the commerce is stated by the mayor of Kewaunee to be as follows: Exports, $13,484,750; imports, $4,278,300; total, $17,763,050. The reliability of these figures is uncertain.

It is believed that the project has a material effect in controlling freight rates on bulk commodities such as coal, grain, etc. It is impracticable to estimate the amount of reduction in rates thereby effected.

For references for more extended information, maps, and reports on examination and survey, see Annual Report for 1904, page 525.

Commercial statistics for 1904.—Arrivals of vessels, 480; exports and imports, 558,050 tons.

July 1, 1904, balance unexpended	$8,308.32
Amount appropriated by river and harbor act approved March 3, 1905	3,000.00
	11,308.32
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	7,981.70
July 1, 1905, balance unexpended	3,326.62

(See Appendix J J 9.)

10. Two Rivers Harbor, Wisconsin.—The original depth of the entrance to Twin Rivers was from 3 to 4 feet, and the present harbor was not available for purposes of commerce.

The original project, adopted March 3, 1871, provided for the formation of a channel of navigable width and 13 feet deep, connecting Twin Rivers with Lake Michigan, by building parallel piers extending to the 19-foot contour and dredging between them, at an estimated cost of $265,588.80.

In 1897 the piers terminated at the 14-foot contour, and a modification then adopted provided for abandoning their further extension. At that date a channel of the required depth had been obtained at an expenditure of $214,500. Since then the expenditures have been for maintenance.

The total expenditure to June 30, 1905, was $244,989.75, of which $30,489.75 was for maintenance.

The expenditures during the fiscal year were for maintenance, resulting in the completion of pile revetments along the harbor piers, and in restoration of channel by dredging; also for a survey of the harbor ordered by act of March 3, 1905.

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The maximum draft that could be carried June 30, 1905, was about 12½ feet. The mean annual variation in level of water surface is about 1 foot.

East and West Twin Rivers have a navigable depth of 7 feet for a distance of about 3 miles and 7 miles, respectively, from the harbor piers. There is no regular commerce on these rivers. For many years they have been used by rowboats and for floating saw logs.

The volume of commerce of this harbor is small and of a local character. Its value is stated by the mayor of Two Rivers to be as follows: Exports, $3,623,555; imports, $602,210; total, $4,225,765. The reliability of these figures is uncertain.

It is believed that the project has a certain effect in controlling freight rates on coal, but the amount of reduction in rates is unknown.

For references for more extended information, maps, and report on examination and survey, see Annual Report for 1904, page 526.

Commercial statistics for 1904.—Arrivals of vessels, 432; exports and imports, 122,846 tons.

July 1, 1904, balance unexpended	$440.02
Amount appropriated by river and harbor act approved March 3, 1905	6,600.00
	7,040.02
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	2,929.77
July 1, 1905, balance unexpended	4,110.25
July 1, 1905, outstanding liabilities	234.74
July 1, 1905, balance available	3,875.51

(See Appendix J J 10.)

11. Manitowoc Harbor, Wisconsin.—The original depth of water at the mouth of the Manitowoc River was about 4 feet at the shoalest point, and the existing harbor was not available for purposes of commerce.

The original project, adopted in 1854, provided for building parallel piers 220 feet apart and dredging between them to obtain a channel 12 feet in depth connecting Manitowoc River with Lake Michigan. It was subsequently modified to increase the depth of channel to 20 feet and to protect the same from northeast seas by a breakwater 400 feet long. These projects were completed at an expenditure of $401,827.75.

The existing project, adopted by Congress by act approved June 13, 1902, provides for extending the breakwater 400 feet, at an estimated cost of $37,000; for a survey, and for maintenance, $8,000, making a total of $45,000.

The amount expended under the existing project up to the close of the fiscal year ending June 30, 1905, was $45,108.20, of which $8,108.20 was for maintenance.

The breakwater was completed in 1903, and since then the expenditures have been for maintenance.

The expenditures during the fiscal year resulted in repairs to the south pier and restoration of the channel by dredging.

The maximum draft that could be carried June 30, 1905, was about 20 feet. The usual mean annual variation of level of water surface is about 1 foot.

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Connecting with the western end of the Government improvement Manitowoc River is navigable for a distance of about 1.8 miles.

The volume of commerce is very large and of a general character. Two lines of car-ferry steamers call at this harbor daily throughout the entire year.

It is believed that the project has a material effect in controlling freight rates; it is impracticable to estimate the amount of reduction in rates thereby effected.

For references for more extended information, maps, and reports on examinations and surveys, see Annual Report for 1904, page 526.

Commercial statistics for 1904.—Arrivals of vessels, 1,854; exports and imports, 1,504,759 tons.

July 1, 1904, balance unexpended	$4,343.69
Amount appropriated by river and harbor act approved March 3, 1905	110,000.00
	114,343.69
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	2,466.92
July 1, 1905, balance unexpended	111,876.77

(See Appendix J J 11.)

12. Sheboygan Harbor, Wisconsin.—The depth of water over the bar at the mouth of the Sheboygan River originally did not exceed 7 feet, and the present harbor was not available for purposes of commerce.

The original project, adopted in 1866, provided for extending the piers built by the city and county of Sheboygan and for a channel between them 13 feet deep. Subsequent modifications provided for extending the piers and increasing depth of channel to 19 feet.

The amount expended on original and modified projects prior to operations under existing project is $393,734.

The existing project, adopted by acts of March 3, 1899, and June 13, 1902, provides for a breakwater 700 feet long, for extending both harbor piers, and for a channel 21 feet deep; estimated cost, $152,000. The total amount expended on existing project up to June 30, 1905, was $170,666.72, of which sum $22,762.91 was for maintenance.

The existing project is completed with the exception of an extension of 100 feet to the breakwater, for which there are funds available.

The expenditures during the fiscal year were for pier extension under existing project and for maintenance, consisting of repairs to piers and dredging for restoration of channel.

The maximum draft that could be carried June 30, 1905, was about 20 feet. The usual mean annual variation of level of water surface is about 1 foot.

Connecting with the westerly end of the Government improvement, Sheboygan River is navigable for a distance of about 1¼ miles.

The additional work proposed is for rebuilding portions of the piers which have become unserviceable through decay and dredging for maintenance of channel.

The commerce of Sheboygan is quite large and of a general character. Its value is unknown.

It is believed that the project has a material effect in controlling freight rates on bulk commodities, such as coal, grain, etc. It is

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impracticable to estimate the amount of reduction in rates thereby effected.

For references for more extended information, maps and reports on examinations and surveys, see Annual Report for 1904, page 527.

Commercial statistics for 1904.—Arrivals of vessels, 905; exports and imports, 5,725,749 tons.

July 1, 1904, balance unexpended		$44,793.11
Amount appropriated by river and harbor act approved March 3, 1905		18,000.00
		62,793.11
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$38,251.29	
For maintenance of improvement	6,002.00	
		44,253.29
July 1, 1905, balance unexpended		18,539.82
July 1, 1905, outstanding liabilities		728.50
July 1, 1905, balance available		17,811.32

(See Appendix J J 12.)

13. Port Washington Harbor, Wisconsin.—The natural channel at the mouth of the Sauk River was narrow, and at the shoalest point had a depth of 1 foot, and the present harbor was not available for purposes of commerce.

The project adopted in 1869 and modified in 1876 provides for a channel 13 feet deep between parallel piers 150 feet apart and for two interior basins having a depth of 13 feet and a combined area of about 5¾ acres. Estimated cost, $181,527.17.

The existing project was completed in 1895 at a cost of $184,848.39. Since that time $14,779.67 has been expended for maintenance, etc., making a total to June 30, 1905, of $199,628.06, of which amount $311.25 was expended during the fiscal year.

The maximum draft that could be carried June 30, 1905, was about 12 feet. The usual mean annual variation of levels of water surface is about 1 foot.

The volume of commerce benefited is small, and is of a local character. Its value is stated by the mayor of Port Washington to be—exports, $245,000; imports, $475,000; total, $720,000.

It is believed that the project has no material effect in controlling freight rates.

For references for more extended information and for reports on examinations and surveys, see Annual Report for 1904, pages 528 and 2899.

Commercial statistics for 1904.—Arrivals of vessels, 329; imports and exports, 60,501 tons.

July 1, 1904, balance unexpended	$5,651.44
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	311.25
July 1, 1905, balance unexpended	5,340.19

(See Appendix J J 13.)

14. Milwaukee Harbor, Wisconsin, including harbor of refuge.—Milwaukee Harbor and the harbor of refuge, which were originally separate works, were consolidated by the act of June 13, 1902.

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The original depth of water at the mouth of the Milwaukee River was not more than 4¼ feet, and the present harbor was not available for purposes of commerce. Milwaukee Bay, in which the harbor of refuge is located, is protected by the coast from storms, except those from the northeast to the southeast, and, while the anchorage ground is good, vessels were in danger of dragging their anchors or of failing to effect anchorage at the proper place.

The original project for the improvement of Milwaukee Harbor was adopted in 1845–46, and provided for dredging the original river mouth and protecting the entrance by parallel piers. Subsequent modifications provided for the abandonment of the improvement of the original river mouth and for the formation of a channel 19 feet deep through the point overlapping the mouth of the river and about 3,000 feet northerly from the original outlet, the channel to be protected by parallel piers. The amount expended on the original and modified projects is $402,752.28, of which $50,400 was expended at original mouth of river.

The project adopted by act of March 3, 1899, provides for a channel 21 feet deep, minimum width between piers to be 200 feet, and the width outside of the pierheads to be 600 feet. Estimated cost, $12,000, and $3,000 annually for maintenance.

The project for the harbor of refuge was adopted in 1881 and provides for a breakwater 7,650 feet long, including an opening therein of 400 feet. Original estimated cost, $800,000; revised estimate, $955,650.

These projects for both the harbor and harbor of refuge are completed, the full projected depth of channel having been secured and the breakwater built to its full projected length.

The project adopted by act of June 13, 1902, provided for concrete superstructure on 2,350 feet of the breakwater and on 1,050 feet of the north harbor pier. This project was completed November 8, 1904.

The total amount expended on these projects to June 30, 1905, is $959,464.67, of which $939,153.50 is for breakwater, $12,000 for 21-foot channel, and $133,531.28 for maintenance.

The river and harbor act of March 3, 1905, appropriated $150,000 for continuing improvement and for maintenance, including the repair and rebuilding of the breakwater belonging to the harbor of refuge, and directed that the so-called "fair weather" opening in said breakwater shall not be closed except by direction of Congress.

This is the existing project, and the appropriation is being expended in providing about 1,100 feet of the breakwater and 600 feet of the north harbor pier with concrete superstructure, under contract to be completed by December 31, 1906.

The results obtained by the expenditures during the fiscal year have been the construction of 250 linear feet of concrete superstructure on the breakwater and 1,050 feet on the north harbor pier.

The expenditures on the existing project to June 30, 1905, amounted to $1,980.31, making the total of all expenditures $1,586,345.91.

The maximum draft that could be carried June 30, 1905, was 20 feet. The mean annual variation of level of water surface is about 1 foot.

The commerce affected by the project is very large and is general in character. Its value is not known.

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It is believed that the project has a material effect in controlling freight rates on bulk commodities, such as coal, grain, and ore. It is impracticable to estimate the amount of reduction in rates thereby effected.

For references for more extended information and for reports on examinations and surveys see Annual Report for 1904, pages 529 and 530.

Commercial statistics for 1904.—Arrivals of vessels, 5,043; exports and imports, 5,406,547 tons.

July 1, 1904, balance unexpended	$158,979.18
Amount appropriated by river and harbor act approved March 3, 1905	150,000.00
	308,979.18
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	127,200.42
July 1, 1905, balance unexpended	181,778.76
July 1, 1905, outstanding liabilities	9.35
July 1, 1905, balance available	181,769.41
July 1, 1905, amount covered by uncompleted contracts	111,695.70

(See Appendix J J 14.)

15. Milwaukee (inner) Harbor, Wisconsin.—The original condition of the rivers comprised in the inner harbor of Milwaukee is not definitely known. These rivers have been dredged, and a depth of about 21 feet below datum maintained therein, by the city of Milwaukee.

The original project, which is the existing project, was adopted by act of March 3, 1905, and provides for improving Menominee, Milwaukee, and Kinnickinnick rivers, which constitute the inner harbor of Milwaukee. This project provides for the excavation of four turning basins—one in the Menominee and three in the Kinnickinnick; the excavation of a channel 100 feet wide from the turning basin in Menominee River to its mouth and 150 feet wide thence to the harbor entrance; the excavation of a channel 100 to 150 feet wide from the mouth of the Kinnickinnick to the uppermost turning basin in that river, all channels to be 21 feet deep. The estimated cost of this improvement is $318,581. The project does not contemplate any maintenance work after the channels and basins have been provided, such work to be left to local interests, and was recommended only on condition that all land needed for turning basins and for widening and straightening the rivers shall be donated to the United States free of cost; that the city of Milwaukee shall revet or dock all turning basins and connecting channels wherever necessary, and that the city bridge over Kinnickinnick River and the two railway bridges immediately above said bridge shall be altered or rebuilt in such wise as to permit the passage of the largest vessels. The act, in adopting the project, provided that no part of the appropriation herein made shall be expended for the purpose named unless the Secretary of War shall have satisfactory assurance that the city of Milwaukee will comply with the conditions imposed upon said municipality as set forth and contained in said project.

The work is to be done under continuing contract.

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There has been no expenditure under the existing project, expenditures being contingent upon the conditions mentioned, which have not yet been fulfilled by the city of Milwaukee.

The maximum draft which could be carried June 30, 1905, was about 20 feet. The usual mean annual variation of water surface is about 1 foot. The rivers are actually navigable as follows: Milwaukee River, about 2¾ miles; Menominee River, about 2 miles; Kinnickinnick River, about 2¼ miles.

The commerce of Milwaukee is very large and of a general character. Its value is unknown.

It is believed that the project will have a material effect in controlling freight rates on bulk commodities, such as coal, grain, and ore. It is impracticable to estimate the amount of reduction in rates thereby effected.

For report on examination and survey, see Annual Report for 1904, Part 3, page 2887.

Commercial statistics for 1904.—Arrivals of vessels, 5,043; exports and imports, 5,406,547 tons.

Amount appropriated by river and harbor act approved March 3, 1905	$100,000.00
July 1, 1905, balance unexpended	100,000.00
Amount (estimated) required for completion of existing project	218,581.00

(See Appendix J J 15.)

16. South Milwaukee Harbor, Wisconsin.—The entrance to this harbor originally varied in depth from absolute closure to about 3 feet, and the harbor was not available for purposes of commerce.

The original project of improvement, which is the existing project, was adopted in 1896, and provides for a channel 18 feet deep and 200 feet wide between parallel piers. Estimated cost, $138,000. (Published in Annual Report of the Chief of Engineers for 1895, page 2641 et seq.)

The total amount expended on existing project up to the close of the fiscal year ending June 30, 1905, is $4,987.90.

The north pier, originally built by private parties, has been extended 185 feet. No dredging has been done, and the harbor in its present condition is not available for commerce.

For references for more extended information and for report on examination and survey, see Annual Report for 1904, pages 530 and 2903.

Commercial statistics for 1904.—There were no arrivals and departures of vessels.

July 1, 1904, balance unexpended	$12.10
July 1, 1905, balance unexpended	12.10
Amount (estimated) required for completion of existing project	133,000.00

(See Appendix J J 16.)

17. Racine Harbor, Wisconsin.—The entrance to this harbor originally varied in depth from absolute closure after storms to about 7 feet, and the present harbor was not available for purposes of commerce.

The original project, adopted in 1842–43, provided for a channel 13 feet deep between parallel piers 160 feet apart. Subsequent modifications provided for extending the piers and increasing the depth of channel to 17 feet.

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The amount expended on original and modified projects prior to operations under the present project is $336,747.26.

The existing project, adopted by act of March 3, 1899, provides for extending the south pier, building 600 feet of breakwater, and increasing depth in channel to 21 feet. Estimated cost, $117,650.

The act of June 13, 1902, authorized a modification of this project, said modification to consist of a change in the location and direction of the breakwater.

The existing project is completed, with the exception of the modification of 1902, which will probably be completed about July 15, 1905.

The total amount expended on the work of existing project up to the close of the fiscal year ending June 30, 1905, is $124,289.29. Of this amount $7,263.33 was for maintenance.

The maximum draft that could be carried June 30, 1905, was about 17.5 feet. The usual mean annual variation of level of water surface is about 1 foot.

Connecting with the western terminus of the Government improvement, Root River is navigable for a distance of about nine-tenths of a mile.

The additional work proposed is for the maintenance of existing works.

The volume of commerce is quite large and is general in character. Its value is not known.

It is believed that the project has a material effect in controlling freight rates on bulk commodities, such as coal, grain, and ore; it is impracticable to estimate the amount of reduction in rates thereby effected.

For references for more extended information and reports on examinations and surveys, see Annual Report for 1904, page 531.

Commercial statistics for 1904.—Arrivals of vessels, 1,680; exports and imports, 412,410 tons.

July 1, 1904, balance unexpended		$19,451.81
Amount appropriated by river and harbor act approved March 3, 1905		30,000.00
Amount allotted from appropriation for maintenance of river and harbor improvements, act of April 28, 1904		6,284.67
		55,736.48
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$736.60	
For maintenance of improvement	4,951.96	
		5,688.56
July 1, 1905, balance unexpended		50,047.92
July 1, 1905, outstanding liabilities		19,709.28
July 1, 1905, balance available		30,338.64

(See Appendix J J 17.)

18. Kenosha Harbor, Wisconsin.—The original depth of water at the mouth of Pike Creek varied from nothing to 4 feet, and the present harbor was not available for purposes of commerce.

The original project, adopted in 1852, provided for a channel 13 feet deep between parallel piers 150 feet apart. Subsequent modifications provided for extending the piers, increasing the depth of channel to 16 feet, and dredging in the basin.

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The amount expended on original and modified projects prior to operations under present project is $298,012.

The existing project, adopted by act of March 3, 1899, provided for extending the south pier, increasing the width between piers to 250 feet by rebuilding the north pier, building 600 feet of breakwater, and increasing the depth in channel and basin to 21 feet and 20 feet, respectively. Estimated cost, $191,000.

The act of June 13, 1902, authorized a modification of this project, said modification to consist of a change in the location and direction of the breakwater.

The existing project is completed with the exception of the modification of 1902. Nothing has been done in furtherance of this modification, pending the action of the Board of Engineers created for the purpose of inquiring into wave action as injuriously affecting this and other harbors.

The total amount expended on the work of existing project up to the close of the fiscal year ending June 30, 1905, is $174,480.12; of this sum $1,058.49 was for maintenance.

The maximum draft that could be carried over the bar at the harbor entrance June 30, 1905, was about 18 feet. The usual mean annual variation of water surface is about 1 foot.

Connecting with the western terminus of the Government improvement Pike Creek is navigable for a distance of about 2,500 feet.

The volume of commerce is not large and is chiefly of a local character. Its value is not known.

It is believed that the project has a material effect in controlling freight rates on bulk commodities, such as coal, grain, and ore; it is impracticable to estimate the amount of reduction in rates thereby effected.

For references for more extended information and for reports on examinations and surveys, see Annual Report for 1904, page 532.

Commercial statistics for 1904.—Arrivals of vessels, 305; exports and imports, 45,991 tons.

July 1, 1904, balance unexpended	$17,475.00
Amount appropriated by river and harbor act approved March 3, 1905	5,000.00
	22,475.00
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	502.00
July 1, 1905, balance unexpended	21,973.00

(See Appendix J J 18.)

19. Waukegan Harbor, Illinois.—Originally there was no navigable channel or natural harbor at this place.

The original project was adopted in 1880, and provided for an artificial harbor of sufficient capacity for local trade by including a portion of Lake Michigan with pile piers, the entrance channel and inclosed area to be dredged to 13 feet.

The amount expended on original and modified projects prior to commencement of operations under present project was $218,944.41.

The existing project, adopted by act of June 13, 1902, provides for extending both harbor piers, building a breakwater, and increasing depth of channel to 20 feet; estimated cost, $345,000, all of which has been appropriated.

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The amount expended on the existing project up to the close of the fiscal year ending June 30, 1905, is $310,339.39.

The results obtained by the expenditures during the fiscal year have been the extension of the south pier 800 feet, the construction of the breakwater and of 882 feet of revetment, and the deepening of the channel and basin to 20 feet below datum.

The maximum draft which could be carried June 30, 1905, was about 17 feet. The usual mean annual variation of water level is about 1 foot.

The commerce affected by the project is mostly coal and general merchandise, and is general in character. The volume of commerce is large and increasing. The value of the commerce is not known.

It is believed that the project has a material effect in controlling freight rates on bulk commodities, such as coal, grain, and ore; it is impracticable to estimate the amount of reduction in rates thereby effected.

For references for more extended information and for report on examination and survey, see Annual Report for 1900, page 3769.

Commercial statistics for 1904.—Arrivals of vessels, 172; exports and imports, 220,391 tons.

July 1, 1904, balance unexpended	$270,156.49
Amount appropriated by river and harbor act approved March 3, 1905	30,000.00
Miscellaneous receipts	.14
	300,156.63
June 30, 1905, amount expended during fiscal year, for works of improvement	233,940.29
July 1, 1905, balance unexpended	66,216.34

(See Appendix J J 19.)

20. Fox River, Wisconsin.—The Fox and Wisconsin rivers, separated at Portage, Wis., by a distance of only 2 miles, one flowing into Lake Michigan, the other into the Mississippi River, were the early means of communication between those waters. In 1846 Congress granted to the State of Wisconsin a quantity of land for the purpose of improving the navigation of this route. By means of a board of public works the State began and carried on the improvement until 1853, when it was transferred to a private company. In 1872 the United States acquired possession of the property, with the exception of the water power, water-power lots, and personal property. The earliest project, that of 1848, called for canals 40 feet wide at bottom and 4 feet deep, with locks 125 feet long and 30 feet wide. This project was enlarged subsequently. The present project is that of a Board of Engineers, submitted September 17, 1884, and modified May 14, 1886. It provides for deepening and widening the channel of the Fox River from Green Bay to Montello to 6 feet depth and 100 feet width and from Montello to Portage to 4 feet depth and for the renovation of 12 old locks.

The improvement of the Wisconsin River was abandoned in 1887.

The amount expended on the Fox and Wisconsin rivers from 1867 to the close of the fiscal year ending June 30, 1905, including $145,000 paid to the Green Bay and Mississippi Canal Company for its property, was $3,111,141.33, of which amount $446,141.33 was appropriated solely for and expended solely upon the Fox River since 1885.

The result of this expenditure upon the Fox River was the construction of 18 new stone locks, 9 composite locks, 16 permanent

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dams, 13 canals, a head wall and feeder at the old first locks at Appleton, a lock house at Appleton, warehouse at Appleton first lock and Berlin lock, a wing dam and brush and stone shore protection to the Portage levee, masonry waste weirs at Little Chute combined locks, and Appleton third lock, masonry culvert at head of Little Chute combined locks, a dry dock at Kaukauna, guard gates at head of Kaukauna Canal; also rebuilding canal banks at Kaukauna, wing walls at Kaukauna fourth lock, and 1,237 linear feet of cement-laid rubble core wall in canal banks of fourth and fifth levels. A channel 75 feet wide and 450 feet long has been secured by blasting and drilling the rock bar below Depere lock from 4 to 12 inches below the top of the lower miter sill. Channel below Depere has been deepened, and channel deepened at mouth of Fond du Lac River, Neenah channel, Fox River at head of Lake Butte des Morts, Grignon Rapids, below Little Chute and Rapide Croche locks, and in the canals and upper Fox River. Masonry outlet to waste weir at Kaukauna second lock, a roadway upon the United States property at Appleton first lock, and fishways in the Eureka, Berlin, White River, Princeton, Grand River, Montello, and Fort Winnebago dams have been constructed. The harbors of Stockbridge, Calumet, and Miller Bay, Lake Winnebago, have been improved, and snags have been removed and bars dredged in Wolf River, making a 4-foot channel 100 feet wide to New London.

The full depth of 6 feet has now been obtained from Depere to Princeton lock. Above this point the projected depth and width have not been obtained.

The expenditures during the fiscal year ending June 30, 1905, were for construction of an elevator dredge and for dredging channel of upper Fox River.

The relative value of commerce involved and the cost of the improvement can not be estimated.

Its principal effect so far, aside from the creation of a valuable water power, has been to cause some reduction in freight rates to points in the Fox River Valley. Deepening the channel of the upper Fox River by dredging has also had, and will continue to have, the effect of draining the enormous expanse of meadow lands in the Fox River Valley and greatly increasing their availability and value.

The maximum draft that could be carried June 30, 1905, at mean low water over the shoalest part of the improvement was 6 feet from Depere to White River lock, 4 feet from there to Montello, and 3 feet from Montello to Portage, the head of navigation on the Fox River.

July 1, 1904, balance unexpended	$70,621.12
Amount appropriated by river and harbor act approved March 3, 1905	35,000.00
	105,621.12
June 30, 1905, amount expended during fiscal year, for works of improvement	5,234.60
July 1, 1905, balance unexpended	100,386.52
July 1, 1905, outstanding liabilities	372.00
July 1, 1905, balance available	100,014.52
July 1, 1905, amount covered by uncompleted contracts	39,000.00
Amount (estimated) required for completion of existing project	110,866.48

(See Appendix J J 20.)

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21. Operating and care of locks and dams on Fox River, Wisconsin.—Under an allotment from the indefinite appropriation for operating and care of canals and other works of navigation there has been expended during the year ending June 30, 1905, the sum of $46,427.20.

The principal work has been dredging bars and channels; making repairs of locks, dams, canal banks, lock houses, dredges, and boats; rebuilding lower gates of Depere lock; repairs of and raising lower wingcribs of Little Kaukauna and of Rapide Croche locks; repairs of Kaukauna third and fourth and Little Chute combined locks; repairing the crest of Appleton upper dam with concrete and replacing wooden sluice gates with new steel gates; repairs of Eureka lock and dam and of Princeton lock.

A detailed statement appended to the report of the local engineer officer in charge shows the items of expenditures. Navigation was closed December 1, 1904, and reopened April 10, 1905. The water in Lake Winnebago and the lower Fox has been maintained at the crests of the dams throughout the year, with the exception of Lake Winnebago during the close of navigation, drawn down by the mills, with permission of the Secretary of War.

For commercial statistics, see report of the local officer upon the improvement of Fox River, Wisconsin.

(See Appendix J J 21.)

22. Removing sunken vessels or craft obstructing or endangering navigation—Wreck of sand scow Hiram R. Bond, in Milwaukee Bay, Wisconsin.—On May 29, 1905, the steam sand scow *Hiram R. Bond* was sunk in collision at a point about five-eighths of a mile east-southeast one-half east from the southerly end of the breakwater in Milwaukee Bay, in about 40 feet of water, and formed a dangerous obstruction to navigation.

On June 7, 1905, the wreck was formally abandoned by the owners and parties interested.

On June 30, 1905, such parts of the wreck as were obstructions to navigation were removed by the United States, at a total cost of $1,200, leaving an unobstructed depth of 30 feet over the site of the wreck.

(See Appendix J J 22.)

IMPROVEMENT OF CHICAGO AND CALUMET HARBORS, AND CHICAGO RIVER, ILLINOIS, AND OF CALUMET RIVER, ILLINOIS AND INDIANA; SURVEY OF ILLINOIS AND DES PLAINES RIVERS, ILLINOIS, FOR WATERWAY FROM LOCKPORT, ILLINOIS, TO ST. LOUIS, MISSOURI.

This district was in the charge of Col. O. H. Ernst, Corps of Engineers, to April 4, 1905, and of Lieut. Col. W. H. Bixby, Corps of Engineers, since that date.

1. Chicago Harbor, Illinois.—The present project was adopted in 1870 and modified in 1878 and 1899, and contemplates—

(*a*) The formation of an outer harbor by inclosing a portion of Lake Michigan just south of the entrance to Chicago River by breakwaters and dredging the same for the purpose of increasing the harbor facilities of Chicago. The river and harbor act of March 3, 1899, provided for dredging the outer basin and harbor entrance to 20 feet

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draft (21 feet depth) at low water, in accordance with the project outlined at pages 2790–2791 of the Annual Report for 1897, and made a first appropriation of $100,000 therefor. The total cost of dredging contemplated in said project was estimated at $509,960. In the Annual Report of 1903 special estimates were submitted for maintenance by the repair in concrete of the north pier, to cost $85,000.

(*b*) The construction of an exterior breakwater in deep water in Lake Michigan, north of the entrance to Chicago River and about 1 mile distant therefrom, to shelter the approaches to the river and outer harbor and to form a harbor of refuge near the southern end of Lake Michigan.

(*c*) To keep the entrance to Chicago River dredged to the same depth—21 feet—as the outer harbor for the passage of vessels navigating the Chicago River as far as the original shore line of Lake Michigan, at or near Rush Street Bridge.

There has been expended upon this project up to June 30, 1905, $1,910,305.22.

All the work under the projects of 1870, 1878, 1897–1899, and 1903 has been completed except dredging the outer basin under the project outlined in the Annual Report for 1897, as referred to above, for which, under the estimate, $294,960 is still to be appropriated, and repair of north pier, the funds for which have been reserved from the March 3, 1905, appropriation, the work being considered as work of maintenance and outside of the 1897 dredging estimate.

No construction work was undertaken during the year for lack of funds.

July 1, 1904, balance unexpended	$1,674.55
Amount appropriated by river and harbor act approved March 3, 1905	200,000.00
Received from sale of property	15.30
	201,689.85
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	1,058.61
July 1, 1905, balance unexpended	200,631.24
Amount (estimated) required for completion of existing project	294,960.00

(See Appendix K K 1.)

2. Chicago River, Illinois.—This river, as far as it is navigable, is entirely within the limits of the city of Chicago, Ill.

Prior to the fiscal year ending June 30, 1896, no work had been done for the improvement of its navigation by the United States.

The project inaugurated by Congress under the act of June 3, 1896, as modified by the act of June 4, 1897, contemplated the improvement of the river by dredging and minor changes of docks and dock lines to admit passage by vessels drawing 16 feet of water. This project was completed with the fiscal year ending June 30, 1902, at which time there had been expended $423,520.51, exclusive of $25,000 allotted from the act of August 18, 1894, for the improvement of Chicago Harbor, Illinois. As a result of this expenditure the river was dredged to a depth of 17 feet below Chicago city datum from the mouth of the river to Ashland avenue on the South Branch and West Fork, and to the stock yards on the South Fork, South Branch, a distance of about 6 miles, and to Belmont avenue on the North Branch, the

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head of navigation. The lands removed under the project for widening and deepening the river were secured at a cost of $91,949.50. The total amount of material removed was 1,998,561 cubic yards. There has been some shoaling since the project was completed.

By the act of June 13, 1902, Congress provided for two turning basins, the project for which was approved August 18, 1902, the estimated cost being $500,000.

The land for these two turning basins has now been acquired and the dredging work, commenced March 9, 1905, under contract, is in progress, with probability of early completion.

There has been expended upon this project to June 30, 1905, $347,989.74.

Tunnels under Chicago River.—By act of Congress approved April 27, 1904, the tunnels under Chicago River at Lasalle street, Washington street, and near Van Buren street, in the city of Chicago, Ill., are declared to be unreasonable obstructions to navigation and public nuisances, and the Secretary of War is directed to give notice to the persons or corporations owning or controlling them to so alter said tunnels as to render navigation over them free, easy, and unobstructed, specifying therein the changes recommended by the Chief of Engineers as necessary to accomplish this end, and prescribing in each case a reasonable time in which to perform the work.

Report on the subject was made by Col. O. H. Ernst, Corps of Engineers, May 26, 1904, after full consideration and discussion at a public hearing. Notices, dated September 27, 1904, requiring alteration of these tunnels so as to provide a least depth of 22 feet over each for a width of 160 feet near the middle of the river at Lasalle street and near Van Buren street, and for the entire width between abutments of the proposed new bridge at Washington street, were served September 30, 1904, on the North Chicago Street Railroad Company, the West Chicago Street Railroad Company, the city of Chicago, the Chicago Passenger Railway Company, and the Chicago Union Traction Company, and October 12, 1904, on the receivers of the Chicago Union Traction Company. Specified alterations to be completed by April 15, 1906.

The report of Colonel Ernst is submitted herewith in Appendix K K 2.

July 1, 1904, balance unexpended	$323,901.32
Received from sale of earth and old buildings	240.00
	324,141.32
June 30, 1905, amount expended during fiscal year	162,473.45
July 1, 1905, balance unexpended	161,667.87
July 1, 1905, amount covered by uncompleted contracts	107,153.53

(See Appendix K K 2.)

3. Calumet Harbor, Illinois.—This harbor is known on the Great Lakes as South Chicago Harbor.

This improvement was designed to furnish a safe and practicable entrance to Calumet River and the port of South Chicago by the construction of parallel piers 300 feet apart, projecting from the shore into Lake Michigan, and by dredging between them.

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The work began in 1870, and all the projected work had been accomplished for 16-foot draft prior to June 30, 1896, resulting in the construction of 3,640 linear feet of north pier and 2,020 linear feet of south pier, and securing and maintaining a channel 16 feet deep and of suitable width from water of similar depth in Lake Michigan to the Calumet River at the roots of the piers, at a cost of $454,483.53. On June 30, 1896, the original project for this locality was completed.

Under date of February 21, 1896, a project for improvement of both the inner and outer harbors was submitted. The estimated cost of this improvement was $1,134,830. (Annual Report of the Chief of Engineers for 1896, p. 2583.) This project, adopted by Congress in the river and harbor act of March 3, 1899, and modified in the act of June 13, 1902, provides for—

(*a*) A breakwater 4,400 feet long, connected with the shore and running due east into the lake, terminating in water 32 feet deep.

(*b*) An extension of this breakwater 2,500 feet long in a southeasterly direction from the end of the first.

(*c*) The anchorage area sheltered by breakwater dredged to 21 feet depth.

(*d*) South pier, at the mouth of the Calumet River, extended 800 feet.

(*e*) The Calumet River dredged to a width of 200 feet and depth of 21 feet for a distance of 2 miles from the mouth.

Contract in progress at the beginning of year for completing the southeast breakwater was completed. New contracts for repair of south pier superstructure were made and are still in progress.

All original work of the February 21, 1896, project has now been completed, leaving only its maintenance and repair.

The expenditures to June 30, 1905, were $1,431,278.15.

July 1, 1904, balance unexpended	$301,668.68
June 30, 1905, amount expended during fiscal year	185,715.83
July 1, 1905, balance unexpended	115,952.85
July 1, 1905, amount covered by uncompleted contracts	16,025.11

(See Appendix K K 3.)

4. Calumet River, Illinois and Indiana.—The project for the improvement of this river, adopted by Congress in 1884 and modified in 1886, contemplated securing a channel 200 feet in width and 16 feet in depth below low water in Lake Michigan from the mouth of Calumet Harbor, Illinois, about 10.5 miles upward, to a point one-half mile east of Hammond, Ind.

The project was modified by the river and harbor act of June 3, 1896, for Calumet Harbor, so as to provide for dredging the channel to 20 feet depth from the mouth 2 miles southward (upward).

Under the project of 1884 there was dredged a channel, measured from the harbor southward, to the full width of 200 feet and depth of 16 feet, 19,518 feet in length, except that over a short portion, where rock was encountered, the width was reduced to 85 feet and the depth to 14 feet.

In addition there was removed 248,516 cubic yards of material from the channel between the forks (about 5.5 miles above the mouth) and one-half mile east of Hammond, Ind., in an effort to

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secure a practicable channel 10 feet deep and 60 feet wide, resulting in failure due to rapid refilling of channel.

Under the supplementary project of 1896 for Calumet Harbor, the river channel was dredged to 20 feet depth for 2 miles above its mouth and a small winding or turning basin 20 feet deep was provided at the first cut-off above the mouth of the river.

The river and harbor act of June 13, 1902, appropriated $75,000 for the improvement of this stream, and provided for an extension of the 20-foot channel from One hundred and sixth to One hundred and twenty-second streets, a distance of 2.2 miles, and for the resumption of the work above the forks. The officer in charge points out that no useful results can be obtained from expenditures above the forks.

Dredging contracts in force at the beginning of the year have been completed. New contracts for redredging, under the act of April 28, 1904, were made and partly completed. New contracts for dredging and rock excavation, under the act of March 3, 1905, were made and the work is now in progress. All this work was for securing 21 feet actual depth between the mouth and One hundred and twenty-second street.

The project of August 3 and September 16, 1903, with estimates in full, on pages 2941–2949, Annual Report for 1904, as adopted by the act of March 3, 1905, provides for—

(*a*) Redredging from mouth to One hundred and sixth street (20 feet draft)	$16,000.00
(*b*) Dredging from One hundred and sixth to One hundred and twenty-second street (20 feet draft)	85,050.00
(*c*) Rock excavation from One hundred and eleventh to One hundred and fourteenth street (20 feet draft)	276,975.00
(*d*) Dredging from One hundred and twenty-second street to forks (16 feet draft)	75,450.00
Contingencies, 10 per cent	45,347.50
(*e*) Dredging five turning basins between mouth and forks (four of 21 feet draft, one of 16 feet)	163,658.00
Total	662,480.50

(*f*) Maintenance, additional $10,000 per annum.

(*g*) In addition, the act of June 13, 1902, authorized the Secretary of War to accept deeds, free of expense to the United States, of lands necessary to allow a 200-foot width of channel from forks, 5.5 miles farther, to a point 0.5 mile above Hammond, Ind.; and the act of March 3, 1905, authorizes similar acceptance for purposes of the turning basins below the forks.

For this work $175,000 has been appropriated, by which work under the first three items has been started, and $10,000 (of the 1905 appropriation) set aside for maintenance for the year 1905–6.

The expenditures to June 30, 1905, amounted to $515,750.22.

July 1, 1904, balance unexpended		$102,250.64
Amount appropriated by river and harbor act approved March 3, 1905		100,000.00
Unexpended balance of allotment for rivers and harbors, Board of Engineers, returned		83.16
		202,333.80
June 30, 1905, amount expended during fiscal year	$90,084.02	
Redeposited to credit of Treasurer United States, balance of allotment of $43,000 from act of April 28, 1904	1,281.02	
		91,365.04
July 1, 1905, balance unexpended		[a]110,968.76
July 1, 1905, amount covered by uncompleted contracts		143,487.50

[a] Includes $5,950.75 for "above the forks."

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Amount (estimated) required for completion of existing project.... $497,480.50

Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905 ..... 176,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix K K 4.)

5. Survey of Illinois and Des Plaines rivers, Illinois, for waterway from Lockport, Ill., to St. Louis, Mo.—Under the provisions of that part of the river and harbor act of June 13, 1902, making an appropriation of $200,000 for this work, of which amount $175,000 is available for surveys, etc., above the mouth of the Illinois River, a Board of Engineer officers consisting of Col. O. H. Ernst, Lieut. Col. Charles J. Allen (now brigadier-general, United States Army, retired), and Maj. Thomas L. Casey, was appointed by Special Orders, No. 19, Headquarters, Corps of Engineers, July 5, 1902. Under Special Orders, No. 17, War Department, Office Chief of Engineers, April 26, 1904, Maj. Jas. L. Lusk was appointed a member of the Board, succeeding Colonel Allen upon his retirement. Under Special Orders, No. 15, War Department, Office Chief of Engineers, April 6, 1905, Lieut. Col. W. H. Bixby was appointed to replace Major Lusk, relieved on account of sickness.

Small survey parties, topographical and hydrographical, were in the field from July, 1904, to June, 1905, mainly making discharge measurements, small surveys to supplement work of the past year and surveys of previous Boards, and making borings. The work is now completed. All office work was completed except revision and preparation of final reports and a few maps.

It is expected that all work will be completed and the final report rendered during the fall of 1905.

July 1, 1904, balance unexpended	$43,164.17
Received from sale of property	10.00
	43,174.17
June 30, 1905, amount expended during fiscal year	39,507.11
July 1, 1905, balance unexpended	3,667.06
July 1, 1905, outstanding liabilities	175.00
July 1, 1905, balance available	3,492.06

(See Appendix K K 5.)

IMPROVEMENT OF ILLINOIS RIVER, ILLINOIS, AND CONSTRUCTION OF ILLINOIS AND MISSISSIPPI CANAL.

This district was in the charge of Maj. C. S. Riché, Corps of Engineers, until April 20, 1905, and of Lieut. Col. W. H. Bixby, Corps of Engineers, since that date. Division engineer, Col. O. H. Ernst, Corps of Engineers, until April 5, 1905.

1. Illinois River, Illinois.—The project, which contemplates the extension of slack-water improvement, begun by the State of Illinois, from Copperas Creek lock to the Mississippi River, and which includes the construction of two locks 350 feet long between sills, 75 feet width of chamber, with 7 feet of water over sills at low-water level of 1879, and dredging the channel where necessary to obtain 7 feet depth at low water, was adopted in 1880.

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The United States has expended on this work up to June 30, 1905, $1,492,506.94, of which $21,255.91 was expended during the fiscal year in maintenance of plant, care and repair of property and plant, and in removing snags. Owing to the high stage of water throughout the year no dredging was necessary.

The lock and dam at Kampsville, Ill., 31 miles above the mouth of Illinois River, has been completed and in use since 1894, and that at Lagrange, 79 miles above the mouth, since 1890.

The State of Illinois, aided by the United States, has executed part of the general project by the construction of locks and dams at Henry and at Copperas Creek, completing, except dredging, that part of the project between Lasalle and the mouth of Copperas Creek, a distance of about 90 miles, over which section the State of Illinois collects tolls.

Modification of bridges, ordered by the Secretary of War February 27, 1904, is now nearly completed, having been delayed and rendered difficult by continued high water.

The work of the Sanitary District of Chicago in lowering the dams at Kampsville and Lagrange was also delayed and hampered by the high water, and it was necessary for them to secure an extension of time to May 23, 1906.

Repairs to the fleet and plant were continued during the year and are still in progress. The marine ways at Beardstown were provided with protection against ice and drift by five clumps of piles. The river has been kept clear of snags, and periodical inspection trips over the navigable portion of the river have been inaugurated.

July 1, 1904, balance unexpended	$65,122.18
June 30, 1905, amount expended during fiscal year, for works of improvement	21,255.91
July 1, 1905, balance unexpended	43,866.27
July 1, 1905, outstanding liabilities	1,500.00
July 1, 1905, balance available	42,366.27
Amount (estimated) required for completion of existing project	182,000.00

(See Appendix L L 1.)

2. Operating and care of Lagrange and Kampsville locks, Illinois River, and approaches thereto.—These locks and dams have been operated and maintained under the indefinite appropriation provided for in section 4 of the river and harbor act of July 5, 1884.

(*a*) *Lagrange lock and dam.*—The river at this point was open to navigation for more than nine months of the year, no boats passing the lock from December 12, 1904, to March 4, 1905. From the beginning of the fiscal year to May 20, 1905, nearly all boats passing this point used the lock; since May 20 nearly all boats have passed over the dam. The number of boats passing this lock shows a substantial increase over that of the preceding year.

Five thousand four hundred and sixty-three dollars and sixty-eight cents was expended during the past year, exclusive of $562.75 outstanding liabilities June 30, 1905.

(*b*) *Kampsville lock and dam.*—The river at this point was open to navigation during the entire year except from December 15, 1904, to March 2, 1905. The lock was used by nearly all boats passing

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this point until May 21, 1905, since which time the boats have passed over the dam.

The cut stone which has been stored at this lock since its construction was broken up into rubblestone and removed to land belonging to the United States in order to dispense with leased land.

The number of boats passing this lock during the fiscal year shows a considerable increase over that of the preceding year.

The sum of $5,773.63 was expended during the past year, exclusive of $572.04 outstanding liabilities June 30, 1905.

(See Appendix L L 2.)

3. Illinois and Mississippi Canal, Illinois.—The object of the improvement is to furnish a link in a navigable waterway from Lake Michigan to the Mississippi River at the mouth of Rock River, Illinois.

The canal has been located on the Rock Island route, approved by the Secretary of War October 27, 1888, as directed in the act of Congress of August 11, 1888. It proceeds from the Illinois River at its great bend, 1¾ miles above the town of Hennepin, Ill.; thence via Bureau Creek Valley and over the summit to Rock River at the mouth of Green River; thence by slack water in Rock River and a canal around the lower rapids of the river at Milan to the Mississippi River at the mouth of Rock River.

The canal is to be at least 80 feet wide at the water surface, 7 feet deep, and with locks 170 feet long and 35 feet width of lock chamber, capable of passing barges carrying 600 tons (maximum) freight.

A report upon the location, with detailed estimate of cost, of this canal was submitted June 21, 1890, and is printed in the Annual Report of the Chief of Engineers for 1890, page 2586.

The river and harbor act of September 19, 1890, made the first appropriation for the construction of the canal, and directed work to be begun by the construction of one of the locks and dams in Rock River.

In accordance with this act work was begun in July, 1892, near the mouth of Rock River, on the construction of a canal around the lower rapids of the river, and since that date has been prosecuted as rapidly as the appropriation of funds permitted. The survey work in locating the canal on the ground and proceedings for acquiring title to the right of way have been completed, and the canal has been definitely located on the ground throughout its entire extent.

An aggregate of $7,247,921.46 has been made available for prosecution of this work and $200,000 additional has been authorized to be expended under continuing contract.

The river and harbor act of March 3, 1905, authorizes the Secretary of War, in his discretion, to construct a fixed dam with movable crest in Rock River, in lieu of the lock and dam at or near Sterling, Ill., provided for by the approved project, the said dam with movable crest to be built from funds already appropriated or authorized for the construction of the canal and to constitute a part of the project for its construction.

There has been expended on this work up to the close of the fiscal year ending June 30, 1905, $6,492,559.80.

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The result of this expenditure has been:

First. The acquisition of the right of way for 4½ miles around the lower rapids of Rock River and the completion of 4½ miles of canal there, involving the construction of 4½ miles of earthwork, 3 locks, 1 railroad and 2 highway swing bridges, 7 sluiceways and gates, 1 arch culvert, 2 dams 1,392 feet long across the arms of Rock River, 3 lock-keepers' houses, 1 small office building, a thorough riprapping of the canal banks (not included in the original estimates), and construction by contract of Moline wagon bridge, at a cost of $25,000, which was also not included in the original estimate.

Second. In the location on the ground and preparation of descriptions, plats, and abstracts of title of all lands needed for the construction of the canal and feeder, and for lands to be overflowed or damaged by the canal at Sterling.

Third. In the completion on eastern section of all earthwork on miles 1 to 18, inclusive, and practical completion of earthwork on miles 19, 20, and 23 to 28, inclusive, and 73 per cent of earthwork on mile 21; about 92 per cent of earthwork on mile 22; the foundations and masonry for all culverts and locks 1 to 21; the construction of 3 aqueducts, 19 highway and 3 railroad bridges, 11 arch culverts and 11 pipe culverts; the erection of 5 houses for superintendents and 2 houses for office use, and acquiring additional land for deposit of waste material on miles 21, 22, and 23; the purchase and installation of a plant for construction of the canal through Cecils Slough, consisting of a duplex overhead cableway and a turntable dredge; the purchase of metal and timber, under contract, for the construction and equipment of lock gates for the canal.

Fourth. In the acquisition by condemnation or purchase of all lands required for the canal, with the possible exception of additional flowage lands in connection with dam at head of the feeder.

Fifth. In the construction of 4,673,008 cubic yards of earthwork on the feeder, completing all work of that character except some cross banks and bridge approaches; completion of 9 arch and 10 pipe culverts; foundations and abutments for 7 highway and 2 railway bridges, and the superstructure of 1 double-track highway and 2 single-track railway bridges; excavation of about 75,000 cubic yards of rock in mile 1, and distribution of same in the form of riprap along the interior slopes of the feeder; the construction of the masonry of the lock, sluiceways, and abutments for headworks of the feeder; and the masonry, backfilling, foundations, and slope paving at aqueduct crossing Green River have been completed and steel for equeduct trunk has been delivered.

Sixth. In the acquiring of lands for the right of way, including land to be damaged by overflow and land upon which to deposit waste material on western section; construction of 4,324,727 cubic yards of earthwork, completing 28 miles and a large portion of the balance; completion of all culverts, foundations for 6 locks and walls for 5, and letting to contract and partial construction of other lock walls, piers, and abutments of aqueduct bridges; completing masonry of all highway bridges on western section and completing superstructures of all except 2; building 2 railway bridges, 3 lock houses, and 8 warehouses.

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The entire work embraced in the original project for the canal, as modified by subsequent projects and plans as the work has progressed, may be summarized as follows:

Surveys and location upon the ground.
Acquisition of right of way and fencing.
Construction of—
- 95.8 miles of earthwork.
- 67 highway bridges.
- 1 farm bridge.
- 3 ponton bridges.
- 8 railroad bridges.
- 9 aqueducts.
- 52 culverts.
- 33 locks.
- 9 sluiceways and gates.
- 3 dams.
- 19 houses.
- Outlet to Rock River.
- New highway on mile 16.
- Improvement of 8.5 miles of Rock River.
- Moline wagon bridge (not in original estimate).

The work thus far completed may be summarized as follows:

Surveys and location upon the ground.
Acquisition of right of way and fencing.
Construction of—
- 91.8 miles of earthwork (except cross banks, etc.).
- 45 highway bridges and masonry for 8 others.
- 1 farm bridge (masonry).
- 8 railroad bridges.
- 6 aqueducts, complete except lining.
- 52 culverts, complete except 14 gates for flushing devices.
- 3 locks complete and in operation.
- 25 locks (masonry only).
- 5 locks under construction.
- 7 sluiceways with gates.
- 2 sluiceways (masonry only).
- 2 dams.
- 13 houses.
- New highway on mile 16.
- Moline wagon bridge.

The work remaining to be done consists of the following, as far as it can be classified at present:

Excavation of cross banks and cut through Cecils Slough.
22 highway bridges (8 abutments completed).
2 ponton bridges.
1 farm bridge.
5 locks (complete masonry).
30 locks (gates, valves, etc.).
14 culvert sluice gates.
2 sluiceways (gates).
6 houses.
3 aqueducts (complete masonry).
9 aqueducts (linings).
Outlet to Rock River.
Miscellaneous work, consisting of revetment, bank protection, surfacing, painting, slope paving, removing cofferdams and tracks, closing gaps, building intakes, maintenance, etc.

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July 1, 1904, balance unexpended	$1,044,878.91
Amount appropriated by river and harbor act approved March 3, 1905	300,000.00
Amount received from sale condemned property	1,175.21
	1,343,054.12
June 30, 1905, amount expended during fiscal year, for works of improvement	587,692.25
July 1, 1905, balance unexpended	755,361.87
July 1, 1905, outstanding liabilities	30,000.00
July 1, 1905, balance available	725,361.87
July 1, 1905, amount covered by uncompleted contracts	246,176.06
Amount (estimated) required for completion of existing project	200,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	200,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix L L 3.)

IMPROVEMENT OF MICHIGAN CITY HARBOR, INDIANA, AND OF RIVERS AND HARBORS ON THE EASTERN SHORE OF LAKE MICHIGAN.

This district was in the charge of Col. M. B. Adams, Corps of Engineers. Division engineer, Col. O. H. Ernst, Corps of Engineers, until October 25, 1904, and Col. G. J. Lydecker, Corps of Engineers, since that date.

General statement as to the usual variations in the level of the lake surface at all the harbors on the eastern shore of Lake Michigan.—The level of the lake surface varies considerably from time to time. At present its maximum height may be stated as from 0.5 to 1 foot below mean low water, and obtains from the end of June to the middle of August. Its lowest stage is between 1.5 and 2 feet below mean low water, and obtains with slight change from early in November to early in April. All depths at the various harbors in this report refer to zero of gauge, which is 581.63 feet above mean tide at New York.

1. Michigan City Harbor, Indiana.—The inner and outer harbors were formerly separate works. They are now consolidated in consequence of the requirements of the river and harbor act of June 13, 1902.

The improvement of this harbor dates from 1836, and has resulted in establishing an inner harbor for local commerce and partly completing an outer harbor designed to facilitate entrance to the former and afford refuge for vessels engaged in general lake commerce.

The inner harbor.—This has been made by deepening the entrance to Trail Creek and protecting the channel by piers extending to deep water in Lake Michigan, to which operations were limited until 1870. The original depths before improvement were 9 feet upon the outer bar and 3½ feet or less at the entrance to the inner harbor, and the width varied from 175 feet in the lower portion to 60 feet or less in the upper portion. Since 1882 the entrance channel has been prolonged up the creek by dredging between revetments, as they are built on

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established wharf lines at the expense of the adjoining property owners, as required by city ordinance. No general project for the expenditure of funds has been definitely adopted, but it seems to have been agreed that the improvement should extend upstream between banks revetted, as previously described, as far as the Lake Erie and Western Railroad bridge. A map of this portion of Trail Creek is given opposite page 2270, Annual Report of the Chief of Engineers for 1882.

It is learned that a recent act of the Indiana legislature now allows the city to build revetments and to assess their cost on the property benefited, as in cases of sewer construction, and that such extensive reconstruction of revetments is soon to be made as to allow the channels to be deepened to 20 feet from the entrance to Franklin Street Bridge, to 18 feet from there to the raliroad bridge, and to 16 feet thence to the upper end of the harbor.

The widening of the channel at the lower bend was provided for in the river and harbor act approved March 3, 1905, and now awaits the approval of the transfer papers donating the land to be cut away before advertising for bids.

In recent years the project has been purely one for maintenance, and has resulted in creating, by dredging, a channel 9,159 feet long between revetments from 100 to 175 feet apart, except at the turning basins, where the width is about 330 feet. The upper limit of this improved channel is 100 feet above the upper turning basin in the map above referred to, but above the lower part of the upper basin the channel has shoaled and is not available for lake vessels.

The total expenditure to June 30, 1902, the date of consolidation with outer harbor, was $438,365.50. Of this total, $287,383.77 was expended from 1836 to 1869, inclusive, principally upon pier construction, but it is now impossible to separate the cost of maintenance for this period from that of original construction. Since 1869, $150,981.73 in all has been expended, of which $54,419.55 was applied to maintenance.

Dredging was begun August 1 and completed August 10 for the removal of the shoal in front of the breakwater pier just outside of west entrance pier and for widening the channel between the entrance piers.

Soundings made May 23 to June 1, 1905, showed the following available depths: In the outer entrance, 20 to 32 feet; at the entrance to the inner harbor, 18 feet for a width of 120 feet next to the east pier; thence to the inner end of the piers, 16 feet in the channel of best water; thence to Sixth Street Bridge, 15 feet, except about 300 feet below the angle above Franklin Street Bridge, where the available depth was 14.5 feet; from the Sixth Street Bridge to the first angle above, 14.5 feet; thence to the second angle, 12 feet, and at the lower end of the upper basin, 7 feet.

The commerce benefited by the improvement is purely local in character, the principal business being in lumber and salt, which are brought from the northern harbors by small steam barges and by sailing vessels.

The channel does not maintain itself and provision should be made for periodical dredging.

The outer harbor.—Michigan City, being at the southern end of the lake, is exposed to northerly storms, especially those from west of

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north, with a clear sweep of the length of the lake, about 250 miles. As a result there arose a demand for a harbor of refuge in this vicinity, which was answered in 1870 by the adoption of a project for the creation of an outer harbor at this place, which was to consist of an outer basin east of the entrance to the inner harbor. In 1882 this project was extended to include the construction of an exterior breakwater northwest of the entrance. The piers and breakwaters covering the outer basin were completed in 1885, and have a total length of 3,171 feet measured on the harbor face, viz, a pile pier, 1,225 feet long, extending in a northerly direction from the shore and closing the basin on the east; a crib breakwater, 1,411 feet long, extending westward from the lake end of the pile pier and closing the basin on the north, and a crib pier, 535 feet long, measured from the angle in the harbor face or 505 feet measured from the rear face of the breakwater, extending northward from the west end of the crib breakwater. The exterior breakwater contemplated by the project of 1882 was to have a total length of 2,000 feet, but a length of only 700 feet had been built.

The river and harbor act of March 3, 1899, authorized the adoption of the project of a Board of Engineers as printed in the Annual Report of the Chief of Engineers for 1897, pages 2899 to 2904, inclusive, and provided for the completion of the work under the continuing-contract system. This project requires the extension of the breakwater pier by 600 feet, the construction of a new detached breakwater 1,500 feet long, and the removal of the present detached breakwater. The estimated cost of the work was given at $282,150, but it is now found necessary to increase this estimate by $30,000, making the total estimated cost of the work $312,150.

Up to June 30, 1905, the sum of $1,096,713.88 had been expended upon the original project and its subsequent modifications. Of this amount $758,226.34 had been expended upon the projects of 1870 and 1882, of which $132,665.25 was applied to maintenance. The total amount expended upon revised project to June 30, 1905, was $338,487.54, of which $294,988.18 was for new construction and $43,499.35 for maintenance.

The Annual Report of the Chief of Engineers for 1897, pages 2899 to 2904, contains the full report of the Board of Engineers referred to above, and a map showing the outlines of the present project is opposite page 2904 of that report.

During the past year the contract for repairing the west entrance pier between stations 16+20 and 21+58 and the east entrance pier between stations 6+70 and 14+05 and for closing the entrance to the outer basin was completed in November, 1904.

The district officer reports that to complete the approved project will require the further appropriation of $30,000, to be used in constructing 200 linear feet of detached breakwater.

The money on hand, $53,184.39, will be expended in continuing the improvement, maintenance, and contingencies.

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Entrances and clearances.

Calendar year.	Number.	Tonnage.
1903	929	175,1
1904	853	228,0

Freight carried, calendar year—

	Tons.
1903	117,32
1904	69,88

NOTE.—No record is kept of traffic between Michigan City, Ind., and Chicago, Ill.

July 1, 1904, balance unexpended		$61,869.78
Amount appropriated by river and harbor act approved March 3, 1905		45,000.00
		106,869.78
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$22,173.03	
For maintenance of improvement	[a] 31,512.36	
		53,685.39
July 1, 1905, balance unexpended		53,184.39
July 1, 1905, outstanding liabilities		147.26
July 1, 1905, balance available		53,037.13
July 1, 1905, amount covered by uncompleted contracts		4,500.00

(See Appendix M M 1.)

2. St. Joseph Harbor and River, Michigan.—These were formerly carried as separate works, but are now combined in consequence of a provision in the river and harbor act of June 13, 1902.

(*a*) *St. Joseph Harbor.*—This harbor is formed by the junction of the St. Joseph and Pawpaw rivers and extends along the city front of St. Joseph and in its original condition had a natural width of 800 feet, which has been reduced to 300 feet by wharves built upon the approved harbor lines. It has been under improvement by the United States since 1836, previous to which time there was a narrow and crooked channel with depths which varied from 3 to 7 feet. The original project of 1836 is not clearly known. Up to 1866 there were built 1,100 feet of north pier and 212 feet of south pier, which protected a cut through the narrow tongue of land to the north of the old river mouth, the width between the piers being 240 feet, which became 257 feet through subsequent repairs. In all $162,113 was expended upon this work. In 1866 the first definitely known project was adopted, and this proposed the extension of the south pier 200 feet for the purpose of facilitating the creation of a direct channel of 16 feet depth through the bar at the entrance. The project of 1866 was modified in 1874, 1875, 1880, and 1892, the changes having reference principally to the length and direction of the two piers. The Benton Harbor Canal, which is about 1 mile long and extends from the upper part of the harbor to the town of Benton Harbor, was taken over by the United States for the purpose of care, maintenance, and improvement. In all there was expended upon these various projects $503,113.23.

[a] $943.75 account dredge.

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The river and harbor act of March 3, 1899, adopted the present project, which is printed in the Annual Report for 1898, pages 2496–2498. This project provides for an entrance channel 18 feet deep and for an interior channel 18 feet deep and 150 feet wide along the city front of St. Joseph, while the Benton Harbor Canal and the turning basin at the mouth of the St. Joseph River are to be dredged to 15 feet. The north pier is to be extended 1,000 feet, and the south pier, upon a line parallel with the north pier, 1,800 feet. The width between will be 330 feet at the entrance, narrowing to 257 feet inside. The estimated cost of completion of the existing project was given in the above report at $380,000. Up to June 30, 1905, there had been expended upon the existing project $347,605.47, of which $44,527.06 was applied to maintenance. Operations since June 25, 1900, have been in progress for the purpose of completing all the work contemplated. As a result of the above expenditures 1,000 feet has been added to the north pier and 1,800 feet to the south pier, and in November, 1901, the proposed dredging had been completed so far as practicable. Deterioration in the dredged channels has since taken place. The bar just beyond the ends of the piers still persists and limits the maximum through draft to 16.6 feet. To complete the existing project the dredging through this bar still remains to be done, and annual dredging will be required.

The north pier and revetment measure 2,854 feet, 2,183.5 feet being crib work and 670.5 feet pile work. At the east end a wing 165 feet long connects it with the dock of the United States light-house depot. The south pier is 2,623 feet long, 1,800 feet being crib work and 820 feet pile work. These structures are in excellent condition except the 165 feet of wing at east end of north pier.

Dredging for the maintenance of the usual channel depths, which was in progress at the beginning of the fiscal year, under contract was continued until July 31, 1904, and 35,170 cubic yards was removed during this period from the channels through bar at the entrance and within the harbor.

Soundings of May 16–20, 1905, showed the following available depths: Outside of the entrance, 19.1 feet on line of north pier, 16 feet 200 feet south of that line, and 19.5 feet on line of south pier. Between the piers, at the outer end, 18 feet for a width of 130 feet next to the north pier and 16.1 feet in the middle of channel; thence to the angle, 18 feet for a width of 100 feet in the north half of the channel and the same width and depth next to the south pier from the angle to the railroad bridge; at the upper end of the bridge, 17.2 feet; thence to the mouth of the Benton Harbor Canal, 18 feet for a width of 60 feet, and in the Benton Harbor Canal, 18 feet for a width of 40 feet throughout, except a length of about 400 feet near the upper end, where the depth in center of channel was 16.6 feet.

The soundings show considerable shoaling of the channels since the general dredging operations in 1901. The accretions causing this deterioration are due to sand brought down by the St. Joseph and Pawpaw rivers during floods, and, as this is a matter of annual recurrence, dredging for the restoration of the channel may be expected to be required from year to year. The cost of this dredging is estimated at $10,000 per year, or for two years, $20,000. The estimate for St. Joseph River is $750, making an aggregate estimate of $20,750.

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The principal traffic benefited by this improvement is the fruit traffic and the carrying of passengers, including excursionists to the summer resorts in this vicinity. Both classes of traffic show continuous growth. The entire traffic is served by a single line of steamers, which, however, during the summer, runs from two to four boats daily, some of these being of very great size.

House Document No. 307, Fifty-fifth Congress, second session, reproduces a map accompanying the present revised project, which is not republished in the Annual Report of the Chief of Engineers for 1898.

(*b*) *St. Joseph River.*—This is a crooked stream, obstructed by numerous shoals, with depth in channel crossings of from 24 to 30 inches. The intervening pools are generally from 4 to 8 feet deep. The part under improvement is from the mouth at St. Joseph to Berrien Springs, a distance of about 25 miles by river. The improvement of this section to make a low-water channel 3 feet deep has been in progress since 1889, and consists in removing snags and logs and closing secondary channels, or concentrating the flow at other critical points by dams of brush, logs, and stone.

The amount expended to June 30, 1905, was $5,949.51, of which $4,555.49 was for construction and $1,394.02 for maintenance, as a result of which many of the worst places of the stream had been improved to the required extent.

Operations on the St. Joseph River during the fiscal year comprised a small amount of wing dam construction, the removal of overhanging trees and snags by a force of hired laborers at a total cost of $449.51, given more in detail in the report of the district officer.

The average annual expenditure has been $500. Experience shows that this is too little to accomplish all that is desired.

The traffic benefited by this improvement is a limited one, three small steamers being employed to carry passengers (almost exclusively summer tourists) and a small quantity of freight, which is principally fruit.

The money on hand will be expended in maintenance and contingencies.

Entrances and clearances.

Calendar year	Number.	Tonnage.
1903	1,430	795,349
1904	1,289	552,228

Freight carried, calendar year—	Tons.
1903	127,872
1904	97,036

July 1, 1904, balance unexpended		$34,388.77
Amount appropriated by river and harbor act approved March 3, 1905		15,000.00
		49,388.77
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$15,350.37	
For maintenance of improvement	10,117.26	
		[a] 25,467.63
July 1, 1905, balance unexpended		23,921.14

(See Appendix M M 2.)

[a] Includes $7,148.46 for dredge.

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3. South Haven Harbor, Michigan.—This harbor is situated at the mouth of Black River. Improvements were begun in 1867, at which time there existed a channel 7 feet deep and 85 feet wide between slab piers. These piers had been built by residents of the vicinity, at a cost of about $18,000. The banks of the river for 500 feet on each side had a rough protection of close piling.

The project of 1866, as modified in 1869, 1872, and 1888, provided for constructing parallel piers and revetments 175 feet apart at the mouth of Black River, with the object of procuring a channel 12 feet deep, and extending the navigable channel one-half mile up Black River to the highway bridge by dredging.

The act approved March 3, 1905, adopted the project, as per House Document No. 119, Fifty-eighth Congress, second session, and provides that none of the $50,000 appropriated for the improvement shall be used, except for maintenance of existing channels, until proper dock lines shall have been established and suitable bulkheads shall have been built along these lines by the city of South Haven or by the riparian owners, and the property lying on the channel side of these dock lines shall have been deeded to the United States free of cost.

The present project for this improvement comprehends the extension and repairs of piers and dredging for a width of 120 feet between the piers and 90 feet above them, to give a depth of 16 feet at a stage of —2 feet, at a cost of $279,370. As yet the necessary action by the city of South Haven or by riparian owners, as provided in the above act, has not been taken. Consequently operations are limited to maintenance of existing channels.

A contract made for dredging harbors on the east shore of Lake Michigan included 22,148 yards at South Haven Harbor, and operations were completed June 21, 1905, leaving the channels in very fair condition under the old project, which must be regarded as governing until the conditions pertaining to the new project are complied with.

The total expenditure to June 30, 1905, was $323,187.60, of which $187,232.83 was expended for construction and $135,954.77 for maintenance.

As is the case with most of the harbors in this vicinity, the principal traffic of South Haven depends upon the fruit crops and the summer resort and excursion travel from Chicago. The business of the harbor has been increasing rapidly.

The money on hand will be expended on maintenance and contingencies until the conditions allowing the continuance of improvement are complied with, and as appropriated will be applied in like manner.

Entrances and clearances.

Calendar year—	Number.	Tonnage.
1903	951	621,559
1904	1,123	758,972

Freight carried, calendar year—	Tons.
1903	76,646
1904	198,804

Passengers carried during season of 1904, 205,981.

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July 1, 1904, balance unexpended	$3,669.65
Amount appropriated by river and harbor act approved March 3, 1905	50,000.00
	53,669.65
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	[a] 7,419.78
July 1, 1905, balance unexpended	46,249.87
July 1, 1905, outstanding liabilities	126.26
July 1, 1905, balance available	46,123.61
July 1, 1905, amount covered by uncompleted contracts	382.05
Amount (estimated) required for completion of existing project	247,000.00

(See Appendix M M 3.)

4. Harbor at Saugatuck, and Kalamazoo River, Michigan.—Before the work of improvement was begun by the United States, in 1869, this harbor, which is at the mouth of the Kalamazoo River, had been improved by local enterprise by the construction of slab piers 200 feet apart, the north pier being 500 feet long and the south pier 1,575 feet. The channel depth varied from 5 to 7 feet. The present project for the old harbor at the mouth of the river was adopted in 1867 and amended in 1869, 1875, and 1882. To June 30, 1905, $201,849.26 had been expended, of which $90,231.99 was for construction and $111,617.27 for maintenance. At present there is a north pier 715 feet long, which is entirely unserviceable; separated from the pier by a long stretch of unprotected bank there is a north revetment, partly destroyed and partly covered by sand. The south pier is 3,863 feet long and is practically ruined. Frequent dredging has been required for maintenance of an 8-foot channel, which rapidly deteriorates. Appropriations since 1882 have been too small to keep the piers in proper repair.

The existing project for the new harbor was adopted by the river and harbor act of June 3, 1896. It provides for creating a channel of 12 feet depth and navigable width by dredging the river for a distance of 1¾ miles below Saugatuck, and thence making a new cut from the river to the lake, entering the latter about 3,700 feet below the present mouth at the Saugatuck piers. The original estimate for the work was $150,000, but authority was granted on May 31, 1900, to increase this to $250,000. To June 30, 1905, $67,672.40 had been expended.

A contract was made July 15, 1903, for pier construction at the new harbor. To determine the exact location for the piers, a survey was made August 18 to September 5, 1903, and in January, 1904, the limits of the land to be acquired for the new harbor entrance were fixed by metes and bounds. The land was deeded to the United States February 15, 1904.

Dredging operations were carried on at the old harbor entrance during the latter part of June, 1905, under contract. Owing to unusual sand accretions having formed at the old entrance in the early spring of 1904, it became necessary to change the direction of the approach in laying out the dredging, so as to avoid the deepest part of the bar outside and keep the amount of work within the available funds. The channel outside was given a course in the

[a] Includes $943.74 for dredge.

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exact direction of the light-house, and as it passes close to the end of the south pier its direction is somewhat southward of the usual one. The ordinary depth of 12 feet outside and 8 feet within the piers will be restored in the narrow channels that have heretofore been provided when the work now approaching completion has been finished.

Operations on the pier construction at the new entrance were commenced in April, 1904, and have been in progress to date.

After due advertisement, bids were opened and a contract entered into with the lowest bidder for excavating the new channel from Kalamazoo River to Lake Michigan, under date of June 16, 1905. Operations under this head are to be commenced early in July.

The time limit on the contract for pier construction was waived by reason of the failure of the contractors to complete the work by December 31, 1904, and, owing probably to its incomplete condition, the portion that had been partly finished suffered considerable injury during the fall and winter storms. Under the specifications the entire work must be left in a state of completion, but as the same storms that breached the work caused considerable erosion of the bottom at the gap and around the south pierhead, which stood alone, in replacing the sheet piles carried away and in driving new sheet piles inside the south pierhead, it was deemed advisable to substitute piles 26 feet long for the 23-foot piles of the specifications, which change has been provided for under supplementary contract. Operations are progressing fairly well, but will require the season of 1905 for completion.

The harbor is near a very prosperous fruit region, and the fruit traffic has been its principal source of business. Saugatuck is but 8 miles south of Holland, with which it is now connected by a trolley road, and about 17 miles north of South Haven. Holland and South Haven both command other sources of business than the fruit traffic alone, and bid fair to increase in importance through the fact that they are termini of important railroad lines.

The Annual Report of the Chief of Engineers for 1896, pages 2741–2743, and House Document No. 192, Fifty-fourth Congress, first session, contain in full the report pertaining to the adopted project for the proposed change in the location of this harbor. The House document contains also a map of the locality.

The money on hand will be expended in continuing improvement, maintenance, and contingencies.

Entrances and clearances.

Calendar year—	Number.	Tonnage.
1903	912	91,936
1904	544	65,760

Freight carried, calendar year—	Tons.
1903	12,591
1904	10,558

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July 1, 1904, balance unexpended		$103,032.93
Amount appropriated by river and harbor act approved March 3, 1905		75,000.00
		178,032.93
June 30, 1905, amount expended during fiscal year:		
For works of improvement	[a] $46,720.45	
For maintenance of improvement	8,595.14	
		55,315.59
July 1, 1905, balance unexpended		122,717.34
July 1, 1905, outstanding liabilities		154.67
July 1, 1905, balance available		122,562.67
July 1, 1905, amount covered by uncompleted contracts		85,124.09
Amount (estimated) required for completion of existing project		75,000.00

(See Appendix M M 4.)

5. Holland (Black Lake) Harbor, Michigan.—When improvement was begun, in August, 1867, by the United States there existed a narrow channel 5½ feet deep between piers built of brush and of irregular cribs. These had been constructed by the harbor commissioners of the adjoining town of Holland.

A project was adopted in 1867 and amended in 1873, 1879, 1884, and 1892. From 1867 to 1880 there were built by the United States piers and revetments aggregating 1,854 feet on the north side and 1,691 feet on the south side. Since the latter date there have been no additions to these structures, which were designed to create a 12-foot channel varying in width from 160 feet inside to 213 feet outside, except, in 1889, a length of 160 feet of pile pier on the south side, designed to close a gap in the existing structure. Upon this project there was expended up to March 3, 1899, $304,217.30, of which $127,597.50 was for maintenance. Repairs made during recent years have diminished the width inside to 148 feet.

A revised project was adopted in the river and harbor act of March 3, 1899, and provided for securing a channel 16 feet deep, protected by piers and revetments 148 feet to 250 feet apart, the estimated cost of completion being $240,000. From March 3, 1899, the date of adoption of this project, to June 30, 1905, there was expended $109,284.56, of which $54,827.46 was for maintenance.

The river and harbor act of March 3, 1905, appropriated $65,000 and authorized continuing contracts for $110,000 additional, with a proviso that the United States engineer in charge may, subject to the approval of the Chief of Engineers, modify the existing project by the widening of the harbor entrance.

A drawing and description of the plan adopted to carry this proviso into effect may be found in the report of the district officer. It is expected that the work of construction will soon be placed under contract, with a view to completion as funds are from time to time appropriated.

Operations for the maintenance of the usual depths were carried on under contract, work having commenced May 22 and having been completed June 13, 1905, with the removal of 22,992 cubic yards. The following depths resulted from the above operations: A depth of 18 feet for a width of 180 feet across the outlying bar, a depth of 17 feet for a width of 120 feet between the outer 300 feet of piers, and a depth of 15 feet farther inside.

[a] Includes $4,800 for dredge.

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This harbor is relatively an important one, being the terminus of one of the lines of the Pere Marquette Railroad Company and of the Grand Rapids, Holland and Chicago Electric Railway, which here connect with two lines of steamers, which, during the season of navigation and when the condition of the harbor permits, run regularly to Chicago and Milwaukee. The passenger business is specially important, but there is also profitable freight traffic, especially during the fruit season. The harbor justifies early improvement in accordance with the requirements of the existing project.

The report upon which the present project is based is published in full in the Annual Report of the Chief of Engineers for 1897, pages 2950, 2951.

The money on hand and to be appropriated will be expended on continuing improvement, maintenance, and contingencies.

Entrances and clearances.

Calendar year—	Number.	Tonnage.
1903	678	769,586
1904	622	745,238

Freight carried, calendar year—		Tons.
1903		16,430
1904		21,450
July 1, 1904, balance unexpended		$35,266.23
Amount appropriated by river and harbor act approved March 3, 1905		65,000.00
		100,266.23
June 30, 1905, amount expended during fiscal year:		
For works of improvement	[a] $17,140.00	
For maintenance of improvement	11,213.97	
		28,353.97
July 1, 1905, balance unexpended		71,912.26
July 1, 1905, outstanding liabilities		52.33
July 1, 1905, balance available		71,859.93
July 1, 1905, amount covered by uncompleted contracts		396.62
Amount (estimated) required for completion of existing project		128,296.69
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905		110,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.		

(See Appendix M M 5.)

6. Grand Haven Harbor, Michigan.—This harbor is at the mouth of Grand River, the largest river in the State of Michigan. Before any work had been done the natural depth at the mouth of the river varied from 9 to 12 feet, with greater depths in the inner reaches.

In 1857 the Detroit and Milwaukee Railroad Company (Grand Trunk), whose western terminus is at the town of Grand Haven, built a pile pier 3,185 feet long upon the south side of the entrance, and also revetted, by means of close piles, portions of the bank upon the

[a] For dredge.

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north side of the river. In 1866, when work by the United States was begun, the pile pier had been partly destroyed by fire and by storms. The available depth was 13 feet.

The present project was adopted in 1866, and amended in 1868, 1880, 1890, and 1892. It provides for the construction of parallel piers and revetments 400 feet apart, with the object of creating an entrance channel 18 feet deep. Estimated cost was $804,366.15. The amendments to the original project did not materially change its original purpose, the changes being principally in the proposed length of the piers and revetments.

To June 30, 1905, there had been expended upon the existing project the sum of $831,068.37, of which $542,976.82 was for construction and $288,091.55 for maintenance.

The district officer is of the opinion that the project can be completed for less than the original estimate.

The result of the above expenditure was the construction and maintenance of 3,538 linear feet of north pier and 5,774 linear feet of south pier, with a channel of variable depth between them maintained by occasional dredging.

The extraordinary freshet in Grand River, March, 1904, caused an unusual amount of sand movement in the river and accretions at its mouth; the revetments were injured, too, by reason of the high water undermining them and destroying portions of them. It was found that 180,000 cubic yards of sand had accumulated in a bar at the mouth of the river and between the piers, that 135 feet of the north revetment was injured and 50 feet actually carried away, and that 1,600 feet of the south revetment had become undermined so that 1,200 feet thereof would require repairs by filling and riprapping and 400 feet would require reconstruction.

On representation of the condition of the harbor allotments aggregating $10,000 and $40,000 were made from the emergency appropriations of June 13, 1902, and April 28, 1904, respectively, and informal contracts were authorized and made with the lowest bidders, after soliciting bids by circular letters, for the removal of 100,000 cubic yards from the bar, May 13, 1904, and for the reconstruction of 400 linear feet of the south pier, August 17, 1904. Dredging was commenced May 13 and completed July 18, 1904, with the removal of 100,000 cubic yards, at a cost of $16,900. The reconstruction of the south pier was commenced August 15 and completed December 31, 1904, at a cost of $32,082.51. Owing to limited funds, the entrance was left obstructed on the line of the north pier and to near mid-channel by a bar having only 13.5 feet depth. The work on the south pier was necessarily pressed to completion without allowing the usual time for settlement of the foundation before sinking the cribs, and, though finished in apparently good condition, showed some settlement, which has since caused the channel face at about mid-length to subside as much as 3 feet, that becomes less toward the ends. As this structure is opposite a place of extreme scour by the river, where depths of 41 feet exist, and as subsidence has apparently ceased, it seems quite likely that the foundation has reached such depths that no further settlement will occur and that repairs by leveling up the superstructure will meet the requirements.

The restricted channel at the entrance became further shoaled up during the fall and winter, so that a further sum of $10,000, making

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the limit of $50,000, from the appropriation of April 28, 1904, was allotted for the purpose of affording relief. When bids were solicited it was found that no dredge would undertake the work until spring. In the meantime, the advent of the U. S. dredge *Gen. Gillespie* in these waters caused the work to be undertaken by that dredge. This dredge was built under the direction of Maj. J. C. Sanford, Corps of Engineers, and the details of the work are given in Appendix H 7, herewith. Work of dredging commenced June 26, 1905, and 23,949 cubic yards was removed from the bar and channel between the piers near the entrance by the close of the fiscal year.

A central bar persists in forming from year to year beyond the entrance to this fine harbor and seriously impairs its usefulness, even when there is no extraordinary freshet in Grand River; consequently it is fortunate that there is a dredge at hand to undertake relief at any time.

This harbor has for years been one of considerable importance. It is the western terminus of the Detroit, Grand Haven and Milwaukee branch of the Grand Trunk Railroad, in connection with which is run throughout the year a line of steamers to Milwaukee. In addition there are two lines with regular and frequent scheduled trips to Chicago. All three lines do a large passenger and a very considerable freight business, especially during the season of fair weather.

The latest map of this harbor is found in the Annual Report of the Chief of Engineers for 1890, page 2650.

It is expected to apply the money on hand to maintenance, repairs, and contingencies.

Entrances and clearances.

Calendar year—	Number.	Tonnage.
1903	3,852	988,022
1904	1,247	1,486,646
Freight carried, calendar year—		Tons.
1903		215,184
1904		471,349
July 1, 1904, balance unexpended		$33,042.30
Amount appropriated by river and harbor act approved March 3, 1905		30,000.00
Amount allotted from appropriation for maintenance of river and harbor improvements, act of April 28, 1904		30,000.00
		93,042.30
June 30, 1905, amount expended during fiscal year, for maintenance of improvement		[a] 49,167.60
July 1, 1905, balance unexpended		43,874.70
July 1, 1905, outstanding liabilities		375.35
July 1, 1905, balance available		43,499.35
Amount (estimated) required for completion of existing project		34,375.00

(See Appendix M M 6.)

7. *Grand River, Michigan.*—Before any work of improvement was done upon this stream the depth in the crossings over some of the bars did not exceed 2 feet.

[a] Includes $1,000 for dredge.

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Between 1881 and 1886 the sum of $50,000 was expended in securing, by dredging, narrow channels through these bars, with a depth of about 4 feet. No further work was done until 1896, but even then, at the expiration of over ten years, traces of the dredged cuts were still apparent.

The former project, upon which work was begun in May, 1897, was adopted by the river and harbor act of June 3, 1896, and is based upon a report upon examination and survey reprinted in Report of the Chief of Engineers for 1892, pages 2369 to 2395. The project contemplated dredging a channel a distance of 38 miles, from Grand Haven to Grand Rapids, with a depth of 10 feet and a width of 100 feet. The project also proposes the use of contraction works wherever necessary to increase the effect of the dredging or to render it more permanent.

The original estimated cost of project adopted in 1896 was $670,500; but the project may be said to have been modified by act of June 13, 1902, and the cost increased to not less than $774,000.

The act of March 3, 1905, appropriated $100,000 for this improvement and modified the former project by adopting the report submitted in House Document No. 216, Fifty-eighth Congress, second session, and by providing that no portion of the money appropriated shall be used in providing a turning basin in the city of Grand Rapids.

The report referred to above recommends, on pages 4 and 5, that a channel of 6 feet depth and 100 feet width be adopted for the improvement. The estimate in the report for a 6-foot channel 100 feet wide from Fulton street, in Grand Rapids, to Grand Haven, Mich., prepared from data furnished by the district officer, is $430,000, including available plant and funds.

To June 30, 1905, the sum of $274,756.60 had been expended in dredging 1,191,743 cubic yards of sand, clay, cobblestones, etc., in building 121,943 linear feet of training walls, and in the purchase and maintenance of plant. This sum includes $13,427.45 expended for maintenance of contraction works.

The dredging of a channel 6 feet deep and 100 feet wide above Wealthy avenue, and as far up as Fulton Street Bridge, is soon to be undertaken.

Operations during the fiscal year have been the deepening of the channels through some of the worst shoals between Wealthy avenue, Grand Rapids, and the mouth of Bass River, 23 miles below, by the Government plant, the construction and repairs of contraction works, as required, and the usual survey work.

The available depths a year ago at extreme low water over the shoalest crossings varied from 3 to 5 feet, there being 14 crossings with less than 5 feet, and from Bass River to Grand Haven no depth of less than 5 feet existed. At the present time the available depths at extreme low water between Grand Haven and Grand Rapids may be stated as follows: Six feet for 27.3 miles, 5 to 6 feet for 8.86 miles, and 3.1 to 5 feet for 3.34 miles. The contraction works are in fairly good condition.

The project is naturally one of constant repair and maintenance. High water ordinarily occurs in the early spring, and is from 12 to 18 feet above low water in the neighborhood of Grand Rapids. In the lower part of the river the difference between the high and low stages

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becomes less, and at the mouth it is inconsiderable. The commerce involved is purely prospective, and it is probable that but little benefit will be derived from the improvement until it is practically completed.

It is expected to expend the money on hand in continuing improvement and in maintenance.

Freight carried, calendar year—		Tons.
1903		83,332
1904		78,291
July 1, 1904, balance unexpended		$39,613.30
Amount appropriated by river and harbor act approved March 3, 1905		100,000.00
Deposited September 30 and December 19		83.65
		139,696.95
June 30, 1905, amount expended during fiscal year:		
For works of improvement	[a] $36,944.27	
For maintenance of improvement	2,425.63	
		39,369.90
July 1, 1905, balance unexpended		100,327.05
July 1, 1905, outstanding liabilities		3,739.72
July 1, 1905, balance available		96,587.33
Amount (estimated) required for completion of existing project		227,000.00

(See Appendix M M 7.)

8. Muskegon Harbor, Michigan.—This harbor is the outlet of Muskegon River, one of the largest in Michigan, which before emptying into Lake Michigan expands into Muskegon Lake. The channel between the lakes in 1867, before operations were begun by the United States, was 3,000 feet long and about 12 feet deep, except at the entrance, where the depth was 11 feet, and the channel fluctuating. By private enterprise the entrance had been protected by converging slab piers.

The present project was adopted in 1866 and amended in 1869, 1873, 1881, 1884, 1890, 1892, and 1902. In its final form it provides for a through channel 20 feet deep and 300 feet wide, protected by piers and revetments. Estimated cost of completion of revised project of 1902, $380,000. The various changes in the original project did not modify it essentially. They refer merely to the depth of the channel and to the width, length, and direction of the piers.

To June 30, 1902, there was expended upon former modifications of the project the sum of $526,293.36, of which $388,218.42 was for construction and $138,074.94 for maintenance. As a result of the above expenditure, therefore, there have been constructed a north pier and revetment 2,780 feet long, and a south pier and revetment 4,402 feet long, protecting a channel whose width varies from 308 feet at the entrance to 167 feet inside, while the maximum depth which, on June 30, 1905, could be carried over the shoalest point in the channel was 16 feet.

From July 1, 1902, to June 30, 1905, there was expended upon project approved June 13, 1902, the sum of $71,806.15, of which $47,810.33 was for construction and $23,995.82 for maintenance.

Dredging to increase the width and depth of the navigable channel between the piers at and outside of the shore line was begun August 8 and completed September 7, 1904. There was then practically a 19-

[a] Includes $10,000 for dredge *Gen. Gillespie.*

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foot depth for the full width of channel at the end of piers; farther inside there was an 18-foot depth for a width of 180 feet next to south pier, and at the shore line an 18-foot depth for a 120-foot width in the middle of channel.

Operations are soon to be undertaken by the U. S. dredge *Gen. Gillespie* that will, it is expected, restore the channel to a very good condition.

The repairs that were completed November 28, 1903, left the timber work of the south pier and the projecting portion of the north pier, with the exception of some breaks caused by colliding vessels, in fair condition. The interior portions of the north pier and the revetment are in need of repairs, and the adopted project provides for rebuilding them on a line 300 feet distant from and parallel to the south pier.

An old store house of the Pere Marquette Railroad Company, that was situated just outside the car-ferry slip, was removed during the year and will necessitate repairs to 310 linear feet of the south revetment upon the site of which the building stood. The district officer estimates that this work will cost $8,525.

In order to widen the channel to 300 feet, in rebuilding the inner portion of the north pier and the north revetment at that distance from the south pier, the necessary land north of the old pier and revetment had to be acquired by donation from the Central Land Company (Pere Marquette Railroad Company). The necessary papers to this end are in the hands of the proper legal officials to pass on the validity of title. It is expected that the work to be done with the funds in hand will at once be placed under contract for completion by the end of the season of 1906.

During the season of navigation three lines of steamers regularly use this harbor, which is a terminus of three important railroad lines. Their business is a substantial one, and with increased facilities should grow considerably. A general freight and passenger business is done, and in the summer months is largely augmented by the fruit and the resort traffic. Muskegon Lake itself is a magnificent harbor, 5 miles long and about 1½ miles wide, with depths varying from 30 to 40 feet. If readily accessible this would be an excellent harbor of refuge.

The Annual Report of the Chief of Engineers for 1901, pages 3131–3134, and House Document No. 104, Fifty-sixth Congress, second session, contain in full a report upon a preliminary examination of this harbor, in which it is estimated that to secure a channel 300 feet wide and 20 feet deep will cost $380,000. This project was adopted by the river and harbor act of June 13, 1902. A map showing the harbor and the outlines of the above project accompanies the document mentioned.

It is expected to apply the money on hand to continuing the improvement and to maintenance, contingencies, etc.

Entrances and clearances.

Calendar year—	Number.	Tonnage.
1903	1,171	650,342
1904	1,075	980,662

Freight carried, calendar year—	Tons.
1903	174,353
1904	157,109

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July 1, 1904, balance unexpended	$14,030.39
Amount appropriated by river and harbor act approved March 3, 1905	100,000.00
	114,030.39
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	[a] 7,519.90
July 1, 1905, balance unexpended	106,510.49
July 1, 1905, outstanding liabilities	88.30
July 1, 1905, balance available	106,422.19
Amount (estimated) required for completion of existing project	216,300.00

(See Appendix M M 8.)

9. White Lake and Pentwater harbors, Michigan.—These harbors were formerly carried as separate works, but are now consolidated in consequence of a provision in the river and harbor act of June 13, 1902.

(*a*) *White Lake Harbor.*—When the present project was adopted the natural outlet of White Lake, about 3,550 feet north of the present entrance, afforded a channel 5 feet deep and 125 feet wide between slab piers built by local enterprise.

The approved project provided for the abandonment of the old outlet and the creation of a new one, 12 feet deep and 200 feet wide between piers and revetments. This project was adopted in 1866, amended in 1873, 1884, and 1892, the present amended estimated cost being $353,550. The various amendments to the original project have not altered it materially, as they relate principally to the length of the proposed piers and revetments. The existing project, therefore, provides for the creation and maintenance of a channel 12 feet deep between piers and revetments about 184 feet apart.

To June 30, 1905, there was expended upon the existing project the sum of $337,325.96, of which $207,862.44 was for construction and $129,463.52 for maintenance. This expenditure procured the construction and maintenance of a north pier and revetment 1,715 feet long, and a south pier and revetment 1,953 feet long, the natural depth of the channel between them being about 10 feet. Periodical dredging is necessary to secure and maintain a 12-foot channel. Up to June 30, 1905, the maximum draft that could be carried over the shoalest point of the channel was 12.2 feet.

Dredging operations for the temporary restoration of channel depths were completed August 19, 1904. A channel 60 feet wide and 13 feet deep resulted from these operations.

Soundings were made April 28 to May 2, 1905, showing the following available depths: Outside of the entrance, 17.8 feet on line of south pier, decreasing to 11.7 feet on line of north pier. Between the piers the best water for 400 feet at the outer end was next to the south pier, with 12.3 feet; and thence to White Lake, in mid-channel, with 14 feet. The stage of the lake at the time of sounding was —0.7 to —1 foot.

Dredging was commenced June 26, under contract dated April 29, and will be completed early in July.

The harbor is but 10.5 miles north of Muskegon. Such traffic as there is hardly exceeds in value the annual expenditure necessary to maintain a reliable 12-foot channel.

[a] Includes $943.74 for dredge.

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The last published map of the locality is contained in the Annual Report of the Chief of Engineers for 1884, page 1982.

(*b*) *Pentwater Harbor.*—Before work was begun at this harbor by the United States there existed an irregular channel 4 feet deep and 75 feet wide between slab piers built by local enterprise.

The existing project, adopted in 1867 and amended in 1873, 1884, and 1892, provides for widening the old entrance to 150 feet and deepening it to 12 feet, the sides being protected by piers and revetments. Estimated cost was $327,713.40. The amendments to the original project relate merely to the length of the proposed piers and revetments and in no wise enlarge its original scope. The present project, therefore, provides for a channel 12 feet deep and about 150 feet wide, protected by suitable piers and revetments.

To June 30, 1905, there was expended the sum of $290,928.56, of which $179,873.15 was for construction and $111,055.41 for maintenance. The result was a channel 140 to 153 feet wide, whose natural depth is from 9 to 10 feet, protected by a north pier and revetment 2,226 feet long, and a south pier and revetment 1,847 feet long. Periodical dredging is necessary to secure the projected depth of 12 feet. The maximum draft which, on June 30, 1905, could be carried over the shoalest point in the improved channel was 13.5 feet.

Dredging operations for the temporary restoration of channel depths at Pentwater Harbor were commenced July 13 and completed August 2, 1904. A channel 120 feet wide and 16 feet deep at the entrance, and 60 feet wide and 14 feet deep between the piers, resulted from these operations, the increased depth having been secured to allow for shoaling.

The condition of the channel, as shown by the soundings made April 26, 1905, was as follows: Outside there was 12.2 feet on line of north pier, 15.3 feet 50 feet south of that line, and 14.2 feet farther south. Between the piers there was 15 feet for a width of 100 feet next to the north pier at outer end, and thence to Pentwater Lake 13.5 feet in middle of channel.

A small amount of dredging is expected to be done soon, under the contract dated April 29, 1905, to improve the condition of the channel through the outer bar.

The commercial importance of this harbor is not great, and for some years has shown a tendency to diminish. The important harbor of Ludington is only 12 miles north of Pentwater.

The last published map of this locality is found in the Annual Report of the Chief of Engineers for 1884, page 1980.

It is expected to apply the funds on hand to continuing the improvement and to maintenance, contingencies, etc.

Entrances and clearances, etc., for Pentwater Harbor.

Calendar year—	Number.	Tonnage.
1903	1,068	62,324
1904	1,290	406,366

Freight carried, calendar year—	Tons.
1903	22,230
1904	15,423

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July 1, 1904, balance unexpended	$9,983.18
Amount appropriated by river and harbor act approved March 3, 1905	20,000.00
	29,983.18
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	4,867.70
July 1, 1905, balance unexpended	25,115.48
July 1, 1905, outstanding liabilities	30.00
July 1, 1905, balance available	25,085.48
July 1, 1905, amount covered by uncompleted contracts	6,000.00
Amount (estimated) required for completion of existing project	40,100.00

(See Appendix M M 9.)

10. Ludington Harbor, Michigan.—This harbor is the outlet of Pere Marquette River, which expands into Pere Marquette Lake before emptying into Lake Michigan. In 1867, before improvement was begun by the United States, the outlet from Pere Marquette Lake to Lake Michigan had a length of 830 feet, protected by divergent slab piers. The entering depth was 7 to 8 feet.

The present project was adopted in 1867 and modified in 1885, 1889, 1890, and 1899. In its final form, as adopted by the river and harbor act of March 3, 1899, it provides for a through channel 183 to 285 feet wide and 18 feet deep, protected by the requisite piers and revetments. Estimated amount required to complete revised project was $210,000. It can not be said that the modifications of the original project materially changed it in any regard. The development of the harbor has been progressive, the changes in the original project affecting only the length of the piers and their direction and the depth between them. It may therefore be said that the estimated cost of completion of the present project is really the sum of the above amount and that previously expended, or $591,055.91 in all.

To June 30, 1905, the sum of $607,159.20 was expended upon the original project and its subsequent modifications. Of the above, $491,416.22 was expended for construction and $115,742.98 for maintenance. As a result of the above expenditure there now exists a reasonably reliable 18-foot channel, protected by piers and revetments. Occasional dredging is necessary to give the 18-foot channel sufficient width.

The contract for extension of piers and repairs of piers and revetments was not completed on time, and the time limit having been waived, work was still in progress July 1, 1904, and was completed September 3, 1904.

With the completion of this contract there remains an extension of 300 feet to the north pier and 200 feet to the south pier to carry out the provisions of the adopted project.

Soundings made April 20–22, 1905, showed the following available depths: Outside there was 18.2 feet on line of north pier, 19.5 feet opposite the middle of entrance, and 17.7 feet on line of south pier. The channel between the piers had a depth of 20 feet for a width of 120 feet at the outer end, and for a width of 70 to 80 feet, thence to Pere Marquette Lake, except about 300 feet from the east end of the piers, where the width was reduced to 40 feet.

Dredging operations with the U. S. dredge *Gen. Gillespie* were commenced June 14 and continued until June 23, when the

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channel was in a condition to allow of more pressing work at other harbors being undertaken. There was 20,417 cubic yards removed in seven and one-half days actual operations by this dredge.

This harbor is one terminus of the main line of the Pere Marquette Railroad Company, which operates lines of car ferries from this point to Manitowoc, Wis., and Milwaukee, Wis. A line of passenger and package freight steamers owned by the railroad company also makes regular sailings to Milwaukee. The business done by the car-ferry lines is of enormous and constantly increasing importance in its effect upon freight rates to and from the Northwest. The volume of this business has steadily increased. It is desirable to give to the car-ferry service the same assurance of regularity of schedule as exists in the case of the ordinary railroad lines. At present difficulty is usually experienced in the fall and winter months, due to the narrowing of the channel by a shoal from the north. The car ferries are large and unwieldy and require ample sea room. A narrow channel is therefore impracticable, and to insure safety and regularity to the service dredging should be done as late in the fall as is possible with the type of dredge available. With the United States seagoing hydraulic dredge available, there will be practically no time when dredging can not be done.

The Annual Report of the Chief of Engineers for 1897, pages 2951–2953, contains in full the existing approved project, adopted by the river and harbor act of March 3, 1899. This is based upon a report which, with a map, is published in House Document No. 273, Fifty-fourth Congress, second session.

It is expected to apply the funds on hand, and those to be appropriated, to maintenance, contingencies, etc.

Entrances and clearances.

Calendar year—	Number.	Tonnage.
1903	3,440	4,721,211
1904	3,556	5,111,4.7

Freight carried, calendar year—	Tons.
1903	1,362,858
1904	1,631,741

July 1, 1904, balance unexpended		$87,662.32
Amount appropriated by river and harbor act approved March 3, 1905		10,000.00
Deposited December 19, 1904		.42
		97,662.74
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$32,847.60	
For maintenance of improvement	8,539.82	
		[a]41,387.42
July 1, 1905, balance unexpended		56,275.32
July 1, 1905, outstanding liabilities		823.76
July 1, 1905, balance available		55,451.56

(See Appendix M M 10.)

11. Manistee Harbor, Michigan.—In 1866, previous to the beginning of work by the United States, the entrance to this harbor was

[a] Includes $17,869.36 for dredge.

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improved by slab piers 100 feet to 150 feet apart, built by local enterprise, a navigable depth of 7 to 8 feet being thereby maintained.

The present project was adopted in 1867 and amended in 1871, 1873, 1875, 1884, 1890, and 1892, and provides for a channel of navigable width with a depth of 15 feet, extending from Lake Michigan to Manistee Lake, protected by piers and revetments at the entrance. The various modifications of the original project merely extended its limits, changed the proposed length of the piers and the proposed depth from 12 feet to 15 feet. Operations have been progressive, and no work under any of the projects not essential to the project in its final form has been done.

To June 30, 1905, there had been expended $422,810.38, of which $329,950.64 was for construction and $92,859.74 for maintenance.

As a result of the above total expenditure to June 30, 1905, there had been built 2,906 linear feet of north and 1,450 linear feet of south pier and revetment, the width between the piers varying between 150 feet inside and 190 feet at the outer end of the south pier, which is 250 feet shorter than the north pier. The work of extending the south pier 150 feet, under contract dated November 14, 1902, was not completed on time, and the time limit having been waived work was in progress at the close of the last fiscal year, with the expectation of early completion. This contract was completed August 3, 1904. The piers and revetments are in fair condition, but the portion of the north revetment occupied by the Manistee and Northeastern Railroad Company, referred to in the Annual Report for 1899, page 2940, still remains without repairs, and a portion of the south pier 100 feet in length is some twenty-three years old and requires renewal above water. Under contract 14,513 cubic yards was dredged from the channels September 16 to October 4, 1904.

The through channel had at various times been dredged so as to afford the projected depth of 15 feet. This channel, however, requires periodical dredging. The maximum draft which on June 30, 1905, could be carried through the improved channel was 15 feet. Soundings made June 12–15, 1905, showed a mid-channel depth of only 15 feet.

It is expected that dredging this season will be done by the U. S. dredge *Gen. Gillespie* and that the usual channel widths will be restored.

The completion of the existing project requires 100 feet additional extension to the south pier, at an estimated cost of $12,000, and maintenance, being for repairs and dredging, is estimated at $15,000, making a total of $27,000.

The commerce tributary to this harbor is derived principally from the salt and lumber industries. The harbor is also a regular port of call for one line of steamers plying from Chicago to points upon the east shore of Lake Michigan, and a single steamer makes stated trips from Manistee to Milwaukee. There are three railroads running into Manistee, being the Pere Marquette, the Manistee and Grand Rapids, and the Manistee and Northeastern.

The last published map of this locality is found in the Annual Report of the Chief of Engineers for 1890, opposite page 2618.

The funds on hand are to be applied to maintenance.

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Entrances and clearances.

Calendar year—	Number.	Tonnage.
1903	2,199	871,327
1904	1,720	355,811

Freight carried, calendar year—	Tons.
1903	570,361
1904	793,823

July 1, 1904, balance unexpended		$32,280.60
Amount appropriated by river and harbor act approved March 3, 1905		10,000.00
Deposit February 11, 1905		24.87
		42,305.47
June 30, 1905, amount expended during fiscal year:		
For works of improvement	[a]$15,165.21	
For maintenance of improvement	2,925.77	
		18,090.98
July 1, 1905, balance unexpended		24,214.49
July 1, 1905, outstanding liabilities		42.00
July 1, 1905, balance available		24,172.49
Amount (estimated) required for completion of existing project		12,000.00

(See Appendix M M 11.)

12. Harbor of refuge at Portage Lake, Manistee County, Mich.—In 1879, when work was begun by the United States, there was a channel 4 feet deep and 130 feet wide between slab piers built by local enterprise.

The approved project, adopted in 1879 and amended in 1881 and 1890, contemplates the construction of a harbor of refuge, with an entrance from Lake Michigan 356 feet wide and 18 feet deep, protected by piers and revetments. Estimated cost, revised in 1897 and 1899, was $344,300.

The modifications of the original project have in no way changed its scope, so that essentially the project is to-day as when originally adopted. All expenditures made up to the present time have contributed to the completion of the project in its present form.

To June 30, 1905, there had been expended the sum of $364,516.63, of which $254,129.21 was for construction and $110,387.42 for maintenance. The approved project is now completed only as far as pier construction is concerned.

Repairs to 787 feet of pile work of the south pier, under contract entered into April 17, 1903, were completed October 7, 1904, and left the works in good condition.

In addition to the dredging of the channel under contract dated April 23, 1903, that was completed June 20, 1904, it is estimated that there is 100,000 cubic yards that should be removed from between the piers to reduce the high banks, at a cost of $17,500. This estimate, based on ruling prices for contract work, would doubtless be very much reduced if it should be found that the United States dredge can be operated advantageously in as shoal water as is found over and near the banks.

[a] Includes $10,000 for dredge.

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On June 30, 1905, the maximum draft that could be carried from Lake Michigan to Portage Lake was 18 feet.

There is absolutely no local commerce. The harbor of refuge serves to permit vessels engaged in the general lake commerce, if necessary, to approach more closely the east shore of Lake Michigan, which in this vicinity has hitherto been destitute of harbors readily available in foul weather.

The last published map of this locality is found in the Annual Report of the Chief of Engineers for 1884, page 1974.

July 1, 1904, balance unexpended		$31,279.02
June 30, 1905, amount expended during fiscal year:		
For works of improvement	[a] $10,000.00	
For maintenance of improvement	16,295.65	
		26,295.65
July 1, 1905, balance unexpended		4,983.37
July 1, 1905, outstanding liabilities		20.50
July 1, 1905, balance available		4,962.87

(See Appendix M M 12.)

13. Arcadia Harbor, Michigan.—The act of March 3, 1905, appropriated $6,000 for the improvement of this harbor in accordance with report submitted in House Document No. 194, Fifty-eighth Congress, second session.

While a plan was submitted for rebuilding the piers at a cost of $90,390 and annual maintenance and dredging at a cost of $5,200, the plan that was recommended and approved was for maintenance of the present channel by dredging only, at a cost of $3,000 annually for a period of five years, at the end of which time if a growth of the commerce is manifested such as to warrant larger expenditures, the plan for radical improvement by reconstruction of the piers could be undertaken. At the time of the survey, September, 1902, the depth was some 12 feet, in a narrow and rather difficult channel, and this depth would be considerably reduced during the usual lowering of the lake surface in the months of October and April, so that only 10 feet could be safely counted on as the navigable depth. The piers terminate at the 10-foot contour.

The channel was surveyed June 21–23, 1905, and the available depth between the piers was found to be only 9 feet.

Operations for increasing this depth by dredging, under contract, are soon to be commenced and carried forward to the practical exhaustion of the available funds.

The number of tons of various articles shipped and received and the entrances and clearances of vessels during past years are shown by the following table:

[a] For dredge.

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Shipments to and from Arcadia Harbor.

ARTICLES SHIPPED.

Year.	Lumber.	Wood.	Bark.	Machinery, rails, etc.	Cedar posts and ties.	Merchandise.	Total.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
1894	12,415	7,437	1,385	.....	.....	.....	21,237
1895	10,703	4,893	1,926	.....	125	93	17,740
1896	15,801	4,845	2,020	320	.....	38	23,024
1897	12,354	6,144	3,752	.....	300	20	22,570
1898	16,215	3,955	3,532	.....	.....	132	23,834
1899	18,211	5,870	3,738	.....	.....	410	28,229
1900	20,285	5,657	3,047	.....	.....	674	29,643
1901	16,673	4,090	2,678	.....	.....	156	23,597

ARTICLES RECEIVED.

Year.	Machinery, rails, etc.	Stone.	Merchandise.	Hay.	Total.
	Tons.	*Tons.*	*Tons.*	*Tons*	*Tons.*
1894	928	1,590	816	.....	3,334
1895	1,090	1,185	406	.....	2,621
1896	.....	1,100	288	55	1,443
1897	.....	1,840	177	.....	2,017
1898	.....	.....	632	.....	632
1899	.....	.....	657	.....	657
1900	.....	.....	758	.....	758
1901	.....	.....	524	.....	524

ENTRANCES AND CLEARANCES.

Calendar year.	Vessels entered.		Vessels cleared.	
	Number.	Tons.	Number.	Tons.
1894	507	36,356	506	36,120
1895	408	29,146	408	29,146
1896	504	33,223	504	33,223
1897	457	32,646	457	32,646
1898	460	31,993	459	31,757
1899	491	32,517	490	32,287
1900	514	36,796	514	36,796
1901	515	36,353	515	36,353

Amount appropriated by river and harbor act approved March 3, 1905	$6,000.00
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	48.75
July 1, 1905, balance unexpended	5,951.25
July 1, 1905, outstanding liabilities	14.50
July 1, 1905, balance available	5,936.75
July 1, 1905, amount covered by uncompleted contracts	2,700.00

(See Appendix M M 13.)

14. Frankfort Harbor, Michigan.—In 1867, when the United States began work of improvement at this harbor, which is the outlet to Lake Aux Becs Scies, there existed an outlet about 750 feet north of the present channel, affording a depth of 3 to 4 feet and width of 70 to 80 feet between slab piers, built by local enterprise.

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The project, adopted in 1866 and amended in 1868, 1879, and 1892, provided for a new outlet, with channel 12 feet deep and 200 feet wide, protected by piers and revetments. The estimated cost, revised in 1897 in compliance with the river and harbor act of June 3, 1896, to cover the cost of securing channel 18 feet deep, was $413,659.85, further revised in 1899 to $421,938.35. The changes in the original project have been in effect merely extensions, so that the existing project does not differ in kind from the original one. All expenditures may therefore justly be regarded as pertaining to the present project.

To June 30, 1905, there had been expended the sum of $424,278.44, of which $321,459.02 was for construction and $102,819.42 for maintenance. The total expenditure above mentioned has resulted in the creation and maintenance of a channel 18 feet deep, whose natural depth is 12 feet, the width being 200 feet. It is protected by a north pier and revetment 1,900 feet long and a south pier and revetment 1,938 feet long, of which the outer 400 feet was built by the Toledo and Ann Arbor Railroad Company. Annual dredging is required to maintain the depth needed for navigation.

Dredging operations under contract were commenced August 29 and completed September 12, 1904, with the removal of 8,008 cubic yards and the restoration of the channel to fair condition.

Soundings made June 24–27, 1905, showed an available depth of 18 feet. On June 30, 1905, the maximum draft that could be carried through the improved channel was probably the same, or 18 feet.

Dredging with the United States dredge may be done during the present season for the purpose of widening the channel and to provide against some shoaling which takes place from time to time.

Practically the entire commerce of this harbor is transacted by the car-ferry lines of the Ann Arbor Railroad, which has its northern terminus at this harbor. These car ferries run to Kewaunee and Marinette, Wis., upon the west shore of Lake Michigan, and form a highly important link in the through commerce between the Northwest and the Atlantic seaboard. The importance of maintaining adequate facilities at Frankfort Harbor is manifest. This can be done with certainty only by repeated radical dredging. Pier extension unaccompanied by thorough dredging will not serve.

The last published map of this harbor is found in the Annual Report of the Chief of Engineers for 1884, page 1973.

The money on hand will be applied to maintenance.

Entrances and clearances.

Calendar year—	Number.	Tonnage.
1903	1,761	2,024,648
1904	1,892	1,618,088

Freight carried, calendar year—	Tons.
1903	948,887
1904	893,857

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July 1, 1904, balance unexpended		$20,237.45
Amount appropriated by river and harbor act approved March 3, 1905		20,000.00
		40,237.45
June 30, 1905, amount expended during fiscal year:		
For works of improvement	[a] $10,000.00	
For maintenance of improvement	2,077.54	
		12,077.54
July 1, 1905, balance unexpended		28,159.91
July 1, 1905, outstanding liabilities		20.00
July 1, 1905, balance available		28,139.91
Amount (estimated) required for completion of existing project		22,000.00

(See Appendix M M 14.)

15. Charlevoix Harbor and entrance to Pine Lake, Michigan.—In 1868, when the first estimate for improvement was made, the available channel in Pine River, between Lake Michigan and Round Lake, was 75 feet wide and 2 to 6 feet deep. Up to 1873 the local authorities, with some assistance from the State, had constructed 468 feet of crib work in the north pier and 80 feet of crib work in the south pier, and the available depth was 6 feet. The first appropriation by the United States was made in 1876, and actual operations were begun in fiscal year 1878 upon the lower channel; the first appropriation for the upper channel was made in 1882, and actual work begun in 1885. Total estimated cost was $186,000.

The original project was proposed in 1868, and as amended in 1876 and 1882 provided for a 12-foot channel from Lake Michigan to Round Lake between piers and revetments 100 to 150 feet apart, and from Round Lake to Pine Lake between revetments 83 feet apart. The following provision of the river and harbor act of June 13, 1902, may be said to have extended the scope of the original project: "Improving harbor at Charlevoix and entrance to Pine Lake, Michigan: Continuing improvement, twenty thousand dollars, to be first expended in obtaining a uniform depth of channel from Lake Michigan to Pine Lake." The controlling depth of the lower channel in June, 1902, was 16.3 feet, and an emergency contract was made to dredge the upper channel to 17 feet. The material dredged amounted to 30,370 cubic yards and effected the desired deepening.

Soundings made June 29–July 1, 1905, showed the following depths: In the lower channel 16 feet outside opposite the middle of the entrance, and between the piers 16 feet for a width of 80 feet at the outer end and for a width of 40 feet inside. In the upper channel there was a depth of 16 feet for a width of 60 feet.

The maximum draft which on June 30, 1905, could be carried through the channels (lower and upper) may therefore be stated as 16 feet. Dredging by the U. S. dredge *Gen. Gillespie* is expected to be done some time this season so as to restore a uniform depth of at least 17 feet.

The project for this harbor contemplates 200 feet extension of the piers, additional repairs of the piers and revetments, and dredging from time to time, as required. The repairs of the 600 feet of the north revetment of the lower channel and the south revetment of the upper channel are soon to be placed under contract.

[a] For dredge.

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Up to June 30, 1905, the sum of $175,723.29 had been expended upon the existing project and its various modifications. The result was a channel 16 feet deep, whose natural depth is 10 feet, protected in its two divisions by a north pier and revetment 2,064 feet long and a south pier and revetment 2,396 feet long. Of the above total expenditure, $80,205.04 was for construction and $95,518.25 for maintenance.

The only operations during the year were the repairs of the outer end of the south pier and the refilling of this portion of the pier with stone.

The principal traffic tributary to this harbor is furnished by the lumber industry, which has recently been growing greatly in importance. The principal sawmills are situated at Boyne and East Jordan, both at the upper end of Pine Lake, the outlet for which is through both channels. Due to the fact that many of the lumber-carrying vessels do not clear at Charlevoix, the commercial statistics fail to disclose the full traffic, which is, however, known to be considerably over 1,000,000 tons. Charlevoix is also a much-frequented summer resort, and during the summer season two steamboat lines make regular and frequent calls at this harbor. There is in addition a small amount of local traffic. A depth of 17 feet at zero of gauge should be maintained to enable the larger class of vessels to transact their business with economy.

The report upon a survey made with a view to obtaining a 16-foot channel is published in full in the Annual Report of the Chief of Engineers for 1897, pages 2953–2954, and is also printed with a map in House Document No. 144, Fifty-fourth Congress, second session.

Report of the examination authorized by the river and harbor act approved June 13, 1902, has been printed as House Document No. 222, Fifty-eighth Congress, second session.

Entrances and clearances.

Calendar year—	Number.	Tonnage.
1903	646	120,720
1904	854	170,223

Freight carried, calendar year—	Tons.
1903	117,586
1904	113,376

July 1, 1904, balance unexpended	$2,083.05
Amount appropriated by river and harbor act approved March 3, 1905	25,000.00
Deposited March 27, 1905	119.65
	27,202.70
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	[a] 2,306.34
July 1, 1905, balance unexpended	24,896.36
July 1, 1905, outstanding liabilities	56.00
July 1, 1905, balance available	24,840.36
Amount (estimated) required for completion of existing project	19,800.00

(See Appendix M M 15.)

[a] Includes $500 for dredge.

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16. Petoskey Harbor, Michigan.—Before work at this harbor was begun by the United States its landing pier was exposed to winds coming from between west and northwest, and in high gales it was dangerous to attempt a landing.

The present project was adopted in the river and harbor act of August 18, 1894. The approved project provides for constructing a breakwater 600 feet long about 600 feet west of the outer end of the landing pier, and another north of it 500 feet long, or as much longer as may be found necessary to cover the landing from all dangerous seas. Work was begun in 1896. Estimated cost was $170,000.

To June 30, 1905, there had been expended upon this work $60,000.31, of which $57,621.63 was for construction and $2,378.68 for maintenance. Four hundred feet of the west breakwater and 200 feet of the north breakwater have been built of timber cribs resting upon a stone foundation in deep water and upon natural bottom in shallow water. The remaining 200 feet of the west breakwater has been constructed of riprap stone and bowlders of suitable size. The river and harbor act of June 13, 1902, provided as follows: "Improving harbor at Petoskey, Michigan: Continuing improvement and for maintenance, fifteen thousand dollars, and the Secretary of War is hereby authorized to change or modify existing plans: *Provided*, That the total of expenditure shall not exceed the amount estimated to complete under the existing project." Investigation has shown that the north breakwater is too near the wharf and that the entrance is too narrow. A contract has therefore been authorized, after due advertisement, for the removal of the north breakwater and for the extension of the west breakwater, under which operations are in progress that were to have been completed November 1, 1904. Failure to complete on time caused the time limit to be waived, and there is a fair prospect that the work will be completed this season.

The act of March 3, 1905, provided for this harbor as follows: "Continuing improvement and for maintenance, twenty thousand dollars."

Bids for the extension of the west breakwater 100 feet are about to be solicited.

The balance on hand is to be applied to further extension of the breakwater as may be required under the project.

July 1, 1904, balance unexpended	$32,420.22
Amount appropriated by river and harbor act approved March 3, 1905	20,000.00
	52,420.22
June 30, 1905, amount expended during fiscal year, for works of improvement	4,420.53
July 1, 1905, balance unexpended	47,999.69
July 1, 1905, outstanding liabilities	135.00
July 1, 1905, balance available	47,864.69
July 1, 1905, amount covered by uncompleted contracts	25,974.70
Amount (estimated) required for completion of existing project	62,000.00

(See Appendix M M 16.)

IMPROVEMENT OF CERTAIN RIVERS AND HARBORS ON THE EASTERN COAST OF MICHIGAN.

This district was in the charge of Maj. Lansing H. Beach, Corps of Engineers. Division engineer, Col. O. H. Ernst, Corps of Engi-

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neers, until October 25, 1904, and Col. G. J. Lydecker, Corps of Engineers, since that date.

1. Cheboygan Harbor, Michigan.—The present harbor is the result of improvements made at the mouth of Cheboygan River since 1871, when the available depth of water was only 6 feet. The project called for a channel 200 feet wide and 14 feet deep, to be secured largely by revetments and guiding walls, and the estimated cost of the whole work was $395,335. The project was modified in 1880 to increase the navigable depth to 15 feet, this channel to be obtained by dredging, and in 1896 to make it 18 feet, and such depth now exists from deep water in the Straits of Mackinac to a point about 1,300 feet below the upper limits of the harbor. The river and harbor act approved June 13, 1902, again modified the project, which now includes the dredging of an 18-foot channel as far up as the bridge. The Report of the Chief of Engineers for 1896, page 2723, summarizes the history of operations to that date.

The work done since was in 1899 and 1900, when 106,115 cubic yards of sand, clay, and mill refuse was removed, at a cost of 14.7 cents per cubic yard, scow measure, and in 1903, when 27,304 cubic yards was dredged, at a cost of 24 cents per cubic yard, scow measure, and the channel carried forward according to project to within 1,300 feet of the upper limits of the harbor, which distance still remains to be dredged.

The total length of improved channel from deep water in the Straits of Mackinac to the State Road Bridge is 7,900 feet; of this, 5,900 feet is in the Straits of Mackinac.

The total amount expended to June 30, 1905, was $173,846.68.

No work was in progress during the past year.

COMMERCIAL STATISTICS.

Receipts and shipments by vessel.

Calendar year.	Received.	Shipped.	Calendar year.	Received.	Shipped.
	Tons.	*Tons.*		*Tons.*	*Tons.*
1893	155,898	285,189	1899	152,689	362,214
1894	76,554	227,346	1900	44,237	59,536
1895	110,062	216,868	1901	161,771	252,727
1896	163,362	362,011	1902	177,231	262,553
1897	147,255	298,161	1903	33,723	259,224
1898	366,332	394,636	1904	24,815	106,461

July 1, 1904, balance unexpended	[a] $2,305.10
Amount appropriated by river and harbor act approved March 3, 1905	7,500.00
	9,805.10
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	151.78
July 1, 1905, balance unexpended	9,653.32
July 1, 1905, outstanding liabilities	242.90
July 1, 1905, balance available	9,410.42
Amount (estimated) required for completion of existing project	5,000.00

(See Appendix N N 1.)

[a] Erroneously reported last year as $2,311.26.

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2. Alpena Harbor (Thunder Bay River), Michigan.—The original depth at the entrance to Thunder Bay River, which forms the harbor of Alpena, was only 7 feet, but local enterprise had secured a narrow channel 12 feet deep through the bar before work was undertaken by the Government in 1877, when, under the appropriation of the preceding year, a channel 13 feet deep and 200 feet wide was secured in the bay. Shoaling having occurred, the channel was again dredged in 1883, this time to a depth of 14 feet. In 1889 the project was modified so as to propose a channel depth of 16 feet and the extension of the improvement up the river about a mile to the vicinity of the dam across the river at that point, with widths varying as follows: Two hundred feet at the 16-foot contour in Thunder Bay, thence tapering to 100 feet at the light-house crib, thence 100 feet to the Second street drawbridge, thence 75 feet to the Minor Lumber Company's wharf, thence 50 feet to the upstream limit of the channel improvement.

This project was completed in 1893, and under it a channel 2,250 feet long and 100 to 200 feet wide was secured in Thunder Bay, and a channel 4,300 feet in length provided in the river. The channel was redredged in 1899.

No work was necessary at this locality during the past year.

The total amount expended to June 30, 1905, was $49,791.57.

COMMERCIAL STATISTICS.

Receipts and shipments by vessel.

Calendar year.	Received.	Shipped.	Calendar year.	Received.	Shipped.
	Tons.	*Tons.*		*Tons.*	*Tons.*
1893	51,600	308,988	1899	27,888	197,725
1894	102,700	363,291	1900	51,653	263,702
1895	85,957	289,203	1901	62,151	169,442
1896	94,067	255,687	1902	60,213	198,201
1897	78,378	293,161	1903	69,721	153,222
1898	60,300	236,075	1904	51,722	150,381

July 1, 1904, balance unexpended	$1,825.93
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	117.50
July 1, 1905, balance unexpended	1,708.43

(See Appendix N N 2.)

3. Saginaw, Flint, Shiawassee, and Bad rivers, Michigan.—(*a*) *Saginaw River.*—Before improvement the navigable capacity of this stream was limited by the bar at its mouth, where a channel depth of only 8 feet was available, and by many shoal stretches in the river between there and the city of Saginaw, over which still less depth was to be found. Its improvement was commenced in 1867 by dredging a straight cut through the bar at the mouth to a depth of 13 feet. In subsequent years the scope of operations was gradually extended to various shoals higher up, but subject to no general project until 1882, when a comprehensive and connected scheme of improvement covering the river to the city of Saginaw was adopted. It called for a navigable channel 14 feet deep and 200 feet wide from Saginaw Bay to the upper limits of Bay City, about 8 miles above the point of beginning, and thence to the head of navigation, some 16 miles farther

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up, a channel of the same width, but only 12 feet deep. The estimated cost of this project was $446,000, which, added to the estimated cost of the several preceding projects ($294,378), gives $740,378 as the estimate of cost for the whole improvement. These estimates concerned the question of original cost only, and took no note of maintenance, which, in a stream of this character, is a matter of great and constant expense, and in the absence of appropriations specifically applicable thereto must be an annual tax of no small magnitude on the successive appropriations for construction. The sum total of appropriations that will have to be made before the work can be completed must therefore largely exceed the original estimates for construction only.

The total expenditure to June 30, 1905, was $809,375.46, and the result has been to obtain only a narrow through channel, which has little permanence, and almost constant dredging is needed to maintain it. This has been the case especially as respects the section of river from Bay City to Saginaw and in a somewhat less degree through the bar at the river's mouth in Saginaw Bay. In order to restore and maintain the channel as required in the interests of navigation, the work of dredging should be constant, as a depth of 12 and 14 feet, respectively, and a minimum width of 150 or 200 feet can only be preserved by dredging the bars which are liable to be formed by each freshet.

No work was in progress during the past fiscal year.

COMMERCIAL STATISTICS.

Receipts and shipments by vessel.

Calendar year.	Received.	Shipped.	Calendar year.	Received.	Shipped.
	Tons.	*Tons.*		*Tons.*	*Tons.*
1893	651,163	1,069,298	1899	728,629	311,547
1894		1,108,307	1900	482,253	402,827
1895	391,751	347,146	1901	1,250,292	694,741
1896	471,106	240,496	1902	1,012,620	106,409
1897	995,980	354,860	1903	359,779	17,999
1898	1,126,891	364,561	1904	264,086	13,010

(*b*) *Flint, Shiawassee, and Bad rivers.*—The river and harbor act of June 13, 1902, provided that not to exceed $12,500 might be expended, in the discretion of the Secretary of War, in dredging these streams up as far as St. Charles, in accordance with plan published in House Document No. 135, Fifty-fifth Congress, second session, and in the Annual Report of the Chief of Engineers for 1898, page 2600. The estimated cost of the work, as stated in that document, is $20,000.

There were no operations during the past year, the conditions not warranting any, and Congress, by act approved March 3, 1905, diverted the unexpended balances of sums theretofore appropriated for the improvement of these rivers and made them available for the improvement of the Saginaw River.

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July 1, 1904, balance unexpended	$31,114.88
Amount appropriated by river and harbor act approved March 3, 1905	30,000.00
	61,114.88
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	2,738.50
July 1, 1905, balance unexpended	58,376.38
July 1, 1905, outstanding liabilities	5.00
July 1, 1905, balance available	58,371.38

(See Appendix N N 3.)

4. Sebewaing River, Michigan.—The original channel from Saginaw Bay to the mouth of Sebewaing River had an available depth of scant 4 feet. The first improvement was made in 1875, by which an entrance depth of 6 feet was provided through a narrow channel, at a cost of $8,000, and this depth was increased to 7 feet in 1880–81, at a further cost of $7,000. The river and harbor act of June 3, 1896, appropriated $5,000 for further operations, in accordance with a plan of improvement submitted in report of November 30, 1895 (printed as H. Doc. No. 71, 54th Cong., 1st sess., and also in the Annual Report of the Chief of Engineers for 1896, p. 2743), which provides for extending the channel to the 8-foot contour in Saginaw Bay, a distance of about 15,000 feet from the river's mouth, and increasing its width and depth to 100 feet and 8 feet, respectively. The estimated cost was $37,000.

No work was done up to June 30, 1899, as sufficient funds were not supplied for commencing it until the appropriation contained in the river and harbor act of March 3, 1899, became available. Contract was made in 1899 to do the work, which was finished, as far as available funds permitted, September 9, 1903.

The total expenditure to June 30, 1905, was $36,616.56.

No work was in progress during the past year.

COMMERCIAL STATISTICS.

Receipts and shipments by vessel.

Calendar year.	Received.	Shipped.	Calendar year.	Received.	Shipped.
	Tons.	*Tons.*		*Tons.*	*Tons.*
1896	43,700	123,274	1901	17,625	77,998
1897	50,481	139,987	1902	33,500	44,750
1898	14,820	151,085	1903	14,405	29,910
1899	13,088	127,450	1904	14,770	30,500
1900	24,200	118,225			

July 1, 1904, balance unexpended	$538.78
Amount appropriated by river and harbor act approved March 3, 1905	5,000.00
	5,538.78
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	155.34
July 1, 1905, balance unexpended	5,383.44

(See Appendix N N 4.)

5. Harbor of refuge at Harbor Beach, Lake Huron, Michigan.—This place was formerly known as Sandbeach. The site for this

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harbor, selected in 1872 after careful consideration, is on the west shore of Lake Huron, 60 miles north of its outlet into the St. Clair River, and the artificial harbor built there since then is the only safe refuge on that coast from the foot of the lake to Tawas Bay, 115 miles above. The work of construction was commenced in 1873 under a project providing for three sections of breakwater made of stone-filled cribwork, so located as to shelter a water area of some 650 acres, and for deepening this area by dredging where necessary. The estimated cost was $1,442,500. The sheltering breakwaters, with a total length of 8,132 feet, were completed in 1885, at a cost of about $975,000, and since that time expenditures have been applied to keeping them in repair, dredging, regulating and controlling the berthing of vessels entering the harbor for refuge, engineering supervision, and general office expenses.

The total expenditure to June 30, 1905, was $1,347,021.45.

The expenditures during the past year were applied to making some temporary repairs to the superstructure of the main pier where not covered by the contract in progress, custody of the harbor, control of vessels, office expenses, some experimental dredging within the harbor, and to rebuilding in concrete the superstructure of the main pier, beginning at the north gap. This work, which was commenced in June, 1904, under contract, progressed very slowly during the summer and fall of 1904, owing to adverse weather conditions, but the contractors, who began operations early in the spring of 1905, have made very favorable progress since then.

The number of vessels that entered the harbor during the past fiscal year was 1,041, with a total tonnage of 761,606. The grand total of vessels that have found shelter there from 1877 to 1904, inclusive, is 33,412, the tonnage of which aggregated 13,693,711. The vessels sheltered in 1877 averaged 289 tons each, and those during the year 1904, 736 tons.

July 1, 1904, balance unexpended	$269,774.66
Amount appropriated by river and harbor act approved March 3, 1905	200,000.00
	469,774.66
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	52,949.90
July 1, 1905, balance unexpended	416,824.76
July 1, 1905, outstanding liabilities	21,997.40
July 1, 1905, balance available	394,827.36
July 1, 1905, amount covered by uncompleted contracts	153,410.69

(See Appendix N N 5.)

6. Mouth of Black River, Rouge River, and Monroe Harbor, Michigan.—(*a*) *Mouth of Black River.*—An extensive shoal and a bar formerly existed in the St. Clair River, adjoining the mouth of the Black River. The bar lay close to the American side and obstructed approach to the Port Huron docks, while the shoal, forming a "middle ground" nearly 50 acres in extent, crowded the main channel in a sharp curve close to the Canadian shore. In 1871 a project was adopted for dredging the bar and middle ground to a uniform depth of 15 feet. Work was commenced in 1872 and completed in 1878. The whole area was redredged between 1889 and 1892 and again in 1897 to a depth of 16 feet.

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The total expenditure to June 30, 1905, was $93,886.14.

No work was in progress during the past fiscal year. The shoal will reform gradually, and as vessels of moderate draft habitually pass over this area instead of through the main channel, followed by those of deep draft, the maintenance of the improvement is highly desirable. Funds now in hand are sufficient for this purpose for the coming year.

(*b*) *Rouge River.*—This stream originally had a channel depth of from 10 to 17 feet from its mouth to the point at which the Wabash Railroad bridge crosses it, a distance of about 3 miles. During the years 1888 to 1892, inclusive, this part was improved by the Government so as to provide a minimum depth of 16 feet in a central channel 240 feet wide for a distance of 800 feet above the mouth, and thence 100 feet wide to the Wabash bridge. The cost of this improvement, originally estimated, was $31,690.39. The total expenditure to June 30, 1904, was $51,490.28, the result obtained being a 16-foot channel, as called for by the approved project, and its maintenance since 1892 to such extent as was necessary to meet the requirements of local commerce, but a gradual shoaling had taken place in the meantime, such as to limit navigation to vessels drawing 13 feet or less. Congress, by joint resolution approved April 11, 1898, authorized an extension of the improvement up to the Maples road, a distance of about 1½ miles above the Wabash Railroad bridge, limiting the expenditure for that purpose to $5,000.

The river was dredged in 1900, but the amount of money available was not sufficient to give the full channel width contemplated by the project for the entire distance. Between the Wabash Railroad bridge and Maples road the channel was dredged 50 feet wide. The Rouge is practically without current, except in rainy weather, and the channel will require constant dredging for maintenance.

The total expenditure to June 30, 1905, was $51,507.28.

No work was in progress during the past year.

COMMERCIAL STATISTICS.

Receipts and shipments by vessel, Rouge River.

Calendar year.	Received.	Shipped.	Calendar year.	Received.	Shipped.
	Tons.	*Tons.*		*Tons.*	*Tons.*
1893	73,732		1899	92,631	768
1894	47,106		1900	119,712	4,600
1895	113,066	1,024	1901	105,533	782
1896	120,590	2,905	1902	56,701	10,000
1897	115,987	9,396	1903	125,272	10,000
1898	117,486	10,259	1904	242,361	6,898

(*c*) *Monroe Harbor.*—The harbor of Monroe, Mich., is within the mouth of the Raisin River, at the western extremity of Lake Erie. In its natural condition the river flowed into the lake through several ponds and winding creeks. The depth of water at the deepest mouth of the river in its natural condition did not exceed 5 feet.

The project for the improvement of this harbor was adopted in 1834, and was practically completed in 1845. It had for its object to dredge a new and direct channel 100 feet wide and 10 feet deep from the lake across the marsh, a distance of 4,000 feet, to the portion of the

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river ordinarily used as a harbor. The sides of the canal were protected by a revetment, and the entrance to the lake was protected by piers extending outward to a depth of 10 feet in the lake.

Subsequently the city of Monroe further improved the river channel by cutting a canal 1,400 feet long across a bend of the river.

The total expenditure to June 30, 1905, was $251,866.86.

An inspection made June 24, 1902, indicates that the depth in the lake has generally been maintained, and there is no special indication of a fill to be found there. Within the jetties, while the depth has generally been maintained, the width of the channel is somewhat reduced. The piers are in need of repairs.

From its size and depth of channel this harbor can not accommodate the larger class of vessels used upon the lake, and its commerce is not large. It is mainly used by excursion boats bringing passengers during the summer months.

No work was in progress during the past year.

July 1, 1904, balance unexpended	$5,986.49
Amount appropriated by river and harbor act approved March 3, 1905	13,000.00
	18,986.49
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	41.50
July 1, 1905, balance unexpended	18,944.99
July 1, 1905, outstanding liabilities	150.30
July 1, 1905, balance available	18,794.69

(See Appendix N N 6.)

7. Black River at Port Huron, Mich.—The improvement of this stream was inaugurated by the river and harbor act of September 19, 1890, under a project which contemplated dredging it to a navigable depth of 16 feet from its mouth to the Grand Trunk Railway bridge, at an estimated cost of $75,000, and the act of July 13, 1892, directed that the improvement be extended 1,400 feet farther upstream, to Washington avenue. Operations were commenced in 1891 and continued until the summer of 1893, when the required 16-foot channel had been dredged throughout the designated limits to a width varying between 160 feet near the mouth and 50 or 75 feet in the contracted river sections above. The total length of channel so dredged was 9,700 feet. Before improvement the minimum channel depth was between 8 and 10 feet for about 1 mile from the mouth of the river, but only 6 to 8 feet from there up to Washington avenue. The narrow upstream section and some shoal spots in the wider section below were redredged in 1897.

The total expenditure to June 30, 1905, was $46,872.90.

Experience and observation show that the narrow dredged channels in the upper limits of the improvement can have no considerable degree of permanence, although the canal to be cut by the city of Port Huron from Lake Huron to the Black River, in the upper part of the town, for the purpose of flushing the stream should, if it has any effect, retard the deterioration somewhat.

Dredging is necessary for maintaining this improvement.

No work was in progress during the past fiscal year.

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COMMERCIAL STATISTICS.

Receipts and shipments by vessel.

Calendar year.	Received.	Shipped.	Calendar year.	Received.	Shipped.
	Tons.	*Tons.*		*Tons.*	*Tons.*
1893	175,081	7,487	1899	130,675	37,368
1894	116,535	4,413	1900	105,981	181
1895	104,850	6,825	1901	120,018	100
1896	186,987	2,569	1902	123,677	2,600
1897	96,925	1,455	1903	163,265	.....
1898	151,606	16,595	1904	197,044	.....

July 1, 1904, balance unexpended	$127.10
July 1, 1905, balance unexpended	127.10
Amount (estimated) required for completion of existing project	28,000.00

(See Appendix N N 7.)

8. Pine River, Michigan.—The $5,000 appropriated for this river in 1875 was applied in dredging a channel 12 feet deep for a distance of 4,000 feet from the mouth of the river. This channel gradually shoaled.

The present project, adopted in 1895, provided for a channel 100 feet wide and 14 feet deep for a distance of 2,500 feet from the mouth of the river, thence 75 feet wide and 12 feet deep to Belknap's brickyard, a total distance of 5,800 feet. The estimated cost was $10,560. This project was completed under two contracts, one in 1896, the other in 1899, all dredging being in Pine River.

The amount expended on this project to June 30, 1905, was $9,374.79.

No work was in progress during the past year.

COMMERCIAL STATISTICS.

Receipts and shipments by vessel.

Calendar year.	Received.	Shipped.	Calendar year.	Received.	Shipped.
	Tons.	*Tons.*		*Tons.*	*Tons.*
1898	100,608	1,150	1902	767	4,842
1899	734,725	7,080	1903	6,598	4,929
1900	370	5,173	1904	6,064	4,297
1901	237	2,145			

July 1, 1904, balance unexpended	$1,335.41
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	150.20
July 1, 1905, balance unexpended	1,185.21

(See Appendix N N 8.)

9. Belle River, Michigan.—The original project for this river, adopted in 1880, contemplated the formation of an ice harbor of refuge by dredging a channel 50 feet wide with depths of 13 feet and 12 feet. This work was completed between 1881 and 1885.

This channel having shoaled, the present project was adopted in 1895. It provides for a channel 75 feet wide, 15 feet deep from the

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St. Clair River to the Bridge Street Bridge, and 14 feet from that point to the Broadway Bridge, a total distance of 5,400 feet. The estimated cost was $21,340. This work was accomplished in two contracts from 1896 to 1899, all dredging being in Belle River.

The principal use of the improvement is as an ice harbor of refuge.

No work was in progress during the past year. The whole amount expended on the project to June 30, 1905, was $11,090.46.

COMMERCIAL STATISTICS.

Receipts and shipments by vessel.

Calendar year.	Received.	Shipped.	Calendar year.	Received.	Shipped.
	Tons.	*Tons.*		*Tons.*	*Tons.*
1897	11,396		1901	15,616	2,928
1898	10,044	3,550	1902	12,499	1,736
1899	5,573	878	1903	15,604	1,408
1900	23,371	4,548	1904	5,777	846

July 1, 1904, balance unexpended	$4,059.54
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	150.00
July 1, 1905, balance unexpended	3,909.54

(See Appendix N N 9.)

10. Clinton River, Michigan.—This stream empties into Anchor Bay, in the northwesterly part of Lake St. Clair, and before improvement had a channel depth of about 10 feet, except at several shoals, over which but 5 or 6 feet could be carried, and a broad flat at the mouth with a general depth of from 3 to 4 feet. In 1870–71 a channel 9 feet deep, 60 feet wide, and 2,700 feet long was dredged through this flat, but being left without works of protection, it soon filled up again. In 1885 a project of general improvement was adopted, which provided for a through channel 8 feet deep to Mount Clemens (8 miles upstream), for a pile dike extending across the flat at the mouth to the curve of 10 feet depth in the bay, and for revetments as needed above. The estimated cost, as modified in 1889, was $34,564.

The total expenditure to June 30, 1905, was $72,720.69, of which $25,500 was applied to occasional and scattering work done before the adoption of the general project of 1885, leaving $47,220.69 as the amount applied to the latter.

The river and harbor act of June 13, 1902, authorized the Secretary of War, in his discretion, to use any sum theretofore appropriated and not expended in extending the channel up to the entrance of the old Clinton and Kalamazoo Canal.

The character of the stream and engineering conditions are stated in the Annual Report of the Chief of Engineers for 1896, page 2736. It is not possible to make the improvement permament without an expenditure disproportionate to the commerce of the river, and its maintenanee can best be accomplished by periodical dredging, as has been done in the past.

No work was in progress during the past fiscal year.

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COMMERCIAL STATISTICS.

Receipts and shipments by vessel.

Calendar year.	Received.	Shipped	Calendar year.	Received.	Shipped.
	Tons.	*Tons.*		*Tons.*	*Tons.*
1896	30,749	410	1901	36,925	.....
1897	29,077	.....	1902	33,968	.....
1898	29,085	.....	1903	28,411	.....
1899	35,525	.....	1904	22,878	257
1900	32,410	282			

July 1, 1904, balance unexpended	$2,502.34
Amount appropriated by river and harbor act approved March 3, 1905	3,000.00
	5,502.34
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	159.03
July 1, 1905, balance unexpended	5,343.31

(See Appendix N N 10.)

11. Removing sunken vessels or craft obstructing or endangering navigation.—The sum of $400 has been allotted for removal of the wreck of the scow *Ellen* from Saginaw River at Saginaw, Mich., but no work has been done as the wreck in its present position does not obstruct general navigation. The funds allotted will be reserved for expenditure in case removal of the wreck is made necessary by a change in its position.

IMPROVEMENT OF WATERS CONNECTING THE GREAT LAKES.

This district was in the charge of Lieut. Col. Chas. E. L. B. Davis, Corps of Engineers, having under his immediate orders First Lieut. Lewis H. Rand, Corps of Engineers, until July 28, 1904. Division engineer, Col. O. H. Ernst, Corps of Engineers, until October 25, 1904, and Col. G. J. Lydecker, Corps of Engineers, since that date.

1. Ship channel connecting waters of the Great Lakes between Chicago, Duluth, and Buffalo.—Before the Government commenced the improvement of this water route, navigation through the natural channels of the rivers by boats drawing about 8 feet of water was difficult and dangerous. Twelve feet draft was available after dredging the middle channel through Lake George in 1858. The freight was largely carried by sailing vessels, and these and the few steamboats were limited in size to less than the dimensions of the State locks at the Sault, which were 350 feet long and 70 feet wide, with 12 feet depth of water on the sills. Improvements were resumed by the Government in 1870, and the total commerce passing the canal that year was less than 540,000 tons, or less than one fifty-eighth of that of 1904. The completion of the Weitzel lock in 1881 and the simultaneous deepening of the Lake George channel permitted an increased draft to 16 feet at mean stage of water.

Prior to 1892 the improvement of this waterway was limited to individual places and local work, explained elsewhere under the heads of St. Marys River, Hay Lake, Lake St. Clair, St. Clair River, and Detroit River.

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The present project was adopted by the river and harbor act of July 13, 1892, the object being to provide a navigable depth of 20 feet by excavating channels to a minimum width of 300 feet through the shoal places in the specified waters, at an estimated cost of $3,340,000, the scope of improvement being limited to shoals not specially provided for by the then existing appropriations.

Under approval of the War Department, dated October 20, 1892, operations were commenced in the spring of 1893, and by 1897 channels of the prescribed depth of 20 feet, with widths of 300 feet or more, had been excavated through all the shoal areas originally specified in the project. Since 1898 the work has consisted in increasing the width and depth of channels at angles, exposed places, and other critical points, and in removing many isolated shoals of comparatively small area that have been found to interfere with the safe navigation of the channel by the larger boats now in commission.

The project contemplated a depth of 20 feet below the mean water surfaces as determined by gauge readings up to the time of the project, viz, 601.5 for Lake Superior, 584.2 for St. Marys River at foot of Sault locks, 581.1 for Lake Huron, 575.5 for Lake St. Clair, and 572.6 for Lake Erie, referenced in feet above mean tide at New York. The daily variations in the water surface, usually very small in calm weather, may reach 2 feet in variable weather, or even 6 to 8 feet in severe storms on lakes Superior and Erie. The changes in the monthly mean elevations of water surface may amount to from one-half foot to 2 feet in a single year, or as much as 4 feet in forty years, such changes being due to variations in annual precipitation, evaporation, and other causes. Since 1892 the prevailing water levels of lakes Huron, St. Clair, and Erie have been almost continuously below the above-named elevations, and in consequence the actual draft available has been 17 to 19 feet. References for extended information are given in Annual Report of Chief of Engineers for 1904, page 582.

The total expenditure on the improvement to June 30, 1905, was $3,237,702.78.

The present commerce is about fifty-eight times that of 1870, twenty-four times that of 1880, and three and one-half times that of 1890.

Operations during the past fiscal year resulted in the removal of shoals at foot of Lake Huron, in the St. Clair River at the mouth of Black River, lower approach to the St. Clair Flats Canal, and the partial removal of shoals in Grossepoint cut, Lake St. Clair; the total amount dredged from these localities being 115,230 cubic yards. Over the improved portion of this channel there is now a least depth of 20 feet at stage of 581.1 feet above mean tide at New York.

In St. Marys River the widening of angle at Sailors Encampment, an additional 200 feet, with depth of 21 feet at a stage of 578.9 feet above mean tide at New York, was completed in July.

The unexpended balance of previous appropriations will suffice for all work required to complete improvements contemplated by the present approved project.

The amount of freight carried through the St. Marys River section of this channel during the navigation season of 1904 was 31,546,106 tons, valued at $334,502,686. Statistics of traffic through Detroit River indicate that 42,792,326 tons of freight passed during the season.

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July 1, 1904, balance unexpended	$154,242.31
June 30, 1905, amount expended during fiscal year, for works of improvement	51,945.09
July 1, 1905, balance unexpended	102,297.22
July 1, 1905, outstanding liabilities	8,500.00
July 1, 1905, balance available	93,797.22
July 1, 1905, amount covered by uncompleted contracts	10,780.00

(See Appendix O O 1.)

2. St. Marys River at the falls, Michigan.—Commercial navigation of the falls, or rapids, of this river at Sault Ste. Marie was impracticable until 1855, when the State of Michigan constructed a canal which provided a navigable channel for vessels whose draft did not exceed 11.5 feet (12 feet in 1870) at mean stage of water, at a cost of about $1,000,000, the proceeds of 750,000 acres of land granted by the United States Congress. This improvement was completed in 1855, the double-lift lock having tandem chambers 350 feet long and 70 feet wide, with gate openings of 70 feet arranged for 9 feet average lift at each lock, and the canal being about 5,400 feet long, with an available width of 64 feet and a top width of 100 feet. The commerce in 1870 was about 540,000 tons per year.

In 1870 the United States entered upon a project for increasing the canal to at least 100 feet width, replacing the stone slope walls with timber revetment piers, building a new lock, and providing for 16 feet draft. The new lock (now known as the Weitzel lock) was opened to traffic in 1881, its single chamber being 515 feet long and 80 feet wide, narrowed at gate openings to 60 feet, and arranged for 18 feet average lift. The cost of the work from 1856 to 1885, inclusive, was $2,875,692, including $10,000 diverted from the 1864 Great Lakes appropriation. A rapidly increasing commerce developed as a result of these improvements.

The project presented in reports dated October 18 and December 22, 1886, provided for building, on the site of the old State locks, a new lock with single lift of 16 to 21 feet, the chamber being 800 feet long by 100 feet wide, with 21 feet of water at mean stage on the miter sills; also, for deepening the canal and its approaches, all at an estimated cost of $4,738,865. By authority of river and harbor act of August 5, 1886, work under this project was begun under War Department approval dated October 28, 1886, and the essential features of the project were so far completed in 1896 as to permit the new lock to be opened to navigation August 3 of that year; this lock has since been known as the Poe lock. Later work has consisted in completing the deepening of the canal and its approaches, rebuilding and extending canal piers, grading and improving canal grounds, etc.

The river and harbor act of June 13, 1902, authorized the following diversions from existing funds, namely, $20,000 for special improvement at Sailors Encampment, $20,000 for salaries and expenses of a special international Commission, and $85,000, estimated as the amount required to complete certain improvements at St. Clair Flats Canal, for which existing funds were insufficient. The act also provided for extending the work at the falls so as to include

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widening and further improvement of the canal above the locks in accordance with the project submitted in House Document No. 128, Fifty-sixth Congress, second session, but made no additional appropriation therefor.

The river and harbor act approved March 3, 1905, appropriated $420,000, and authorized work to the extent of $600,000 more, for the prosecution of the project. This project, as presented in preliminary survey report of June 4, 1900 (Annual Report of the Chief of Engineers for 1901, p. 3200), and modified by final survey report of December 3, 1904 (printed herewith in Appendix O O 9), contemplates widening the upper entrance of canal, the building of a new lock, and the purchase of additional lands needed, all at an estimated cost of $4,410,000, but has been adopted by Congress only in so far as concerns the widening and improvement of the canal above the locks.

Of this amount $1,020,000 has been authorized, leaving $3,390,000 still to be provided. This latter amount includes the estimate for the new lock, which will be urgently needed by the time the canal widening already provided for can be completed, but which has not yet been authorized by Congress.

Commerce is now about fifty-eight times that of 1870 and three and one-half times that of 1890.

The water surface, usually changing slowly, may have an extreme range of 6 feet during a severe storm, and the monthly mean elevation of water surface may change as much as 2 feet in one year or 4 feet during forty years.

During the past fiscal year work on project for widening the canal above the locks to provide a channel 108 feet wide between the central pier and the north abutment of the railway swing bridge was continued. The cofferdam surrounding a part of the site of the canal widening was built up higher after settlement. A tape comparator was constructed and further studies were made for movable dams and new lock, with estimates of cost.

The purchase of lands fronting on the river, extending from the Weitzel lock to the old Fort Brady Reservation and needed for canal purposes, was continued, and five lots, containing a total of about 2.15 acres, were acquired, and title papers for remainder of land are in course of preparation.

The total expenditures to June 30, 1905, are $4,354,066.55, leaving $829,798.45 still available.

The commerce passing the falls during the navigation season of 1904, a period of seven months and twenty-seven days, comprised 31,546,106 tons of freight, valued at $334,502,686. The number of passengers reported during the same period was 37,695.

More detailed information may be found in Annual Report of the Chief of Engineers for 1886, pages 1792–1808.

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July 1, 1904, balance unexpended	$544,892.48
Amount appropriated by river and harbor act approved March 3, 1905	420,000.00
	964,892.48
June 30, 1905, amount expended during fiscal year, for works of improvement	[a]135,094.03
July 1, 1905, balance unexpended	829,798.45
July 1, 1905, outstanding liabilities and diversions under act of June 13, 1902	106,429.11
July 1, 1905, balance available	723,369.34
July 1, 1905, amount covered by uncompleted contracts	778.50
Amount (estimated) required for completion of existing project	600,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	600,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix O O 2.)

3. Operating and care of St. Marys Falls Canal, Michigan.—This service is provided for by the permanent indefinite appropriation for operating and care of canals and other works of navigation, under the provisions of section 4 of the river and harbor act of July 5, 1884.

The former conditions and results of improvement are the same as above stated for St. Marys River at the falls.

During the fiscal year ending June 30, 1905, the United States canal was open to navigation 244 days, the closed season being from December 14, 1904, to April 13, 1905, inclusive. A total of 15,195 vessels, aggregating 27,272,017 registered tons, and carrying 34,385,090 tons of freight and 22,931 passengers, passed through the locks in 9,121 lockages. The Canadian canal at Sault Ste. Marie, Ontario, open 261 days, passed 5,040 vessels in 3,671 lockages, carrying 6,705,304 tons of freight and 19,286 passengers; making the combined traffic through the two canals 41,090,394 tons of freight and 42,217 passengers.

The principal items of freight during the past fiscal year through both canals were: Iron ore, 28,062,784 tons; coal, 7,154,004 tons; flour, 5,350,007 barrels; wheat, 49,445,196 bushels; other grain, 36,097,239 bushels; lumber, 1,004,205 M. feet B. M., and general merchandise, 839,770 tons.

Other statistics in relation to this traffic and commerce are summarized in the following statements:

Summary of traffic through St. Marys Falls Canal, Michigan, for the fiscal year ending June 30, 1905.

Number of vessels through Weitzel lock	6,224
Number of vessels through Poe lock	8,971
Number of lockages through Weitzel lock	4,245
Number of lockages through Poe lock	4,876
Total registered tonnage	27,272,017
Total freight tonnage	34,385,090
Total time spent in making lockages	4,539 hrs. 17 min.

[a] Includes payments by Treasury Department account of—

Michigan Central Railroad Company	$12.52
Duluth, South Shore and Atlantic Railroad Company	6.26
Total	18.78

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Average time spent in making a lockage	29 min. 52 sec.
Total time spent by vessels in passing locks	7,420 hrs. 12 min.
Average time spent by vessels in passing locks	29 min. 18 sec.
Cost per lockage	$9.35
Cost per passage	$5.61
Cost per registered ton—mills	3.13
Cost per freight ton—do	2.48

The Weitzel lock was open to navigation 227 days, from July 1 to December 5, 1904, and from April 23, 1905, to June 30, 1905.

The time for the Poe lock was 244 days, July 1 to December 13, 1904, and from April 14, 1905, to June 30, 1905.

Summary of St. Marys River commerce, via American and Canadian canals, during the calendar season of 1904, viz, from April 30 to December 26, 1904, a period of 241 days.

Total mile-tons	26,608,815,636
Total freight carried—tons	31,546,106
Total valuation placed on freight carried	$334,502,686
Average value per ton of freight carried	$10.60
Total amount paid for freight transportation	$21,552,894.30
Average distance freight was carried—miles	843.5
Cost per mile per ton—mills	0.81
Average cost per ton for freight transportation	$0.68
Total number of registered vessels using canals	886
Total number of passages by unregistered crafts carrying freight	513
Time American canal was operated—days	223
Time Canadian canal was operated—do	241
Total valuation placed on registered vessels	$69,166,400
Total number of passengers transported	37,695
Freight carried by—	
Registered vessels—tons	31,489,497
Unregistered vessels—do	56,609
American vessels—per cent	94
Canadian vessels—do	6
Passengers carried by—	
American vessels—do	37
Canadian vessels—do	63

This service is provided for from the permanent indefinite appropriation for operating and care of canals and other works of navigation under section 4 of the river and harbor act of July 5, 1884. The total expenditure on this account from 1881, when the Weitzel lock was first put in service, to June 30, 1905 (excluding $7,034.25 outstanding liabilities), amounts to $1,311,804.71, of which $78,212.10 related to operations during the past fiscal year. The growth of freight traffic during the same period is shown by the following tabular statement:

Freight traffic of calendar years or navigation seasons.

	Tons.		Tons.
1881	1,567,741	1893	10,796,572
1882	2,029,521	1894	13,195,860
1883	2,267,105	1895	15,062,580
1884	2,874,557	1896	16,239,061
1885	3,256,628	1897	18,982,755
1886	4,527,759	1898	21,234,664
1887	5,494,649	1899	25,255,810
1888	6,411,423	1900	25,643,073
1889	7,516,022	1901	28,403,065
1890	9,041,213	1902	35,961,146
1891	8,888,759	1903	34,674,437
1892	11,214,333	1904	31,546,106

(See Appendix O O 3.)

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4. Hay Lake and Neebish channels, St. Marys River, Michigan.—The original conditions of this waterway were about the same as already explained for the ship channel and St. Marys River at the falls.

On account of rapids and shoals that intervened between the navigable channel of the river and the lake at its head and foot this channel was not navigable for commercial purposes before improvement.

The original project of improvement of 1882 contemplated the excavation of channels 17 feet deep and 300 feet wide through all obstructed portions of the Hay Lake route by way of the Middle Neebish, but this project was modified in 1886 to provide a depth of 20 feet and to widen at angles and other critical places, at a total estimated cost of $2,659,115, and the modified project was adopted by river and harbor act of August 5, 1886. The work of improvement was commenced in 1883, under War Department approval of October 27, 1882, and by 1894 work had so far progressed that the route was opened to commerce June 7 of that year, though full width and depth of channel had not been obtained, and since that time several shoals in the deep-water section of the lake have been removed and the dredged channels have been widened at critical places.

The river and harbor act of June 13, 1902, appropriated $500,000 and authorized work up to $4,000,000 more for improving Middle and West Neebish channels to provide for the commencement and prosecution of the project outlined in the preliminary report of June 4, 1900 (Annual Report of the Chief of Engineers for 1901, p. 3200), and the river and harbor act of March 3, 1905, appropriated $500,000 and authorized work up to $750,000 more for improving Hay Lake and Neebish channels, for continuing this improvement. The final report of the survey, dated December 3, 1904, is printed herewith in Appendix O O 9.

The part of the project outlined in the above-named reports relative to the river below the canal which has been covered by these two acts is to provide a channel 1,000 feet wide from the Sault locks to the upper entrance to Hay Lake; to widen and deepen the upper entrance channel into Hay Lake so as to give a least width of 600 feet, with clear depth of 21 feet at low water; to excavate a new channel having least width of 300 feet and low-water depth of 21 feet between Hay Lake and Mud Lake by way of the West Neebish; and to deepen the Middle Neebish channel to give depth of 21 feet at low water, leaving its width unchanged. The effect of the execution of this project will be to provide a clear navigable depth of 21 feet from St. Marys Falls Canal to Lake Huron, the least width being 300 feet where two channels are provided, one for upbound and one for down-bound boats, and 600 feet at all other places.

The sundry civil act of March 3, 1903, appropriated $800.000, and that of March 3, 1905, appropriated $1,200,000 more for this same project under head of Middle and West Neebish channels. The total amount expended to June 30, 1905, on the Hay Lake and Neebish projects combined was $3,512,686.96.

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The upper entrance channel to Hay Lake is now 600 to 1,100 feet wide, and the dredging to depth of 21 feet at minimum low water has been completed for 4 miles, about four-fifths the total distance. The 5-mile reach of natural deep water in Hay Lake has a width of 3,000 feet. The lower entrance channel through the Middle Neebish rapids has a width of 300 feet for a distance of 5 miles and a depth of 20 feet mean stage of water.

For the 8 miles through Little Mud Lake and past Sailors Encampment into Mud Lake the channel is 300 feet wide for 2½ miles, and upward of 600 feet for remainder of distance has been dredged to a depth of 21 feet at mean stage of water. This channel is provided with range lights and gas buoys as aids to night navigation, and as it is 5 feet deeper and 11 miles shorter than the old channel by the way of Lake George, the latter route has been practically abandoned except for rafts.

The commerce during the season of 1904 amounted to nearly 32,000,000 freight tons.

The West Neebish route is closed to navigation, and that channel will not be opened till completion of the rock section in 1908.

The water surface, usually changing slowly, may rise or fall 2 feet during a severe storm, and the monthly mean may change as much as 2 feet in one year or 4 feet during forty years.

More extended information, with sketches and maps, may be found in Annual Reports of the Chief of Engineers for 1886, pages 1792–1808 (special history), and 1895, pages 2866 and 3052.

During the fiscal year the deepening at Little Rapids to 21 feet at a Lake Huron stage of 578.8 was completed from the upper entrance angle to Frechettes Point, a distance of 3 miles.

The deepening near Sixmile Point is now in progress and will be completed this season. The Ninemile Point shoal in mid Hay Lake was removed to a depth of 22 feet at lowest water.

About one-half of the excavation was done for the channel across the flats of Hay Lake entrance to the West Neebish, and one-half of the excavation across the Mud Lake flats. The rock section at West Neebish was inclosed with cofferdams, the area unwatered, cableway plant installed, and one-tenth of the limestone rock excavated.

The estimated amount to complete continuing contracts (including payment of $233,000 of outstanding liabilities) is $3,183,000.

The funds on hand amount to $2,146,428.04, and $1,000,000 additional will be needed for next season's work.

HAY LAKE CHANNEL.

July 1, 1904, balance unexpended	$4,838.42
June 30, 1905, amount expended during fiscal year, for works of improvement	3,075.57
July 1, 1905, balance unexpended	1,762.85

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MIDDLE AND WEST NEEBISH CHANNELS.

July 1, 1904, balance unexpended	$1,216,195.19
Amount appropriated by sundry civil act approved March 3, 1905	1,200,000.00
	2,416,195.19
June 30, 1905, amount expended during fiscal year, for works of improvement	[a] 771,530.00
July 1, 1905, balance unexpended	1,644,665.19
July 1, 1905, outstanding liabilities	233,221.00
July 1, 1905, balance available	1,411,444.19
July 1, 1905, amount covered by uncompleted contracts	2,949,000.00
Amount (estimated) required for completion of existing project	2,000,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	1,000,000.00

HAY LAKE AND NEEBISH CHANNELS.

Amount appropriated by river and harbor act approved March 3, 1905	$500,000.00
July 1, 1905, balance unexpended	500,000.00
Amount (estimated) required for completion of existing project	750,000.00

(See Appendix O O 4.)

5. St. Clair Flats Canal, Michigan.—Before the Government commenced work, in 1855, at this locality, boats were obliged to follow the natural delta outlet channels of the St. Clair River, where the draft was less than 11 feet, in order to get from the river into the St. Clair Lake.

Between 1855 and 1865 the Government spent $45,000 in gaining 1 or 2 feet depth temporarily through these delta channels.

The present improvement dates from 1866, and proposed a straight dredged cut across a flat where the depth was only about 6 feet, the object being to secure 13 feet depth over 300 feet width of channel, modified in 1872 to give 16 feet and in 1886 to give 18 and 20 feet, all at a total cost of $1,326,060, as adopted by the river and harbor acts of June 23, 1866, and September 19, 1890, and approved by the War Department under various dates from 1866 up to October 9, 1890. This work was practically completed to 18 feet depth by 1892, after which it was incorporated into the 20–21-foot ship channel.

The dredged material was deposited so as to form dikes on each side of the cut, the channel faces of which are sustained by substantial sheet-pile revetments. In its present condition the width of waterway between revetments is 292 feet, depth of water 20 feet at mean stage, and length of each lateral dike 7,221 feet.

The water surface, usually changing slowly, may rise or fall 2 feet during a severe storm, and the monthly mean may change as much as 2 feet in one year or 4 feet during forty years.

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[a] Includes payments by Treasury Department account of—

Duluth, South Shore and Atlantic Railroad Company	$6.44
Michigan Central Railroad Company	12.08
Total	18.52

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The river and harbor act of June 13, 1902, appropriated $330,000 and authorized the diversion from the St. Marys River appropriation of as much more as might be needed (now estimated at $85,000) to commence and complete a second channel of 20 feet depth over 300 feet width alongside the existing channel, so as to provide two separate channels, one for ascending and one for descending boats.

The total amount appropriated for this improvement from its beginning in 1866 is $1,094,810 (exclusive of the $85,000 authority above referred to), and the total expenditure to June 30, 1905, is $846,626.29.

During the fiscal year work under the contract for the construction of a new channel was commenced. At the end of the year the channel had been dredged to a width of 150 feet and a depth of 20 feet for a length of 4,317 feet, and 2,558 feet of pier revetment had been built.

The commerce through the St. Clair Flats Canal during the season of 1904 was 38,044,929 tons of 2,000 pounds, being mostly through freights between lakes Superior and Erie. Its estimated value is $403,276,247.40.

July 1, 1904, balance unexpended	$328,908.94
June 30, 1905, amount expended during fiscal year, for works of improvement	[a] 80,725.23
July 1, 1905, balance unexpended	248,183.71
July 1, 1905, outstanding liabilities	40,044.00
July 1, 1905, balance available	[b] 208,139.71
July 1, 1905, amount covered by uncompleted contracts	254,316.00

(See Appendix O O 5.)

6. Operating and care of St. Clair Flats Canal, Michigan.—This service is provided for by the permanent indefinite appropriation for operating and care of canals and other works of navigation, under the provisions of section 4 of the river and harbor act of July 5, 1884.

Operations of the past fiscal year were of the same routine character as have been carried on since the canal was opened to traffic in 1871, viz, a custodian was present during the season of navigation to watch the passage of vessels, enforce regulations respecting traffic through the canal, and supervise all work provided for the care and repair of the canal dikes.

Under formal contract, dated September 16, 1904, the building of a custodian's dwelling and boathouse was awarded to Charles S. Rose and Frank X. Pouliot, of Marine City, for the sum of $3,757, and was completed during the year.

The expenditure to June 30, 1905, was $136,705.12 (excluding $347.64 estimated outstanding liabilities), of which $19,968.69 was for the service of the preceding year.

(See Appendix O O 6.)

[a] Actual expenditures during the year	$81,106.81
Deduct amount received from sale of old drift bolts, December 22, 1904	381.58
Net expenditures during the year	80,725.23

[b] This does not include, however, the $85,000 (estimated) diverted from the appropriation for improving St. Marys River at the falls by act of June 13, 1902.

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7. Detroit River, Michigan.—Before improvement the shoalest part of the channel through Detroit River was at the Limekiln Crossing, where the normal depth was 12½ to 15 feet over a bottom of solid rock.

The first projects of 1874 provided for a winding channel of at least 20 feet depth over 300 feet width, modified in 1883 so as to somewhat straighten such channel, in 1886 to give 400 feet width, in 1888 to give 440 feet width. The general depth above and below the Limekiln was 20 feet or more, but the bed of the river was studded with large bowlders and rocky shoals, which limited the safe navigable depth to scant 15 feet through a distance of about 12 miles.

A new general project of improvement was thereupon adopted in 1892 for the removal of all obstructive shoals between the city of Detroit and Lake Erie, with a view to obtaining a through channel with a least width of 600 feet and navigable depth of 20 feet, at a total estimated cost of $1,554,500, as adopted by river and harbor acts of July 13, 1892, and March 3, 1899, and as approved by the War Department at various dates from 1892 up to July 3, 1899. All of this amount has been appropriated and expended.

The water surface, usually changing slowly, may rise or fall from a few inches during many days of calm weather up to about 4 feet during severe storms, and about 6 feet during short, severe hurricanes; and the monthly mean may change as much as 2 feet in one year or 4 feet in forty years.

The river and harbor act of June 13, 1902, appropriated $500,000, and authorized work up to $1,250,000 more, for the commencement and prosecution of a new project (that of 1900) so as to provide 21 feet minimum low-water depth over 600 feet minimum width of channel from Detroit through Detroit River to Lake Erie. Continuing contracts have been made for the performance of this work to the extent authorized, and additional appropriations have been made as follows: By the sundry civil acts of March 3, 1903, $450,000, and March 3, 1905, $500,000. The estimate of cost of this project, printed herewith in Appendix O O 10, is $3,750,000, and the river and harbor act of March 3, 1905, authorized work to the extent of $400,000 for the further prosecution of this project, but this act carried no appropriation. No contracts have as yet been made under this last authority.

Prior to the fiscal year the work under the 1892 project was completed, resulting in a least depth of 19 feet at a Lake Erie stage of 572.6; also, under the 1902 project, the channel to Wyandotte, Mich., was improved by rounding off the point at the northerly end of Grosse Isle to a depth of 20 feet at a Lake Erie stage of 570.8.

The total expenditure on the improvement up to June 30, 1905, was $1,967,661.96. As a result of the work done to that date, a channel, ranging from 500 to 800 feet in width, was obtained, in which the least depth at mean stage of water (Lake Erie stage of 572.6) was 19 feet and from 19 to 21 feet through most of the distance.

For the head of the river, at Grossepoint, a preliminary examination was favorably reported on December 26, 1888, followed by survey reports of February 8, 1890 (printed together as H. Ex. Doc. No. 200, 51st Cong., 1st sess.; also Annual Report of Chief of Engineers for 1890, pp. 2749–2752), with estimates of $553,300 for 19.5

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feet depth over 800 feet width, and $690,800 for 20 feet depth. No appropriation has yet been made for this work.

More extended information may be found as follows: Annual Reports of the Chief of Engineers for 1891, pages 2794–2801 (special history); 1896, page 2758 (map); and 1904, pages 3140–3148; also House Document No. 160, Fifty-eighth Congress, second session (main channel to Wyandotte, Mich.).

The commerce was about 42,800,000 tons for the calendar year 1904, being mainly through freight from Lake Erie to lakes Superior and Michigan, or from those places to Detroit, being nearly twice that of 1892.

Work under the 1902 project, which provides for a channel with a least width of 600 feet and a depth of 21 feet at a Lake Erie stage of 570.8 feet, was performed during the fiscal year under continuing contracts at Limekiln Crossing, Amherstburg reach, and Hackett range, and for a part of the year at Bar Point shoals.

Extensive surveys were also made relating to present and future work.

The location of the proposed channel at Bar Point shoals, mouth of Detroit River, was shifted slightly in accordance with approval of the War Department dated November 12, 1904.

July 1, 1904, balance unexpended	$909,358.22
Amount appropriated by sundry civil act approved March 3, 1905	500,000.00
	1,409,358.22
June 30, 1905, amount expended during fiscal year, for works of improvement	372,520.18
July 1, 1905, balance unexpended	1,036,838.04
July 1, 1905, outstanding liabilities	149,650.00
July 1, 1905, balance available	887,188.04
July 1, 1905, amount covered by uncompleted contracts	1,095,328.00
Amount (estimated) required for completion of existing project	2,300,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	[a]700,000.00

(See Appendix O O 7.)

8. Removing sunken vessels or craft obstructing or endangering navigation.—The barge *Richard Martini* was sunk in Detroit River, above Belle Isle bridge. A contract for its removal for the lump sum of $1,200 has been made. The removal of the wreck of steamer *Minnesota* from St. Clair River channel was completed by the Canadian government.

(See Appendix O O 8.)

[a] For continuing-contract work authorized by the river and harbor act of—

June 13, 1902	$300,000
March 3, 1905	400,000

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SURVEYS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 3, 1899.

Final reports on surveys required by the river and harbor act approved March 3, 1899, of the following localities within this district have been duly submitted by Lieut. Col. Chas. E. L. B. Davis, Corps of Engineers:

1. Survey of waters connecting lakes Superior and Huron, including Hay Lake channel, with a plan and estimate of the cost of such improvement as will secure a safe and convenient channel 21 feet deep between said lakes.—Lieutenant-Colonel Davis submitted final report dated December 3, 1904. The estimated cost of the plan presented is $10,160,000. The report was transmitted to Congress and printed in House Document No. 215, Fifty-eighth Congress, third session. (See also Appendix O O 9.)

2. Survey of Detroit River from Detroit, Mich., to Lake Erie, with plan and estimate of the cost of such improvement as will secure a safe and convenient channel 21 feet deep.—Lieutenant-Colonel Davis submitted final report dated November 22, 1904. The estimated cost of the plan presented is $3,750,000. The report was transmitted to Congress and printed in House Document No. 40, Fifty-eighth Congress, third session. (See also Appendix O O 10.)

IMPROVEMENT OF RIVERS AND HARBORS ON LAKE ERIE, IN THE STATE OF OHIO.

This district was in the charge of Lieut. Col. Dan C. Kingman, Corps of Engineers. Division engineer, Col. O. H. Ernst, Corps of Engineers, until October 25, 1904, and Col. G. J. Lydecker, Corps of Engineers, since that date.

1. Toledo Harbor, Ohio.—The harbor of Toledo is in the Maumee River. The wharf frontage on the river extends over a distance of about 3 miles, the lower end of which is about 4 miles above the mouth of the river, at the head of Maumee Bay.

Originally the channels in the river were much better than in the bay, having minimum depths of 14 to 16 feet, while in the bay the least depth was 8.5 feet, and the maximum depth for most of the distance was but 12 feet.

In 1866 a project was adopted to dredge the channels of deepest water in the bay to a depth of 12 feet. The project was amended from time to time until 1887, when the old indirect channel had a minimum depth of 15 feet.

In 1887 a project was adopted for a straight channel through Maumee Bay, with a depth of 17 feet and a bottom width of 200 feet. The estimated cost, including dikes or other channel protections, was $1,875,000.

The project for a straight channel was amended in 1893 by increasing the width of outer section, about 3 miles long, to 300 feet. Since 1892 the improvement has been extended to include the Maumee River.

The present project was adopted in 1899 and was authorized by the act of Congress of that year. It is simply an enlargement of previous projects, and provides for a channel in the river and bay 400 feet wide and 21 feet deep, estimated to cost $1,095,000. A continuous contract was authorized for the execution of this work, which involves dredging only, the limit of cost being fixed at $950,000.

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The total expenditures for improving and maintaining channels in Maumee River and Bay to June 30, 1905, was $2,278,289.43.

The Maumee River discharges large quantities of silt in the bay, and this deposit goes on during the progress of the work. It is therefore impracticable to separate the cost of maintenance from that of improvement.

The net result of all the expenditures has been to secure a channel 21 feet deep and not less than 200 feet wide from the upper limits of the harbor outward to the lake, with the exception of a short distance at the extreme upper end of the harbor, where the present width is 100 feet. Nearly all of the river channel has been given the full width of 400 feet, and in the straight channel in the bay it has also been given a full width outward to a point more than 4,000 feet beyond the range lights, and the work is in progress in the outer section.

The contractor has employed three good dredges during the entire working season and has excavated 1,292,849 cubic yards of material, making a total with the work previously done of 5,306,245 cubic yards. He has begun the work of constructing the dike connecting the range lights, and at the end of the fiscal year had placed in position 273 square yards of the mattress foundation. While the rate of progress has been good it has not been such as to secure the completion of the work within the stipulated time. It seems probable that a few months' extension of time may be necessary to complete the contract.

The U. S. dredge *Maumee* was required elsewhere during the working season of 1904. The amount of work done in Toledo Harbor during this time was only about 4,000 yards. In the spring of 1905 it was returned to this work, and its total excavation for the year has been 43,740 cubic yards, making, with the work previously done, a total of 881,891 cubic yards, all of which has been excavated from the river portion of the channel.

The commerce of Toledo for the calendar year 1904 amounted to 3,115,019 tons.

For details of work during the fiscal year on construction of the dredge *Burton*, see Appendix H 7, herewith.

July 1, 1904, balance unexpended		$267,475.42
Amount appropriated by river and harbor act approved March 3, 1905		20,000.00
Amount appropriated by sundry civil act approved March 3, 1905		161,000.00
Proceeds from sale of Government property		176.00
		448,651.42
June 30, 1905, amount expended during fiscal year for works of improvement		[a]134,919.10
July 1, 1905, balance unexpended		313,732.32
July 1, 1905, outstanding liabilities		19,353.80
July 1, 1905, balance available		294,378.52
July 1, 1905, amount covered by uncompleted contracts		210,346.83
Amount (estimated) required for completion of existing project		15,500.00

[a] Includes $7,302.96 for dredge *Burton*.

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Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905 ..... $15,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix P P 1.)

2. Port Clinton Harbor, Ohio.—The harbor of Port Clinton is within the mouth of Portage River. This river flows into Lake Erie at a point about 13 miles by land and 22 miles by lake west of the city of Sandusky. In its natural condition the depth of water on the bar at the mouth of the river rarely exceeded 5 feet.

The project for its improvement was adopted in 1871 and slightly modified in 1872 and 1873. It provided for the construction of two parallel jetties extending outward from the mouth of the river to a depth of 10 feet in the lake, at an estimated cost of $90,000.

The work done consisted mainly of sheet piling of oak plank secured and reenforced by oak piles, with heavy oak waling pieces. The pierhead of the east jetty was a solid construction of piles and stone, and 720 linear feet of west jetty consisted of a substructure of piles with superstructure of timber cribwork, both filled with stone.

The jetties were extended to a depth of 10 feet in the lake in 1883. Since then no further extension has been made. The channel has been dredged from time to time, the last work of this kind being done in 1903. A depth of 13 feet between the jetties and 12 feet in the lake beyond their outer extremities has been secured. The jetties have become very much decayed and have been partially protected by riprap piled against them so as to give a slope of about 1 on 1. This stone is in turn protected by a covering of large stone which, above the water, is roughly laid as a pavement.

The total amount expended to June 30, 1905, was $99,039.10.

The present project is practically one of maintenance and provides for completely protecting the old wooden jetties by riprap. There has already been used for this purpose 13,296 tons of stone, but additional protection is necessary.

The funds available at the beginning of the fiscal year were insufficient to permit any work to be undertaken. An examination of the channel made in the spring of 1905 shows that the depths in the channel between the jetties and outward to the lake are well maintained.

The river and harbor act of March 3, 1905, appropriated $2,000 for maintenance at this place. Owing to the small size of the appropriation it was thought that the money could be more advantageously expended by combining under one contract the work at this place and at the harbor of Vermilion. Plans and specifications were prepared with this end in view, proposals were invited, and one contract for both works was awarded. The work contemplated consists in placing riprap along the unprotected portions of the jetties, and it will suffice to afford protection over the portions which most need it.

The commerce of Port Clinton is not large. The total amount reported for the calendar year 1904 was 6,535 tons.

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July 1, 1904, balance unexpended	$75.91
Amount appropriated by river and harbor act approved March 3, 1905	2,000.00
	2,075.91
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	115.01
July 1, 1905, balance unexpended	1,960.90
July 1, 1905, outstanding liabilities	100.00
July 1, 1905, balance available	1,860.90

(See Appendix P P 2.)

3. Sandusky Harbor, Ohio.—The harbor of Sandusky is in the lower part of Sandusky Bay, along the city front, the part nearest to the lake being about 2 miles from the bar which divides the waters of the bay from those of the lake. In its natural condition the depth was only such as the bay afforded, which was about 10 feet along the city front and from 9 to 12 feet thence to the lake.

A long, flat sand bar divided the bay from the lake, this bar being cut through by a channel from 1,000 to 2,000 feet in width near its central portion. The southern part of the bar is called "Cedar Point" and the northern "Sand Point." Between these two points the currents between the bay and the lake, resulting from the action of the wind and from varying barometric pressures, had scoured out the channel to a depth of not less than 18 feet for a distance of a mile or more, the maximum depth being as great as 40 feet. This place has always been known as the "Deep Hole."

The first appropriation was made for a survey in 1826, and the first improvement was made in 1844, consisting in the construction of a dam to close a breach across Sand Point. With this exception all the improvements made previous to 1896 consisted in deepening natural channels and in making a new straight channel from the city front to Cedar Point and in removing sand and bowlders from the dock channel along the city front. Natural causes have washed away a greater part of Sand Point since 1826, and there is now a space of about 7,000 feet between the edge of the Deep Hole and Sand Point, in which the water has a depth of from 2 to 6 feet.

In 1896 and subsequently the project was added to so as to provide for the construction of parallel jetties of stone upon mattress foundations extending from Cedar Point and Sand Point outward, with a view to confining and directing the flow of water to and from the bay. Provision was also made for the construction of certain spurs and mattresses for the protection of the channel near Cedar Point and at the point of the bar near the light-house.

The present project, which was authorized by the river and harbor act of June 13, 1902, includes all of the permanent works of protection and regulation provided for in the earlier plans, at an estimated cost of $274,564, and in addition provides for securing and maintaining a channel 21 feet deep at mean lake level, with a width of 400 feet in the approaches to the harbor front and 300 feet in the harbor channel, at an estimated cost of $781,000. The estimated cost of completing the project, exclusive of the amounts appropriated prior to the last river and harbor act, was $930,000.

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The act of March 3, 1905, modified the project by omitting therefrom the excavation of rock in the dock channel other than that already provided for by contract. The exclusion of this work diminishes the cost of completion on the basis of the original estimate by the sum of $320,000.

The total expenditure for improving Sandusky Harbor, from 1844 to June 30, 1905, was $679,590.20.

This expenditure has resulted in the dredging as above described and in the construction of a portion of the sill, jetties, dikes, and mattress which the plan provides for. In all about 12½ per cent of the latter class of work had been accomplished.

The river and harbor act of March 3, 1905, appropriated $125,000 for the work and authorized contracts to be made to an amount not to exceed $480,000, in addition, for the completion of the project. It is proposed to apply this money first to the complete excavation of the channels, there being good reason to hope that experience will show that it will be more economical to maintain them by periodical dredging than to attempt to protect them by additional dikes, sills, and jetties. A contract has been let for dredging about 2,000,000 yards of material in the straight channel and the dock channels. This will complete this portion of the improvement. The excavation of the channel on the bar, being in an exposed locality, is to be done by the Government hydraulic dredge.

At the beginning of the fiscal year a contract for dredging work was in force, which provided among other things for the excavation of 5,403 cubic yards of rock in the dock channel. All the work under this contract, except the rock excavation, had been completed. The time of completing the contract has been extended. It is desirable that this work should be finished, because the prices are very favorable to the United States. Nothing was accomplished during the fiscal year except to prepare a drilling and dredging plant. It is probable that the work will be completed during the coming year, and this will be all of the rock excavation that can be done under the law. The citizens of Sandusky have voted to issue bonds to carry out this portion of the improvement.

Serious shoaling having taken place in the narrow portions of the channel, an allotment of $10,000 from the river and harbor appropriation of April 28, 1904, was made before the beginning of the present fiscal year, and during the season the necessary dredging was done to remove these shoals. In all about 78,000 cubic yards of material was excavated, part of which was done by the U. S. dredge *Maumee* and the remainder under an open-market agreement with a dredging company.

The receipts and shipments at the harbor of Sandusky for the calendar year 1904 amounted to 1,436,615 tons.

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July 1, 1904, balance unexpended		$31,659.88
Amount appropriated by river and harbor act approved March 3, 1905		125,000.00
		156,659.88
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$8,000.00	
For maintenance of improvement	11,458.08	
		[a] 19,458.08
July 1, 1905, balance unexpended		137,201.80
July 1, 1905, outstanding liabilities		200.00
July 1, 1905, balance available		137,001.80
July 1, 1905, amount covered by uncompleted contracts		10,653.58
Amount (estimated) required for completion of existing project		485,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905		175,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix P P 3.)

4. Huron Harbor, Ohio.—This harbor is situated at the mouth of Huron River. In its natural condition the entrance was practically closed by a sand bar.

The first project for its improvement was adopted in 1826 and provided for the construction of two parallel jetties 140 feet apart extending outward from the river banks. These jetties were lengthened from time to time and repaired as required, and the channel was finally deepened by dredging.

The total amount expended under all projects for all purposes of construction and maintenance to June 30, 1905, was $269,908.95.

The present project for the improvement of this harbor was authorized by the river and harbor act of March 3, 1905. It is based upon a survey, plan, and estimate called for by the river and harbor act of June 13, 1902, and is published in full in the Report of the Chief of Engineers for 1904, pages 3209 to 3218, inclusive.

Briefly, this plan proposes to utilize all of that portion of the west jetty which is serviceable, and to extend the same 240 feet and terminate it at its outer extremity in a pierhead 50 feet square; also, to build another pierhead of the same dimensions 300 feet easterly from the first, and to connect it with the shore by a new jetty of rubble-mound type built entirely of stone. The new jetty will not be parallel to the west jetty, but will diverge as it approaches the shore, and will reach the shore at a point 1,200 feet distant from the west jetty. The channel and a part of the sheltered area are to be dredged to a depth of 21 feet and the old east jetty is to be completely removed. The pierheads and the west jetty extension are to be capped with concrete. The total estimated cost of the work is $315,500, exclusive of funds in hand.

In the spring of 1904 it was necessary to make an allotment of $40,000 from the river and harbor act of April 28, 1904, for the maintenance of this harbor. This money has been expended during the past year in rebuilding about 490 linear feet of the shoreward end of

[a] Includes $8,000 for dredge *Burton*.

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the west jetty, which was in such a ruinous condition that it threatened to give way and to involve the destruction of the channel. This extension directly advances the project and diminishes proportionally the amount required for its completion. A special construction of 12 by 12 sheet piling is now being built to connect this work with the shore, and a length of about 80 feet will have to be covered.

The river and harbor act of March 3, 1905, appropriated $68,500 and authorized contracts to be entered into for $200,000 more for the completion of the new project. The funds available will be expended in the jetty extension and the construction of the two pierheads. This work will be done by hired labor, and arrangements are now being made to procure the material.

The receipts and shipments of this harbor for the calendar year 1904 amounted to 502,848 tons.

July 1, 1904, balance unexpended	$47,850.35
Proceeds from sale of Government property	25.00
Amount appropriated by river and harbor act approved March 3, 1905	68,500.00
	116,375.35
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	40,485.59
July 1, 1905, balance unexpended	75,889.76
July 1, 1905, outstanding liabilities	3,277.42
July 1, 1905, balance available	72,612.34
Amount (estimated) required for completion of existing project	200,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	200,000.00

(See Appendix P P 4.)

5. Vermilion Harbor, Ohio.—Vermilion Harbor is at the mouth of Vermilion River, which empties into Lake Erie about 20 miles eastward from Sandusky.

The improvement of this harbor was first undertaken in 1836, when an appropriation of $10,000 was made for this purpose. The original project provided for parallel jetties extending outward to 12 feet of water in the lake. The jetties were built, but the current only sufficed to maintain a channel of about 7 feet depth across the bar. In the natural condition of the harbor there was only about 2 feet of water at this place. Dredging was accordingly resorted to and the project enlarged to provide for a depth of 14 feet of water. This involved the removal of rock and the project was never fully executed.

The total amount of money expended to June 30, 1905, is $133,310.74.

Exclusive of the appropriation made in the river and harbor act of March 3, 1905, there has been but $10,000 available for the repair and maintenance of these works for the past twenty-two years. As a result the superstructure of the jetties is very badly decayed and the channel has deteriorated.

The act of June 13, 1902, called for an examination and survey of this harbor. The report is given in full in the Report of the Chief

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of Engineers for 1904, pages 3235 to 3242, inclusive, and recommended maintenance by repair of the existing jetties in a durable and permanent manner, the timber superstructure to be removed down to the level of the water, the side walls of the cribs to be reenforced by a riprapping of heavy stone having a slope of 1 on 1½; these slopes to be carried up above the surface of the water so as to give the jetty a height of 5 feet; above water the heavy stone protection to be laid in the form of a pavement. The estimated cost of this work is $42,350.

The act of March 3, 1905, appropriated $15,000 for maintenance, which will be expended in the manner recommended in the above-mentioned report. It was thought that this money would be more advantageously expended by combining under one contract the works at the harbors of Vermilion and Port Clinton, and plans and specifications have been prepared and proposals invited with this end in view, and a single contract has been let for both works. The work will begin at the shoreward end of the west jetty and be continued outward as far as the means will allow. By this plan the portions of the jetty most in need of repairs will receive attention first.

The harbor of Vermilion has but very little commerce and its use is local. The receipts and shipments for the calendar year 1904 amounted to 4,900 tons.

Amount appropriated by river and harbor act approved March 3, 1905	$15,000.00
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	33.19
July 1, 1905, balance unexpended	14,966.81
July 1, 1905, outstanding liabilities	100.00
July 1, 1905, balance available	14,866.81

(See Appendix P P 5.)

6. Black River (Lorain) Harbor, Ohio.—This harbor is within the mouth of Black River, where it enters Lake Erie, 26 miles west of Cleveland. In its natural condition the depth of water at the mouth of this river did not exceed 3 feet, but the river itself was navigable for a distance of 3 miles from its mouth for all vessels then in use upon the lake.

The first project provided for the construction of parallel jetties. These jetties have had to be rebuilt and extended from time to time so as to keep pace with increasing requirements, and dredging has been resorted to to secure a greater depth than the natural currents would afford.

The present project was formally adopted by the river and harbor act of March 3, 1899, which made provision for its execution by a continuous contract. It provides for the construction of two rubble-mound breakwaters converging toward the lake, having an opening between them at their outer extremities 500 feet in width, and in prolongation of the axial line of the jettied channel. It also provides for repairing or rebuilding the jetties and for dredging the protected areas to a depth of 20 feet. The estimated cost is $695,500.

The total amount expended prior to the adoption of the present project was $292,204.77, and the amount expended upon the new project from the time of its adoption to June 30, 1905, was $350,434.74.

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The amount authorized by the act of March 3, 1899, not being sufficient to secure the completion of the work at such prices as could be obtained by advertisement, special authority was given in the river and harbor act of June 6, 1900, to enter into contract for such portion of the work as the funds available would allow, at a cost not to exceed a 10 per cent increase over the original estimates. This authority permitted a contract to be made for all of the work proposed except the rubble-mound portion of the east breakwater. Work was in progress under this contract at the beginning of the fiscal year. The repair and rebuilding of the jetties proposed had been completed with the exception of a length of 188 feet. This has since been finished. Work was in progress upon the west breakwater, but the rate of progress was slow and not such as to complete the contract on time. During the year the contractor has done work upon the breakwater to the value of $41,777.77 and upon the jetties of $11,862.14.

After the letting of this contract the United States was able to secure without cost the placing of about 50,000 cubic yards of shale rock along the axial line of the proposed east breakwater. This material had a value in place, on the basis of contract prices, of $35,000, and advanced the construction of the east breakwater to this extent. A contract was let in August, 1904, for the completion of as much of this breakwater as the means available would allow. A superstructure of heavy placed stone was adopted instead of a paved cross section. About $20,000 in excess of the funds then available was necessary to complete the east breakwater. This amount was provided in the river and harbor act of March 3, 1905. The act appropriated in all $85,000, from which the aforementioned allotment has been made, and the remainder will be applied to building 645 linear feet of concrete superstructure upon the old west jetty and to such work of dredging as may be necessary to maintain the channel.

The commerce of Lorain for the calendar year 1904 amounted to 2,393,238 tons.

July 1, 1904, balance unexpended		$338,422.49
Amount appropriated by river and harbor act approved March 3, 1905		85,000.00
Amount appropriated by sundry civil act approved March 3, 1905		20,000.00
Proceeds from salvage of property		32.50
		443,454.99
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$95,212.38	
For maintenance of improvement	3,644.85	
		98,857.23
July 1, 1905, balance unexpended		344,597.76
July 1, 1905, outstanding liabilities		8,891.73
July 1, 1905, balance available		335,706.03
July 1, 1905, amount covered by uncompleted contracts		291,776.95
Amount (estimated) required for completion of existing project		151,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905		46,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix P P 6.)

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7. Cleveland Harbor, Ohio.—The old harbor of Cleveland was entirely within the mouth of the Cuyahoga River, where the natural depth of the water was sufficient for the requirements of the time. The mouth of the river was obstructed by an extensive sand bar, across which a channel of varying location and uncertain depth existed. Sometimes the mouth of the river would be entirely closed by the action of the waves and would remain so until a freshet in the river cut out a new entrance.

The first improvement was undertaken in 1825, and the plan contemplated straightening the channel so that it would lead more directly into the lake, and making the new location permanent by jetties to confine the water and concentrate the action of the current upon the bar. These jetties were built, repaired, extended, and, in part, rebuilt, and the channel was made deeper and maintained by dredging as necessity required; but there was no change in the general plan of improvement until 1875, at which time the total expenditure had been $348,881.61.

In 1875 a project was adopted for a breakwater in 5 fathoms of water. The west breakwater was commenced in 1876 and completed in 1883, a total length of 7,130 feet. The east breakwater was commenced in 1888 and continued at intervals until 1893, when its length was 2,494.5 feet. In 1895 an opening of 200 feet was made in the shore arm of the west breakwater as a sanitary measure. In 1896 a project for completing the improvement was approved by Congress, and contracts for the work were authorized, at a total cost not to exceed $1,354,000. (See Annual Report of the Chief of Engineers for 1896, pp. 2949-2953.) These improvements involve the completion of the east breakwater, covering an extension of about 3,000 feet; removing superstructure of the old west breakwater to a depth of 2 to 3 feet below water level and replacing it with a superstructure of concrete masonry; reenforcing the cribs below the masonry; sheathing the face of east breakwater; removing and rebuilding the east and west piers, and widening the mouth of the river. A continuous contract for the work was authorized.

In 1899 a project was prepared and was authorized by the river and harbor act of that year for deepening the channel and sheltered area by dredging to a depth of 21 feet. This project was enlarged by the act of June 13, 1902, to permit the dredging to be carried to a depth of 25 feet. The estimated cost of the work was $478,400. Since 1899 the sum of $115,000 has been expended toward the execution of this project and there has been excavated from the sheltered area and jettied channel 766,928 cubic yards, but, as shown by the annual report of the district engineer for 1904, the deposit which has taken place over this area during this period has equaled or exceeded the amount of material removed; therefore the work done must be regarded simply as maintenance work and not in advancement of the project.

An addition to the project was authorized by the act of Congress of June 13, 1902, providing for improving and enlarging the entrance to the harbor, and for extending the breakwater eastward to Gordon Park in the city of Cleveland, a distance of about 16,000 feet, at a total estimated cost of $4,481,456, and the act authorized an expenditure of $2,800,000 for prosecuting this project.

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The total of all expenditures for improving Cleveland Harbor from 1825 to June 30, 1905, was $3,899,599.22.

This expenditure has covered the cost of the construction of the works under the earlier projects and their maintenance up to the time that the project was enlarged. It has sufficed for the completion of the project of 1896, with the exception of a small amount of jetty extension and dredging near the mouth of the Cuyahoga River and south of the Lake Shore Railway bridge. This work would have cost about $35,000, but it could not be carried out because the United States never obtained title to the land which would have to be dredged away. A length of about 270 feet of the east breakwater extension, being a portion of the shore arm, was not built because it was forbidden by the river and harbor act of June 13, 1902. If completed, this work would have cost $45,000.

The work at the new entrance and for the extension of the breakwater eastward is being carried out under continuous contracts. New entrance work is about 37 per cent completed. It should be about 50 per cent completed, the rate of progress not having been up to the contract requirements. The breakwater extension work is about 38 per cent completed, which is about 1½ per cent in advance of the contract requirements. The work of sheathing the east breakwater with hard-wood plank has been carried on by hired labor and is now very nearly completed. Minor repairs have been made to the jetties and breakwaters by hired labor during the year.

The sundry civil act of March 3, 1905, appropriated $180,800, under the authorization of the act of 1896, for improving harbor at Cleveland, Ohio, continuing improvement. This will be applied to repair and maintenance as follows: Sheathing with hard-wood plank the harbor side of the west breakwater; protecting the west breakwater on the lake side by a riprap of heavy stone, about 10 tons to the running foot of breakwater, and repairing and strengthening the portion of the shore arm of the breakwater between the 200-foot opening and the harbor line. This will be given a concrete top to conform to the remainder of this structure. The funds appropriated by the same act, under the authorization of 1902, will be applied to the new entrance and main breakwater extension under continuous contracts.

The river and harbor act of March 3, 1905, appropriated $200,000 for continuing the improvement and for maintenance. This will be expended in the advancement of the project for deepening the channel and sheltered area to 25 feet. The greater portion of the work will be done in the west basin, where no previous dredging has been done and where the shoaling has been sufficient to prevent its use by the largest class of vessels. One hundred and fifty thousand dollars will be expended for this purpose under contract and the remainder will be expended for the operation of the United States dredge.

The receipts and shipments at Cleveland for the calendar year 1904 amounted to 9,350,417 tons.

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July 1, 1904, balance unexpended		$1,001,178.88
Amount appropriated by river and harbor act approved March 3, 1905		200,000.00
Amount appropriated by sundry civil act approved March 3, 1905		630,800.00
Proceeds from sale of Government property		9.96
Collected on account of damages to piers		100.00
		1,832,088.84
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$657,233.75	
For maintenance of improvement	50,878.58	
		[a] 708,112.33
July 1, 1905, balance unexpended		1,123,976.51
July 1, 1905, outstanding liabilities		[b] 29,781.18
July 1, 1905, balance available		1,094,195.33
July 1, 1905, amount covered by uncompleted contracts		1,861,307.27
Amount (estimated) required for completion of existing project		3,207,356.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905		550,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix P P 7.)

8. Fairport Harbor, Ohio.—This harbor is situated at the mouth of Grand River, where it enters Lake Erie, about 32 miles eastward from the harbor of Cleveland. Before the improvement was undertaken the depth across the bar at the mouth of the river was variable and uncertain and quite insufficient for the needs of commerce.

The first improvement was undertaken in 1825, and the original project provided for the construction of parallel jetties of cribwork filled with stone, placed about 200 feet apart and extending outward across the bar and into the lake. The jetties were extended and have been repeatedly repaired and rebuilt as necessities required, and the channel has been deepened and redredged many times.

In 1896 the project was enlarged to provide for the construction of two breakwaters converging toward the lake, the outer ends being in deep water, and sufficient space being left between them to afford an easy entrance to the jettied channel. These breakwaters were to terminate in pierheads 50 feet square, and the total length of the west breakwater was to be 2,050 feet and the east breakwater 1,350 feet. The estimated cost of the work, including dredging between the breakwaters to a depth of 20 feet, was, as revised in 1900, $585,000.

The total amount expended to June 30, 1905, was $668,566.52.

This expenditure has resulted in the construction of the west jetty 2,370 feet in length and the east jetty 1,765 feet in length from the original shore line; also in the construction of 828 linear feet of the shoreward end of the west breakwater. All of these structures are of timber cribs filled with stone and all were surmounted originally by timber superstructures. Owing to the advance of the shore line, a considerable portion of these jetties is now within the present shore line and are no longer maintained by the United States. These works have been repaired and maintained and a very large amount of dredging has been done to improve and preserve the channel.

[a] Includes $17,139.32 for dredge *Burton*.
[b] Includes $326.51 for dredge *Burton*.

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Very extensive and complete work of repair and maintenance was undertaken with funds provided by the river and harbor act of June 13, 1902. Five hundred and eighty linear feet at the shoreward end of the east jetty was completely rebuilt of timber cribs with a concrete top, and 570 linear feet of the west jetty was extensively repaired with tongued and grooved piling below the water and with concrete and stone above, and 1,137 linear feet of the remaining portion of the jetties was protected below water by a sheathing of hard-wood plank. All of this work was done under contract, and at the beginning of the present fiscal year was about 94 per cent completed. It was finished September 19, 1904. The amount earned by the contractor during the present fiscal year was $7,313.36. In addition to this, minor work of repair was done by hired labor, at a total cost of $1,995.66.

This harbor suffers greatly from the extensive movement of sand, which constantly re-forms the bar at the outer end of the jetties. Dredging was done in the spring of 1904, involving the removal of more than 30,000 cubic yards of material, but notwithstanding this the bar re-formed in August and it was necessary to remove 10,112 cubic yards to restore the channel. In the spring of 1905 it was again obstructed, and the U. S. dredge *Burton* was sent to this place, where it removed 21,016 cubic yards of material, at a field cost of $1,770.84, again restoring the channel.

On account of this extensive sand movement it has been determined that it will be necessary to connect the west breakwater with the shore. The river and harbor act of March 3, 1905, permitted this to be done, and plans and specifications were prepared for the execution of this work under contract, a rubble-mounted structure being adopted. The work was advertised, but the bids received were all deemed excessive and were rejected, and the work has again been placed under advertisement.

In the fall of 1904 the east jetty was damaged by being struck by the steamer *Princeton*. The estimated cost of making good the injury has been collected through the Department of Justice and placed to the credit of the appropriation.

The receipts and shipments at this harbor during the calendar year amounted to 1,781,796 tons. Plans are under way for greatly improving the docks and dock machinery, and when this is done there will no doubt be a large increase of tonnage at this port.

July 1, 1904, balance unexpended		$66,032.53
Collection on account of damages to pier		101.50
Amount appropriated by river and harbor act approved March 3, 1905		135,000.00
		201,134.03
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$5,000.00	
For maintenance of improvement	28,943.52	
		[a]33,943.52
July 1, 1905, balance unexpended		167,190.51
July 1, 1905, outstanding liabilities		939.66
July 1, 1905, balance available		166,250.85
Amount (estimated) required for completion of existing project		345,000.00

(See Appendix P P 8.)

[a] Includes $5,000 for dredge *Burton*.

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9. Ashtabula Harbor, Ohio.—This harbor is situated at the mouth of the Ashtabula River, where it enters Lake Erie, at a point about 54 miles eastward from the harbor of Cleveland. In its natural condition the mouth of the river was obstructed by a bar, upon which the depth of water varied according to the prevailing conditions of storms on the lake and freshets in the river. The greatest possible depth on the bar was 9 feet, this being the distance to the underlying rock near the short line. The minimum depth probably did not exceed 2 feet.

The original project for the improvement of this harbor was adopted in 1826 and provided for the construction of two parallel jetties extending outward into the lake. These jetties have been built and repaired from time to time and extended farther into the lake, and the channel has been deepened by dredging to meet the increasing demands of commerce, the project being modified accordingly.

Under the authority of the river and harbor act of 1896 a new project was adopted. It modifies the previous project in regard to the length of the jetties and provides for the construction of two separate breakwaters converging toward the lake, their outer ends being about 400 feet apart and in water 29 feet deep. The estimated cost was $465,000.

The river and harbor act of March 3, 1899, authorized a continuous contract to be made for the construction of these breakwaters at a cost not to exceed $430,000.

The total amount expended for all purposes to June 30, 1905, was $1,004,818.90.

These expenditures had sufficed for the construction and maintenance of the jetties, which have now been completed as far as it is proposed to carry them, and for all the necessary dredging for the purpose of securing and maintaining the required depths in the channel, and for the completion of about 66 per cent of the breakwater work provided for under the continuous contract. The two timber-crib pierheads with concrete tops have been completed, and the light-house has been erected upon one of them. A large amount of work has been done upon the two rubble-mound breakwaters.

At the beginning of the fiscal year work was in progress on the west breakwater, but the force and plant was entirely inadequate for work of this magnitude. The total amount earned by the contractor during the working season was $16,406.82. The contractor for this work is the same as for Conneaut, and for reasons explained in that report no work has been done this season.

At the close of the fiscal year 1904 dredging was in progress under an emergency contract to restore the channel between the jetties and across the bar. The work was not completed until July 11. A total of 27,424 cubic yards of material was removed at a cost, in round numbers, including inspection, of $8,400. The bar had re-formed in the spring of 1905, and the navigable depth over it did not exceed 16½ feet. The U. S. dredge *Burton* was sent on April 11 to remove this obstruction. The work was completed on April 29, 11,000 cubic yards, place measurement, having been removed, at a field cost of $2,014.99.

As explained in the Annual Report of 1904, the Secretary of War under authority of law has granted permission to the Pittsburgh,

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Youngstown and Ashtabula Railroad Company to remove the west jetty and replace the same by a bulkhead 60 feet farther west, thus increasing the width of the channel. Up to the beginning of the fiscal year this work had been about one-half completed. Operations are now in progress to finish it. The company is required to furnish a suitable site for the range light.

The act of Congress of March 3, 1905, authorized the funds available from the appropriation of 1902 to be applied to extension of the west breakwater to a point at or near the shore. Proposals have been invited for extending this work 1,500 feet. The lowest bid received was unsigned and otherwise defective and all other bids were unreasonable and excessive, so that the proposals were rejected and the work readvertised.

The owners of the steamer *M. A. Hanna*, which damaged and destroyed the outer end of the east jetty, have tendered the sum of $3,375.75 in satisfaction of this injury. This offer has been accepted by the War Department and the amount has been placed to the credit of the appropriation.

The commerce of Ashtabula is very great; notwithstanding the depression in the ore trade during the calendar year 1904, the receipts and shipments amounted to more than 5,600,000 tons.

July 1, 1904, balance unexpended		$395,644.44
Amount appropriated by river and harbor act approved March 3, 1905		20,000.00
Collections on account of damages to piers		3,525.75
Proceeds from sale of Government property		1.00
		419,171.19
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$39,971.84	
For maintenance of improvement	12,230.84	
		[a] 52,202.68
July 1, 1905, balance unexpended		366,968.51
July 1, 1905, outstanding liabilities		100.00
July 1, 1905, balance available		366,868.51
July 1, 1905, amount covered by uncompleted contracts		158,734.34

(See Appendix P P 9.)

10. Conneaut Harbor, Ohio.—This is the most easterly harbor in the Cleveland district. It is at the mouth of Conneaut Creek, in the northeastern part of the State of Ohio, and near the Pennsylvania line. In its natural condition the creek was obstructed by a bar at its mouth, over which the average depth of water did not exceed 2 feet.

The first improvement was undertaken in 1829 and consisted in the construction of parallel jetties of timber cribs filled with stone. Only a moderate degree of improvement was sought, and the greatest depth ever obtained under this project through the action of these jetties did not exceed 12 feet.

After 1870 the appropriations became very small and irregular, and they ceased altogether in 1880. Up to this time the total expenditures for construction and maintenance had been $112,629.39. No appropriations at all were made for this harbor from 1880 to 1892. At

[a] Includes $14,900 for dredge *Burton*.

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the end of this period the jetties were in a decayed and ruinous condition and the channel had filled up with sand and silt and had practically reverted to its original condition. The harbor could only be used by small sailing craft such as were then engaged in fishing.

A new project was prepared in 1892 which provided for the construction of parallel jetties 200 feet apart and extending outward to a depth of 17 feet in the lake. The old work was of little or no value in the new project. This project was added to in 1896 so as to provide for the construction of two detached breakwaters converging toward the lake and designed to shelter the entrance to the jettied channel. The project provided for securing a navigable depth of 20 feet in the channel and sheltered area.

The estimated cost of the new project, exclusive of maintenance, was $610,000. After $220,000 had been appropriated, a portion of which was applied to the advancement of the project, the balance being necessary for purposes of maintenance, an expenditure of $450,000 was authorized by the river and harbor act of June 13, 1902, for the prosecution of the work.

In addition to the new work described, it was necessary in the way of maintenance and to make the entire improvement of a permanent character to replace 412 linear feet of sheet-piling work at the shoreward end of the east jetty by a permanent crib structure with a concrete top; also to repair and strengthen 1,006 linear feet of existing jetty and to rebuild its superstructure in concrete. This work of maintenance was included in the plans for the expenditure of the appropriation authorized by the act of 1902.

The total amount expended from the adoption of the present project to June 30, 1905, was $659,440.30. This has sufficed to complete about 71 per cent of the work proposed and for the maintenance of the channel and of the work already done.

The work of carrying forward the improvement has been placed under a continuous contract, and the prices were such as to provide for the completion of all the work proposed, except a length of 250 feet at the shoreward end of the east breakwater. To complete this structure will cost about $40,000, and the funds for the purpose were provided in the river and harbor act of March 3, 1905.

At the beginning of the fiscal year 1905 the work under the continuous contract was about 39 per cent completed, and good progress was being made. It was continued until about the close of the working season and about 71 per cent completed. At this time the affairs of the contractor became involved and a receiver was appointed by the United States court, since which time no more work has been done. In reply to an inquiry made by the district engineer, the receiver stated on the 27th of June, 1905, that a movement was on foot whereby the company would be absorbed by a new company, but up to the end of the fiscal year the nature of the reorganization had not been disclosed.

In 1902 the steamer *Mecosta* collided with the outer end of the west jetty at Conneaut, inflicting damages that cost $1,345.84 to repair. The matter was placed in the hands of the United States attorney, and in due course the company tendered in settlement $1,000, which was accepted by the United States, and has been placed to the credit of the appropriation.

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In September, 1904, the steamer *W. D. Rees* collided with the east jetty, inflicting damages which it was estimated would cost $866 to repair. The owners of the vessel have tendered $600 in payment of the damages, and upon the advice of the United States attorney this offer has been accepted.

In the spring of 1905 it was found that dredging was necessary in order to secure the required width of channel between the jetties and outward across the bar. The U. S. dredge *Burton* was sent to this place and began the work on May 1 and completed it on May 19. Fourteen thousand cubic yards of material was removed, at a field cost of $1,673.70, and the channel was put in a satisfactory condition.

Conneaut is one of the most important ore harbors on Lake Erie. Notwithstanding the depression in the ore business during the year 1904, the receipts and shipments at this harbor amounted to 4,548,538 tons.

July 1, 1904, balance unexpended		$296,264.65
Collection on account of damages to pier		1,000.00
Amount appropriated by river and harbor act approved March 3, 1905		60,000.00
Proceeds from sale of Government property		.50
		357,265.15
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$164,938.73	
For maintenance of improvement	3,068.63	
		168,007.36
July 1, 1905, balance unexpended		189,257.79
July 1, 1905, outstanding liabilities		100.00
July 1, 1905, balance available		189,157.79
July 1, 1905, amount covered by uncompleted contracts		126,795.16

(See Appendix P P 10.)

11. Removing sunken vessels or craft obstructing or endangering navigation.—Tow barge L. L. Lamb.—This vessel foundered and sunk August 16, 1902, near the entrance to Fairport Harbor. The operations connected with its removal were carried out in the fiscal year 1904, and are described in the Report of the Chief of Engineers for that year. The determination of cost and final settlement was made during the present fiscal year. The allotment for the removal of the wreck was $1,500. The expense connected therewith was $210.53, of which $150 was spent during the year, and the balance of the allotment has been redeposited to the credit of the United States.

Yacht Idler.—This vessel was sunk on the 23d of March, 1904, at the entrance to Fairport Harbor. It was abandoned by the owners and was removed by the U. S. dredge *Maumee*. The removal was completed before the close of the fiscal year 1904, but the cost was not determined and the final settlement made until the present year. The expenses incident to the removal of this wreck were $375 expended during the year.

Schooner General Franz Sigel.—This vessel foundered and sunk in Lake Erie, near Stoney Point, in July, 1903. It was abandoned by the owners and was broken up and removed by the U. S. dredge *Maumee* in the latter part of July, 1904. The portion of its cargo, which was of coal, was saved and sold at public auction for $255.50.

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Total cost of removing this wreck was $1,406.60, of which $1,300.60 was spent during the past fiscal year.

Car ferry Shenango No. 1.—This vessel burned and sunk while held in the ice outside of the harbor of Conneaut, Ohio, on the 29th of March, 1904. It contained 26 empty steel cars.

Proposals were invited by newspaper advertisement and a contract awarded to George W. Pfohl, of Buffalo, N. Y., to remove the wreck for the value of the salvage. After working upon the wreck for some time and procuring an extension of time for completing his contract, he finally abandoned it and declined to proceed. His contract was annulled in the spring of 1905 and new proposals were invited. The bid of Charles W. Johnston, of Lewes, Del., was the lowest, being $4,900, and he was called upon to enter into contract. When the contracts were sent him he declined to sign them, declaring that the work was much more difficult than he supposed. The next lowest bidder was Van Sant & Boehm, of Atlantic City, N. J., and these parties have been called upon to enter into contract, but at the time of preparing this report they had not been heard from.

The first allotment for removing this wreck was $2,500. This was increased after readvertisement to $5,500, and again increased to $10,500. The sum of $6.20 was spent during the year.

Steamer Philip Minch.—This vessel took fire off Sandusky Harbor on the night of November 19, 1904. It finally sunk at a point about 15 miles in a northeasterly direction from this port. It has been found and buoyed. It lies in about 45 feet of water, but it has not yet been practicable to make a thorough examination of it in order to determine whether or not it forms an obstruction to navigation. This information will be obtained as soon as practicable.

(See Appendix P P 11.)

IMPROVEMENT OF ERIE HARBOR, PENNSYLVANIA, AND OF CERTAIN RIVERS AND HARBORS IN WESTERN NEW YORK.

This district was in the temporary charge of First Lieut. Paul S. Bond, Corps of Engineers, until August 25, 1904, and in the charge of Col. H. M. Adams, Corps of Engineers, since that date. Division engineer, Col. Amos Stickney, Corps of Engineers.

1. Harbor at Erie, Pa.—In its original condition the harbor of Erie was nearly landlocked, the only entrance being at the east end, through a channel which was narrow and tortuous, variable in position, with a depth of about 6 feet.

The original project, approved March 26, 1824, provided for closing the eastern end of the harbor by means of a breakwater, in which there should be an opening 200 feet wide, and for extending to deep water in the lake two parallel piers, one on each side of the opening. The project also included the necessary work of dredging to keep the channel open, making the necessary repairs to existing structures, and maintaining the Presque Isle Peninsula.

The project was modified by the river and harbor act of March 3, 1899, and now requires the harbor basin and entrance channel to be dredged to a depth of 20 feet at mean lake level, the north and south piers to be provided with concrete superstructure and extended 500 and 1,000 feet, respectively, and four protection jetties to be built along the outer shore of Presque Isle Peninsula.

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The estimated cost of completing the modified project was $877,000.

At the beginning of the past fiscal year, under the modified project, 1,210 feet of wooden superstructure on north pier had been replaced with concrete, the north pier had been extended 510 feet, two protection jetties had been built, the channel dredged 20 feet deep, the basin dredged 20 feet deep, except a strip 250 feet wide along the eastern end, and the wooden superstructure on all of the south pier—1,217 feet—had been replaced with concrete.

Work proposed for the ensuing fiscal year includes the extension of the south pier, completion of the basin excavation, and, under maintenance, the replacing of 750 feet of decayed wooden superstructure on the north pier with concrete, for the purpose of extension of benefits.

The total amount expended on the harbor to June 30, 1905, was $1,171,650.08. It is impracticable to separate the cost of construction and maintenance.

The maximum draft that could be carried June 30, 1905, at mean lake level over the shoalest part of the locality under improvement was 19 feet, and the usual variation of level of water surface is about 2 feet.

The following table gives the total arrivals and departures, including tonnage, for the past ten years:

Year.	Number.	Tonnage.	Year.	Number.	Tonnage.
1895	2,936	3,323,672	1900	2,709	3,403,312
1896	3,100	3,323,672	1901	3,405	3,204,325
1897	3,133	4,051,984	1902	2,809	3,873,734
1898	2,939	3,939,019	1903	2,423	3,503,628
1899	3,200	3,961,794	1904	1,996	2,890,321

For more extended information and photographs see Annual Report of the Chief of Engineers for 1900, page 4100 et seq., and for 1903, page 2115 et seq.

A chart of Erie Harbor is issued in the series of charts for the survey of the Northern and Northwestern Lakes, index Ec 2.

July 1, 1904, balance unexpended	$28,222.46
Amount appropriated by river and harbor act approved March 3, 1905	125,000.00
Received from sales	6.00
	153,228.46
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	3,288.42
July 1, 1905, balance unexpended	149,940.04
July 1, 1905, amount covered by uncompleted contracts	112,927.50
Amount (estimated) required for completion of existing project	62,000.00

(See Appendix Q Q 1.)

2. Harbor at Dunkirk, N. Y.—This is an artificially protected harbor lying in an indentation of the south shore of Lake Erie, between Point Gratiot on the west and Battery Point on the east. The distance between these points is 9,600 feet, and the maximum breadth of the indentation is 3,600 feet.

The original depth of water was about 10 feet and from 15 to 16 feet to underlying rock.

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The existing project, approved November 30, 1870, provides for a detached breakwater 2,860 feet long, one part of which, 2,300 feet long, was to be nearly parallel with the shore; the other part, 560 feet long, to be nearly parallel with the axis of the channel entrance.

This breakwater and the pier already built were to form the harbor, and the old channel was to be enlarged to 170 feet wide and 13 feet deep.

All the works now existent at Dunkirk have been built according to this plan, and the entrance channel and harbor basin, containing about 65 acres in all, have been excavated to a depth suitable for vessels drawing 16 feet at mean lake level.

The total amount expended on the harbor to June 30, 1905, was $965,574.85.

It is impracticable to separate the cost of construction and maintenance.

During the past fiscal year no work was done.

The old timber breakwater and pier need repairs, which can most advantageously be done with concrete.

The maximum draft that could be carried June 30, 1905, at mean lake level over the shoalest part of the locality under improvement was 16 feet, and the usual variation of level of water surface is about 2 feet.

The following table gives the total arrivals and departures, including tonnage, for the past ten years:

Year.	Number.	Tonnage.	Year.	Number.	Tonnage.
1895	69	15,650	1900	278	107,316
1896	42	12,160	1901	171	49,148
1897	197	12,160	1902	143	33,435
1898	180	22,005	1903	287	64,303
1899	192	82,783	1904	117	5,128

For more extended information and map, see Annual Report of the Chief of Engineers for 1898, page 2748 et seq.

A chart of Dunkirk Harbor is issued in the series of charts of the survey of the Northern and Northwestern Lakes, index Ea 8.

July 1, 1904, balance unexpended	$22,029.38
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	16.85
July 1, 1905, balance unexpended	22,012.53

(See Appendix Q Q 2.)

3. Harbor at Buffalo, N. Y.—Buffalo Creek was the original harbor of the port of Buffalo. In its original condition the entrance channel from the lake was shallow and frequently closed by a gravel bar. The original project for the improvement of this harbor was adopted in 1826, and provided at first for the construction of piers on the north and south sides of Buffalo Creek. Subsequently a masonry sea wall, 5,400 feet long, was built along the lake shore south of the harbor entrance, and a sand-catch pier of piles and stone, 879 feet long, built out from the shore.

Between 1868 and 1893 a detached breakwater, 7,600 feet long, was built of timber cribs about a half mile distant from the lake shore and parallel with it.

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A shore arm, about 4,000 feet long, was projected in 1874, to extend to the south end of this breakwater, leaving an opening of 150 feet. Work on this was in progress when it was wrecked by storm in 1893.

A new project was adopted in 1895 on the recommendation of a Board of Engineer officers, and consists of the abandonment of the shore arm and the extension of the breakwater to Stony Point.

The report of the Board and details of its plans are published in the Annual Report of the Chief of Engineers for 1895, page 3153 et seq. The river and harbor act of June 3, 1896, added to the project of the Board of Engineers by providing for the construction of a farther length of the sand-catch pier, extending it to the established pierhead line.

The river and harbor acts of June 6, 1900, and June 13, 1902, made special provision for deepening the entrance to Buffalo Harbor and the city ship canal. The entrance channel was dredged 22 feet at mean lake level in 1900–1902.

The project now in force for the improvement of Buffalo Harbor is:

(*a*) To maintain existing structures, making the requisite repairs, and replacing the wooden superstructure of the breakwater with concrete when necessary, and to maintain the entrance channel 22 feet deep at mean lake level.

(*b*) To build an extension of the breakwater to Stony Point, leaving the necessary openings for the convenience of commerce.

(*c*) To extend the sand-catch pier to the established pierhead line.

This project has been completed, except the maintenance of existing structures, etc., as noted in (*a*), and an extension of the Stony Point section of the breakwater, for which funds were appropriated in the sundry civil act of March 3, 1905. This work is for the purpose of providing shelter for the part of the harbor injuriously affected by waves coming through the opening in the breakwater at South Buffalo. The district officer estimates that it will cost $80,000 to finish the extension in addition to the amount already appropriated.

The timber-crib-concrete portion of the breakwater adjoining the stone breakwater has been strengthened by depositing a riprap of heavy stone along the sea face.

The timber-crib portion of the south harbor section was damaged by a storm December 27–28, 1904. It will be rebuilt and a stone superstructure placed on it.

The further strengthening of the stone breakwater and timber-crib-concrete portion adjoining it is essential to place these structures in a thoroughly stable and permanent form.

The total amount expended by the United States on the improvement of Buffalo Harbor to June 30, 1905, was $4,993,263.30. It is impracticable to separate the cost of construction and maintenance.

A good harbor has been obtained. The principal features are north and south piers and the entrance channel between them at the mouth of Buffalo Creek, in which most of the business of the port is done, and the outer breakwater system, consisting of four sections of breakwater of an aggregate length of 22,600 feet, inclosing an outer harbor 4½ miles long and over one-half mile wide. This breakwater system comprises 8,894 linear feet of breakwater finished in concrete,

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7,250 linear feet of stone or rubble mound type, and 6,456 feet of timber-crib breakwater.

The maximum draft that could be carried June 30, 1905, at mean water level over the shoalest part of the locality under improvement was 20 feet, except at the Stony Point end of the outer harbor basin, where the maximum draft is limited to 14 feet. The usual variation of level of water surface is from 3 to 4 feet, with maximum variation much greater.

Attention is called to the need of a storage ground, work yard, and slip, for loading and unloading timber and other materials used in harbor construction. The Government has no place for storage and dockage of this character, and the rental of property for the purpose is neither feasible nor desirable in a crowded port like Buffalo. The cost of providing such adequate storage facilities is estimated at $73,600, and it is recommended that the existing project be extended by Congress so as to provide for these facilities at the cost stated.

The commerce of Buffalo is large. During the year 1904 arrivals and departures of vessels by lake and river aggregated in number 7,375 and in tonnage 9,721,287.

The arrivals and departures of canal boats by the Erie Canal were 5,132 in number, with a tonnage of 988,725. The principal receipts by lake and river were wheat, corn, flour, oats, iron ore, lumber, copper, pig iron, glucose, lard, and pork. The total receipts amounted to 6,380,401 tons.

The shipments by lake were principally coal, sugar, salt, and cement, and aggregated 4,503,579 tons.

For comparison the following table is given, showing the arrivals and departures by lake and canal and the tonnage for the past five years:

Year.	Lake.		Canal.	
	Number.	Tonnage.	Number.	Tonnage.
1900	9,973	10,216,407	6,482	888,318
1901	11,599	10,454,680	6,812	1,653,384
1902	9,814	11,656,280	6,550	833,619
1903	8,727	11,586,719	6,974	1,324,216
1904	7,375	10,783,980	5,132	988,725

	Arrivals and departures.		Receipts of freight.		Shipments of freight.	
	1903.	1904.	1903.	1904.	1903.	1904.
Lake and river	8,727	7,375	7,479,991	6,280,401	4,318,281	4,503,579
Canal	6,974	5,132	577,444	424,492	746,772	564,233
Total	15,701	12,507	8,057,435	6,704,893	5,065,053	5,067,812

Total shipments and receipts:

	Tons.
1903	13,122,488
1904	11,772,705

For more extended information and maps and photographs, see Annual Reports of the Chief of Engineers since 1897.

A chart of Buffalo Harbor is issued in the series of charts of the survey of the Northern and Northwestern Lakes, index Ea 1.

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July 1, 1904, balance unexpended	$27,763.24
Amount appropriated by river and harbor act approved March 3, 1905	150,000.00
Amount appropriated by sundry civil act approved March 3, 1905	143,506.00
Amount received from sales	46.00
	321,315.24
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	20,787.17
July 1, 1905, balance unexpended	300,528.07
July 1, 1905, amount covered by uncompleted contracts	25,746.60
Amount (estimated) required for completion of existing project	80,000.00

(See Appendix Q Q 3.)

4. Lake Erie entrance to Black Rock Harbor and Erie Basin, New York.—The adopted project contemplates the formation, by dredging and rock removal, of a channel 2,300 feet long, 400 feet wide, and 23 feet deep at mean lake level, except where bed rock is found at a depth of 22 feet, from Buffalo main entrance channel to Erie Basin, and a branch channel and basin, 1,920 feet long, 500 feet wide, and 23 feet deep at mean lake level, to Black Rock Harbor, at an estimated cost of $814,643. The act of June 13, 1902, authorized the letting of a continuing contract in the sum of $614,643, exclusive of amount appropriated, for completing the work.

The plan of improvement is printed in House Document No. 125, Fifty-sixth Congress, second session, and in the Annual Report of the Chief of Engineers for 1901, page 3345.

The work was begun April 30, 1903, under a continuing contract for the whole work, to be completed under certain conditions of contract on or before December 31, 1906.

At the close of the fiscal year the channel from Buffalo main entrance channel to Erie Basin, though incomplete, was available for vessels of 18 feet draft.

A small amount of work had been done in the basin to Black Rock Harbor.

The total amount expended on the project to June 30, 1905, was $177,683.45, all for works of improvement.

The maximum draft that could be carried over the shoalest part of the locality under improvement at mean lake level June 30, 1905, was 10 feet, and the usual variation of level of water surface from 3 to 4 feet, with maximum variation much greater.

For commercial statistics, see report on Buffalo Harbor, New York.

The locality is shown on a chart of Buffalo Harbor and Niagara River to the Falls, issued in the series of charts of the survey of the Northern and Northwestern Lakes, index Ea 1, and of an index map facing page 2142, Annual Report of the Chief of Engineers for 1903.

July 1, 1904, balance unexpended	$376,607.10
Amount appropriated by sundry civil act approved March 3, 1905	52,000.00
	428,607.10
June 30, 1905, amount expended during fiscal year, for works of improvement	29,290.55
July 1, 1905, balance unexpended	399,316.55
July 1, 1905, amount covered by uncompleted contracts	634,136.56
Amount (estimated) required for completion of existing project	237,643.00

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Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	$237,643.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix Q Q 4.)

5. Buffalo entrance to Erie Basin and Black Rock Harbor, New York.—The first appropriation—$50,000—for this improvement was made March 3, 1899, and an appropriation of $191,701.25 was made June 6, 1900, to complete the work.

The adopted project is to build a breakwater about 2,200 feet long, covering and protecting the entrance to Erie Basin and Black Rock Harbor and the lake front of Buffalo Harbor between the State structures known as the Erie Basin breakwater and the Bird Island pier.

The project has been completed and the breakwater is the northerly section of the outer breakwater system forming the outer harbor of Buffalo.

The amount expended to June 30, 1905, was $238,436.81, of which $236,278.10 was for construction and $2,158.71 was for maintenance. No money was expended during the past fiscal year.

The maximum draft that could be carried over the shoalest part of the locality under improvement at mean water level June 30, 1905, was 20 feet, and the usual variation of level of water surface is from 3 to 4 feet, with maximum variation much greater.

For commercial statistics see report on Buffalo Harbor.

For more extended information see Annual Report of the Chief of Engineers for 1897, page 3246 et seq., and for 1901, page 3324 et seq.

The locality is shown on a chart of Buffalo Harbor and Niagara River to the Falls, issued in the series of charts of the survey of the Northern and Northwestern Lakes, index No. Ea 1, and on an index map facing page 2143, Annual Report of the Chief of Engineers for 1903.

July 1, 1904, balance unexpended	$3,264.44
July 1, 1905, balance unexpended	3,264.44

(See Appendix Q Q 5.)

6. Black Rock Harbor and channel, New York.—This is a new work, the first appropriation for which was made by the river and harbor act of March 3, 1905, as follows:

For improvement in accordance with the report contained in House Document Numbered Four hundred and twenty-eight, Fifty-eighth Congress, second session, one hundred thousand dollars:

Provided, That a contract or contracts may be entered into by the Secretary of War for such materials and work as may be necessary to prosecute such project, to be paid for as appropriations may from time to time be made by law, not to exceed in the aggregate six hundred thousand dollars, in addition to the sum herein appropriated:

Provided further, That no portion of the amount herein provided shall be expended until the Secretary of War shall have satisfactory assurance of the construction of the barge canal project by the State of New York:

And provided further, That the Secretary of War shall report as to whether any portion of the expense of the improvement proposed by said House document ought in equity be borne by the abutting owners of the property along which such improvements are to be made, in consideration of any special benefits derived by such property owners through such improvements.

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Black Rock Harbor is in reality a canal built along the east bank of Niagara River, located partially between the main shore and Squaw Island, and having at its lower end a lock 36½ feet wide by 200 feet long, and a depth of 9½ feet on miter sills at mean lake level. This harbor, or canal, is separated from the Erie Canal by a wall of stone and earth.

The object of the improvement is to provide a channel for deep-draft vessels between Buffalo and Tonawanda around the rapids at the head of Niagara River. This is to be accomplished by making a channel 200 feet wide and 23 feet deep at mean lake level, joining at the foot of Maryland street, Buffalo, the 23-foot channel now under contract, the proposed channel to extend westerly and northerly, through Black Rock Harbor and the Erie Canal combined, to the present lock, where a ship lock of the requisite capacity is to be built, the channel to extend from the foot of the ship lock through the Niagara River to deep water above Tonawanda, 400 feet wide and 23 feet deep at mean river level.

Report of survey is printed on page 3284 et seq. of report for 1904.

No funds have yet been expended on this work, no action having yet been taken by the State of New York on an application dated March 27, 1905, for certain lands and structures needed in the prosecution of the work.

The maximum draft that could be carried June 30, 1905, at mean lake level over the shoalest part of the locality under improvement was 8 feet, and the usual variation of water surface is from 3 to 4 feet.

The locality is shown on United States Lake Survey chart No. Ea 1.

For commercial statistics, see report on Buffalo Harbor and on Tonawanda Harbor and Niagara River, New York.

Amount appropriated by river and harbor act approved March 3, 1905	$100,000.00
July 1, 1905, balance unexpended	100,000.00
Amount (estimated) required for completion of existing project	4,400,000.00

(See Appendix Q Q 6.)

7. Tonawanda Harbor and Niagara River, New York.—In its original condition the navigation of Niagara River from Lake Erie to Tonawanda was obstructed by several reefs and shoals, which materially limited the draft of vessels traversing it, and the river in some places has a very swift current. The water in the harbor between Tonawanda Island and the mainland was shoal.

The adopted project of April 11, 1888, is to remove obstructions, so as to make a channel 400 feet wide and 18 feet deep at mean river level, which includes work at the following places:

(*a*) On the Horseshoe reef at the entrance to Niagara River.

(*b*) On the reef at Strawberry Island.

(*c*) On shoal abreast of Rattlesnake Island.

(*d*) The full width of the river between Tonawanda Island and the mainland along the front of Tonawanda and North Tonawanda.

This project was extended June 3, 1896, to include the river to the north line of the village of North Tonawanda, and June 13, 1902, to include the dredging of Tonawanda Harbor.

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The project is completed, except at the Buffalo waterworks intake pier, where the width of the channel is about 25 feet, and from the Tonawanda Iron and Steel Company's docks to the north line of North Tonawanda, where the depth is from 12 to 15 feet. The amount expended to June 30, 1905, was $652,436.67, all for excavation.

No work is proposed for the ensuing fiscal year.

The commerce of Tonawanda is large. During the year 1904 there were entered and cleared 1,487 lake craft, with a tonnage of 880,662 tons. The receipts were principally lumber, iron ore, and limestone, and aggregated 906,820 tons. The shipments from Tonawanda are entirely by Erie Canal.

The maximum draft that could be carried June 30, 1905, at mean water level over the shoalest part of the locality under improvement was 15 feet, and the usual variation of level of water surface is 2 feet.

A chart of Niagara River to the Falls is issued in the series of charts of the Northern and Northwestern Lakes, index Ea 1.

July 1, 1904, balance unexpended	$110,323.05
June 30, 1905, amount expended during fiscal year, for works of improvement	80,059.72
July 1, 1905, balance unexpended	30,263.33
Amount (estimated) required for completion of existing project	497,287.93

(See Appendix Q Q 7.)

8. Removing sunken vessels or craft obstructing or endangering navigation.—On November 25, 1904, the lumber barge *Massasoit* drifted down the Niagara River and lodged against the intake pier of the Buffalo waterworks, where the channel is swift and narrow, being about 100 feet in width.

The wreck was dislodged from the pier in small pieces by the city authorities and became a menace to navigation.

The matter was reported to the Chief of Engineers January 20, 1905, and an allotment of $500 was made February 2, 1905, for the purpose of removing the obstruction.

It is thought that when the ice went out in the spring freshet the small pieces of the wreck were carried down and lodged on shoals or dropped into deep holes outside of the channel, as search has been made in the channels and nothing found.

The funds will be kept on hand in order to remove any pieces that may be found later.

On July 9, 1904, a report was received that a large spar, apparently fastened to wreckage, projected out of the water of Lake Erie about 20 miles southwest by west from Buffalo, in the track of steamers.

An investigation was made and, it being found a menace to navigation, an allotment of $65 was made and the spar removed July 22, 1904.

IMPROVEMENT OF HARBORS ON LAKE ONTARIO AND OF ST. LAWRENCE RIVER AND HARBORS THEREON, NEW YORK.

This district was in the temporary charge of First Lieut. Paul S. Bond, Corps of Engineers, until August 25, 1904, and of Col. H. M. Adams, Corps of Engineers, since that date. Division engineer, Col. Amos Stickney, Corps of Engineers.

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1. Harbors at Wilson and Oak Orchard, N. Y.—(a) Wilson Harbor.—This harbor is at the mouth of Twelvemile Creek. In its original condition there was a depth on the bar of 1 foot. In 1846 two piers were built by private enterprise about 400 feet into the lake.

The original project of 1873 for improvement by the General Government was to extend the piers to the 12-foot curve in Lake Ontario and to dredge a channel 12 feet deep between the piers and to deep water in the creek, at an estimated cost of $90,000, increased in 1877 to $100,000. January 10, 1900, the project was modified to obtain and maintain a depth of 10 feet at extreme low water, seven-tenths foot below zero of Oswego gauge or low water, without further extension of the piers, at least for the present.

The river and harbor act of June 13, 1902, contained an item making an appropriation of $4,500 for improving harbors at Wilson and Oak Orchard, N. Y. The distribution of this appropriation between the two harbors decided upon and approved was to allot one-half, or $2,250, to each of the harbors, the allotment to Wilson Harbor to be expended in repairs to the piers, and, if investigation showed it necessary, to dredge the entrance channel. This allotment was made by the Secretary of War July 16, 1902.

The amount expended to June 30, 1905, was $74,256.93, of which $16,914.48 was applied to maintenance of improvement.

During the fiscal year ending June 30, 1905, no work was done.

The river and harbor act of March 3, 1905, repeals the provisions of all previous acts providing for work at this harbor, and directs that any amounts remaining unexpended shall be paid into the Treasury of the United States.

Under the provisions of this act the unexpended funds were paid into the Treasury March 21, 1905.

The maximum draft that could be carried into this harbor at low water June 30, 1905, was 7 feet, and the usual variation of level of water surface is 3 feet.

The following is a statement of the commerce of this port for the years given:

	Tons.		Tons.
1899	124	1902	148
1900	653	1903	489
1901	312	1904	173

For more extended information and sketch, see Annual Report of the Chief of Engineers for 1889, page 2395 et seq.

July 1, 1904, balance unexpended	$493.57
June 30, 1905, covered into the surplus fund of the Treasury	493.57

(b) Oak Orchard Harbor.—This harbor is at the mouth of Oak Orchard Creek, and in its original condition had about 3 feet of water on the bar.

The original project, adopted in 1836 and finally revised in 1881, was to narrow the mouth of the creek to 200 feet by two breakwaters running along the lake shore, and to make a 12-foot channel between parallel piers, connecting with the breakwaters, from deep water in the creek to the 12-foot curve in the lake. The estimated cost is not known.

The piers were built west 1,300 feet long, east 920 feet long, and a shore protection added extending 90 feet easterly from the shore end

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of the east pier. The channel was dredged about 150 feet wide and 11½ feet deep at low water between the piers. At the ends of the piers, where the rock excavation ceased, the depth is 9¾ feet at low water (zero of Oswego gauge) over the rock.

These piers are intact but decayed, and the channel fills in with sand. No work was done on this harbor for several years (from 1895 to 1902), no funds being available.

The river and harbor act of June 13, 1902, contained an item appropriating $4,500 for improving Wilson and Oak Orchard harbors. The distribution of the appropriation between the two harbors decided upon and approved was to allot one-half, or $2,250, to each of the harbors, the allotment for Oak Orchard Harbor to be expended in repairs to the piers and, if investigation showed it necessary, to dredge the entrance channel. This allotment was made by the Secretary of War July 16, 1902.

The amount expended to June 30, 1905, was $206,615.79. The cost of construction and maintenance can not be separated.

During the past year minor repairs to the piers were made, at a cost of $773.76. No dredging was done in the channel.

The river and harbor act of March 3, 1905, repeals the provisions of all previous acts providing for work at this harbor, and directs that any amounts remaining unexpended shall be paid into the Treasury of the United States.

Under the provisions of this act the unexpended funds were paid into the Treasury March 21, 1905.

The maximum draft that could be carried June 30, 1905, over the shoalest part of the improvement was 9 feet at low water, and the usual variation of level of water surface is 3 feet.

The following is a statement of the commerce of this port for the years given:

	Tons.		Tons.
1901	375	1903	1,760
1902	477	1904	405

July 1, 1904, balance unexpended		$1,407.97
June 30, 1905, amount expended during fiscal year:		
For maintenance of improvement	$773.76	
Covered into surplus fund United States Treasury	634.21	
		1,407.97

(See Appendix R R 1.)

2. Harbor at Olcott, N. Y.—This harbor is at the mouth of Eighteenmile Creek. In its original condition there was a depth of 3 feet on the bar.

The original project, adopted in 1867, provided for a channel 11 feet deep and 150 feet wide between parallel piers about 200 feet apart. The piers were built—east pier 850 feet and west pier 873 feet long—and the channel dredged 11 feet deep. In 1891 a new project was adopted calling for a depth of 13½ feet from the Main Street Bridge to deep water in the lake. The adopted plane of reference is low water of Lake Ontario (zero of the Oswego gauge). The width of the channel of the project is 180 feet between the piers, narrowing to 98 feet at Main Street Bridge.

The piers are intact, but in need of extensive repairs, and the channel fills in rapidly and requires dredging annually to maintain the required depth.

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The amount expended to June 30, 1905, was $177,829.41. It is impracticable to separate the cost of construction and maintenance.

During the past fiscal year no work was done and none is proposed, funds not being available.

The maximum draft that could be carried June 30, 1905, over the shoalest part of the improvement was 10 feet at low water. The usual variation of level of water surface is 3 feet.

The commerce of Olcott is small, but a considerable excursion business is developing.

The following is a statement of the commerce of this port for the years given:

	Tons.
1902	477
1903	1,760
1904	None.

For more extended information and map, see Annual Report of the Chief of Engineers for 1891, page 2893 et seq.

July 1, 1904, balance unexpended	$174.29
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	3.70
July 1, 1905, balance unexpended	170.59

(See Appendix R R 2.)

3. Harbor at Charlotte, N. Y.—This harbor is at the mouth of the Genesee River. In its original condition vessels of more than 8 feet draft could not cross the bar.

The original project of 1829 was to secure a channel 12 feet deep across the bar by constructing parallel piers to confine and direct the action of spring freshets. The present project, of 1882, is to obtain a depth of 15 feet by extending the two piers a total of 3,250 feet and by dredging. After the piers had been extended 1,444 feet the project was modified July 18, 1896, to preserve the depth by dredging without further extension of the piers for the present, and March 2, 1897, it was again modified to obtain and maintain not less than 16 feet and not more than 16½ feet at low water (zero of Oswego gauge) in a channel not more than 200 feet wide.

The amount expended to June 30, 1905, was $588,084.73. It is impracticable to separate the cost of construction and maintenance.

During the fiscal year the entrance channel was dredged where most urgently needed, the old superstructure on 316 feet of the west pier was removed, the substructure repaired, and a new concrete superstructure built, and urgent repairs were made to the superstructure of both piers.

June 30, 1905, the maximum draft that could be carried in the channel at low water was 15 feet, and the usual variation of level of water surface is 3 feet.

The Genesee River is navigable for lake vessels for a distance of about 2½ miles above its mouth.

The following is a statement of the commerce at this port during the past ten years:

	Tons.		Tons.
1895	369,417	1900	399,605
1896	444,557	1901	549,207
1897	385,981	1902	557,690
1898	483,850	1903	569,169
1899	447,428	1904	554,212

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The work proposed for the ensuing fiscal year, to make the improvement available, is to make necessary repairs to piers and to dredge the channel.

For more extended information and map, see Annual Report of the Chief of Engineers for 1881, page 2436.

A chart of Charlotte Harbor is issued in the series of charts of the survey of the Northern and Northwestern Lakes, index On 1.

July 1, 1904, balance unexpended		$24,932.39
Amount appropriated by river and harbor act approved March 3, 1905		80,000.00
		104,932.39
June 30, 1905:		
Amount expended during fiscal year, for maintenance of improvement	$28,188.72	
Turned into Treasury	1,269.07	
		29,457.79
July 1, 1905, balance unexpended		75,474.60

(See Appendix R R 3.)

4. Harbor at Great Sodus Bay, New York.—In its original condition the channel connecting this bay with Lake Ontario was wide and impracticable for vessels drawing over 8 feet.

The original project of 1829 was to narrow the entrance by constructing two converging breakwaters and to secure a channel 12 feet deep by building two parallel piers about 450 feet apart connecting with the ends of the breakwater and by dredging. The present project, of 1882, is to obtain a depth of 15 feet at low water (zero of Oswego gauge) by extending the two piers a total of 1,100 feet and by dredging. After the piers had been extended 519 feet to their present lengths—west pier, 1,580 feet; east pier, 1,294 feet—the project was modified July 18, 1896, to restore and maintain the channel 150 feet wide between the piers, flaring to 250 feet in the lake to the requisite depth of 15 feet at low water, by dredging, without further extension of the piers for the present.

The amount expended to June 30, 1905, was $495,328.35, of which $87,076.55 was for maintenance.

During the past fiscal year $950.96 from the regular appropriation and $1,054.73 from the emergency allotment of $1,250, made June 3, 1904, was expended on dredging and pier repairs.

The minimum depth June 30, 1905, was 13 feet at low water in a channel width of 150 feet, and the usual variation of level of water surface is 3 feet.

The following is a statement of commerce at this port for the past ten years:

	Tons.		Tons.
1895	43,566	1900	84,379
1896	36,361	1901	57,730
1897	36,361	1902	26,726
1898	79,709	1903	18,875
1899	78,885	1904	30,797

For more extended information and map, see Annual Report of the Chief of Engineers for 1881, page 2441 et seq.

A chart of Great Sodus Bay is issued in the series of charts of the survey of the Northern and Northwestern Lakes, index Om 3.

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July 1, 1904, balance unexpended	$2,575.14
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	2,005.69
July 1, 1905, balance unexpended	569.45

(See Appendix R R 4.)

5. Harbor at Little Sodus Bay, New York.—In its original condition the channel connecting this bay with Lake Ontario was about 150 feet wide and 18 inches deep.

The original project of 1854 was to protect the channel by building two parallel piers 250 feet apart across the bar to the 15-foot curve in the lake and to connect them with the shore by breakwaters. In 1867 this project was modified to provide for dredging to the depth of 12 feet. The present project, of 1882, is to obtain a depth of 15 feet at low water (zero of Oswego gauge) by extending the piers to the 15-foot curve in the lake and by dredging. After the piers had been extended 835 feet to their present lengths—west pier, 1,747 feet; east pier, 1,510 feet—the project was modified June 29, 1898, to restore and maintain the entrance channel, 150 feet wide, to the requisite depth of 15 feet, by dredging, without further extension of the piers for the present, and this was modified by the river and harbor act of June 13, 1902, to extend the east pier 300 feet.

The amount expended to June 30, 1905, was $346,881.30, of which $65,038.51 was applied to maintenance of improvement.

During the past fiscal year the extension of the east pier has been in progress under contract and it will be completed early in the next fiscal year. The replacing with concrete of about 600 feet of timber superstructure on the east pier was begun in May, 1905, and will continue through the next fiscal year.

Urgent repairs to piers were made, at a cost of $820.96, from the emergency allotment of $2,000 made June 3, 1904.

The minimum depth over the shoalest part of the locality under improvement June 30, 1905, was 13 feet at low water in a channel width of 150 feet, and the usual variation of level of water surface is 3 feet.

The following is a statement of commerce at this port for ten years:

	Tons.		Tons.
1895	63,708	1900	59,511
1896	65,418	1901	135,118
1897	68,888	1902	52,543
1898	50,339	1903	120,692
1899	81,969	1904	137,258

Work proposed for the ensuing fiscal year, necessary to make the improvement available, consists in maintenance of channel and piers.

For more extended information and map, see Annual Report of the Chief of Engineers for 1881, page 2443 et seq.

A chart of Little Sodus Bay is issued in the series of charts of the survey of the Northern and Northwestern Lakes, index No. Ol 9.

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July 1, 1904, balance unexpended		$22,383.57
Amount appropriated by river and harbor act approved March 3, 1905		30,000.00
		52,383.57
June 30, 1905:		
Amount expended during fiscal year, for maintenance of improvement	$3,822.10	
Turned into Treasury	1,179.04	
		5,001.14
July 1, 1905, balance unexpended		47,382.43
July 1, 1905, amount covered by uncompleted contracts		20,016.00

(See Appendix R R 5.)

6. Harbor at Oswego, N. Y.—This harbor comprises the lower part of Oswego River, a cove at its mouth, protected by a breakwater now known as the inner breakwater, and an outer harbor formed by an outer breakwater. In its original condition the harbor in the Oswego River was navigable by vessels of light draft only, and the cove had no protection against the lake seas.

The original project of 1827 (completed in 1829) was to build across the cove a breakwater of timber cribs filled with stone. Between 1830 and 1838 a superstructure of masonry was built on 500 feet of this breakwater. Between 1866 and 1869 $41,000 was expended in dredging the harbor to the depth of 12 feet at extreme low water. Between 1868 and 1870 a light-house pier was built, extending north 437 feet from the channel end of the breakwater. In 1871 the project for an outer harbor formed by an outer breakwater was adopted, and in 1881 an outer breakwater was completed having a lake face 4,870 feet long, a westerly shore return 916 feet long, and an easterly return 246 feet long. In 1881 a project was adopted to build an east breakwater, 248 feet of which was constructed in 1881 and removed in 1889. In 1885 and 1889 two spurs to the outer breakwater, 100 and 150 feet long, respectively, were built.

In the acts of March 3, 1893, and August 18, 1894, special provisions were made for extending the deep-water area of the harbor in the mouth of the Oswego River by the removal of rock.

The present project was adopted June 3, 1896, based on a special report printed in the Annual Report of the Chief of Engineers for 1895, page 3213 et seq., and as subsequently modified is: First, to build an east breakwater 1,435 feet long, at an estimated cost of $197,000 (acts of March 3, 1895, and June 3, 1896); second, to narrow the breach made in the outer breakwater in 1884 from 175 to about 75 feet, at an estimated cost of $18,500; third, to widen and deepen the inner harbor in the mouth of the Oswego River and to extend the deep-water area farther upstream by rock excavation.

There are 5,907 feet of outer breakwater and 1,993 feet of inner breakwater and light-house pier, forming an outer harbor containing 140 acres and an inner harbor containing 9.35 acres (including the Oswego River). The areas having a controlling depth of 14.5 feet at low water are 40 acres in the outer harbor and 4½ acres in the inner harbor.

Under maintenance there is required: The maintenance of the outer breakwater and inner breakwater and light-house pier, the

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maintenance of a depth of 15.7 feet at low water in the entrance channel and in the outer harbor, and the maintenance of a depth of 15 feet at low water in the cove behind the inner breakwater and in the harbor in the mouth of Oswego River.

The plane of reference is low water (zero of Oswego gauge).

The outer breakwater is a weak structure, difficult and costly to maintain.

The river and harbor act of March 3, 1905, makes an appropriation for continuing repairs under the present method, printed as plan "b" on page 3368, Report of the Chief of Engineers for 1904.

The amount expended to June 30, 1905, was $2,013,194.70. It is impracticable to separate the cost of construction and maintenance.

During the fiscal year the inner breakwater was repaired where absolutely necessary, and the removal of shoals in the outer harbor and entrance channel was carried on in connection with the breakwater repairs.

Rock removal to a depth of 15 feet at low water was carried upstream in the Oswego River to the north line of Seneca street.

June 30, 1905, the minimum depth at low water over the shoalest part of the locality under improvement was 14½ feet.

The usual variation of level of water surface is 3 feet.

The following is a statement of the commerce of this harbor for the past ten years:

	Tons.		Tons.
1895	749, 575	1900	575, 160
1896	783, 972	1901	565, 052
1897	706, 805	1902	334, 009
1898	615, 503	1903	733, 734
1899	716, 753	1904	712, 481

Work proposed for the ensuing fiscal year, necessary to make the improvements available and extend its benefits, consists in dredging on shoals as may be required in the outer harbor and entrance channel, and repairs on the outer and inner breakwaters.

Report of survey of the outer breakwater is printed on page 3363 et seq. of the report for 1904.

For more extended information and map see Annual Report of the Chief of Engineers for 1881, page 2451 et seq.

A chart of Oswego Harbor is published in the series of charts of the survey of the Northern and Northwestern Lakes, index Ol 7, and an index map facing page 2160 of the Annual Report of the Chief of Engineers for 1903.

July 1, 1904, balance unexpended	$28, 392. 32
Amount appropriated by river and harbor act approved March 3, 1905	100, 000. 00
	128, 392. 32
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	17, 906. 15
July 1, 1905, balance unexpended	110, 486. 17

(See Appendix R R 6.)

7. Harbor at Cape Vincent, N. Y.—This harbor is an open roadstead on the St. Lawrence River 2½ miles from Lake Ontario, and is a convenient location for vessels to lie during storms at night and in thick weather.

The original project of 1896 was to build a breakwater parallel to

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and 600 feet from the railroad wharf, 1,600 feet long, at an estimated cost of $320,000. On May 13, 1899, this project was modified to build a breakwater parallel to and 500 feet from the railroad wharf, 1,550 feet long, of which length 150 feet, or so much thereof as required, was to be a shore return at upper end, at an estimated cost of $200,000. Four hundred and ten feet of this breakwater, of which 50 feet was shore return, was built in 1900, 300 feet was finished in June, 1905, and 200 feet is under contract.

The amount expended to June 30, 1905, was $62,984.05, all for construction.

The maximum draft that could be carried over the locality under improvement at low water June 30, 1905, was 19 feet, and the usual variation of level of water surface is 3 feet.

The commerce of Cape Vincent is not large. This improvement is intended to make a harbor of refuge for all craft plying between Lake Ontario and the St. Lawrence River.

The following is a statement of the commerce of this port for the years given:

	Tons.		Tons.
1900	10,721	1903	15,666
1901	4,209	1904	20,083
1902	4,175		

Work proposed for the next fiscal year necessary to make the improvement available is to continue the extension of the breakwater as far as the funds that may be appropriated will permit.

For more extended information and map, see Annual Report of the Chief of Engineers for 1897, page 3286 et seq., and for 1903, page 2162 et seq.

July 1, 1904, balance unexpended	$36,789.83
Amount appropriated by river and harbor act approved March 3, 1905	30,000.00
	66,789.83
June 30, 1905, amount expended during fiscal year, for works of improvement	1,773.88
July 1, 1905, balance unexpended	65,015.95
July 1, 1905, amount covered by uncompleted contracts	63,107.11
Amount (estimated) required for completion of existing project	72,000.00

(See Appendix R R 7.)

8. Shoals in the St. Lawrence River between Ogdensburg and the foot of Lake Ontario.—In its original condition the channel of the St. Lawrence River, from Sister Island light down to the head of Brockville Narrows, was obstructed by 12 ledges on which the depth was 9½ to 16 feet at low water.

The original project, act of September 19, 1890, was to remove to 18 feet below the zero of the Ogdensburg gauge ledges between Sister Island and Crossover lights, at an estimated cost of $43,305. In 1893, owing to the discovery of several outlying spurs, the estimated cost was increased to $54,772. By the act of June 3, 1896, the project was extended to embrace ledges in the St. Lawrence River between Ogdensburg and the foot of Lake Ontario.

April 13, 1897, the removal of the obstructions to a depth of 1.4 feet greater, i. e., to 18 feet below the zero of the Oswego gauge, was included in the project, thereby increasing the total estimated cost to $108,000.

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The amount expended to June 30, 1905, was $68,000, all for works of improvement. No work was done during the past fiscal year owing to lack of funds.

There were twelve dangerous shoals and rock ledges in or near the track of vessels, of which nine (all the rock ledges in United States waters) have been removed to 18 feet below the zero of the Oswego gauge.

There still remain to be removed three or more rock ledges and shoals in Canadian waters, which are included in the project. Application for permission to remove these shoals was made through the Department of State to the Canadian government, and on December 22, 1899, the necessary permission was granted.

No work is proposed for the next fiscal year, no funds being available.

The maximum draft that could be carried over the locality under improvement at low water June 30, 1905, was 16 feet, and the usual variation of level of water surface is 3 feet.

All the commerce of the St. Lawrence River is benefited by this improvement.

For more extended information, see Annual Report of the Chief of Engineers for 1901, pages 3373 et seq.

Amount (estimated) required for completion of existing project.... $40,000.00

(See Appendix R R 8.)

9. Harbor at Ogdensburg, N. Y.—In its original condition the low-water depth in this harbor was 9 feet in the upper entrance channel leading to the Oswegatchie River, 10 to 12 feet in the two lower entrance channels, and 6 to 12 feet along the city front.

The original project of 1868 was to dredge the channels to the depth of 12 feet, and to build, if necessary, 5,500 linear feet of piers, at an estimated cost of $100,000. The piers were never built. The project of 1882 provided for dredging the upper entrance channel from the St. Lawrence River channel across the shoal to and into the mouth of the Oswegatchie to 16 feet and the lower entrance channels and channels along the city front to 15 feet at extreme low water, at an estimated cost of $75,000. The present project (see Annual Report of the Chief of Engineers for 1890, p. 2872) provided for dredging all the channels to a depth of 16.5 feet below the zero of the Ogdensburg gauge (15 feet below the zero of the Oswego gauge), at an estimated cost of $158,950. The project was modified February 27, 1897, to deepen the two lower entrance channels to 16 feet below the zero of the Oswego gauge, and by act of March 3, 1899, further modified to dredge 900 feet of the channel along the front of Ogdensburg above Franklin street to but 14 feet below the same zero, the projected depths of the upper entrance channel to and into the mouth of the Oswegatchie River up to the bridge, and the balance of the channel along the city front to remain 15 feet. The dredging of all of the channels of the project was completed in July, 1903, but they are not stable, and frequent redredging is necessary to maintain the required depths.

The amount expended to June 30, 1905, was $317,224.94, of which $45,505.73 was applied to maintenance of improvement.

The maximum draft that could be carried over the improvement at low water (zero, Oswego gauge) June 30, 1905, was as follows: In

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the lower entrance channels, 15½ feet; in the channel along the city front, 12 feet; elsewhere, 15 feet. The usual variation of level of water surface is 3 feet.

The following is a statement of commerce at this port for the past ten years:

	Tons.		Tons.
1895	693, 825	1900	646, 248
1896	886, 438	1901	439, 148
1897	866, 035	1902	837, 025
1898	645, 201	1903	1, 185, 785
1899	670, 363	1904	898, 257

Work proposed for the ensuing fiscal year necessary to make the improvement available consists in dredging channels wherever necessary.

For more extended information and map, see Annual Report of the Chief of Engineers for 1881, page 2451 et seq.

A chart of Ogdensburg Harbor, now in preparation, will be published in the series of charts of the survey of the Northern and Northwestern Lakes.

An index map is printed in the Annual Report of the Chief of Engineers for 1903, facing page 2166.

July 1, 1904, balance unexpended	$274. 31
Amount appropriated by river and harbor act approved March 3, 1905	15, 000. 00
	15, 274. 31
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	143. 69
July 1, 1905, balance unexpended	15, 130. 62
July 1, 1905, amount covered by uncompleted contracts	14, 000. 00

(See Appendix R R 9.)

10. St. Lawrence River at the head of Long Sault Island, New York.—The sum of $48,000 was appropriated by the river and harbor act of June 13, 1902, for improvement of this locality by dredging a channel 1,700 feet long, 150 feet wide, and 18 feet deep across a shoal at the head of Long Sault Island.

This appropriation was made subject to certain conditions respecting the use free of toll, etc., of the canal of the St. Lawrence Power Company from the St. Lawrence River to Massena, but the company having declined to comply with said conditions, obtained permission, under the provisions of section 1 of the said act, to do the proposed work itself, and no work has been done by the United States.

Pursuant to the provisions of section 7 of the river and harbor act of March 3, 1905, which repealed the previous action of Congress providing for the prosecution of this work, the available funds have been covered into the surplus fund, United States Treasury.

July 1, 1904, balance unexpended	$48, 000. 00
June 30, 1905, covered into surplus fund, United States Treasury	48. 000. 00

PACIFIC COAST.

IMPROVEMENT OF HARBORS IN CALIFORNIA SOUTH OF SAN FRANCISCO.

This district was in the charge of Capt. C. H. McKinstry, Corps of Engineers. Division engineer, Col. D. P. Heap, Corps of Engineers

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(now brigadier-general, U. S. Army, retired), until October 16, 1904, and Col. T. H. Handbury, Corps of Engineers, since that date.

1. San Diego Harbor, California.—San Diego Harbor is just north of the national boundary of Mexico and 482 nautical miles south of San Francisco.

The river and harbor act approved March 3, 1875, appropriated $80,000 for the construction of a dike across the mouth of San Diego River, causing it to empty into False Bay and thus preventing San Diego Harbor from being injured by the deposit of material brought down during flood stages. This work was completed in 1876, at a cost of $79,798.72, which, with the cost of repairs made up to the time of adoption of the present project, brought the total expenditures to $81,918.45.

The present project for the improvement of the harbor, adopted by the river and harbor act approved September 19, 1890, provided for the construction of a jetty on Zuninga shoal, at the entrance to the harbor; the maintenance of a channel 24 feet deep at mean low tide and 500 feet wide through the "middle ground," and for repairs to restraining dike. The jetty was to rise to the height of extreme high water and to be about 7,500 feet long, with a view to producing a depth of 26 feet at mean lower low water on the outer bar.

At the time of the adoption of this project the governing depth on the bar was 21 feet. Just inside the entrance was a middle ground carrying but 17 feet of water. The main channel, lying to the west of the middle ground, was of ample depth, but was difficult of navigation on account of two sharp turns.

The original estimated cost of this improvement was $394,400, but as work on the inner half of the jetty progressed under the different contracts it became evident that this sum would be inadequate. Therefore, under date of June 20, 1900, the local officer was authorized to change this estimated cost to $542,850.

The appropriation of $192,850 in the sundry civil act of March 3, 1903, brought the total of appropriations up to the amount of the revised estimate.

The amount expended on the present project up to the close of the fiscal year ending June 30, 1905, is $543,296.49. Of this, $4,913.58 was applied to maintenance, viz, to repairing the restraining dike. Further repairs to this dike have been made by the city of San Diego.

The jetty has been extended to its full contemplated length of 7,500 feet; a channel 26 feet deep and 271 feet wide (28 feet deep over a width of 171 feet) has been dredged across the outer bar, and a channel 26 feet deep and 400 feet wide has been dredged across the middle ground.

During a severe storm in March, 1905, the channel through the outer bar shoaled to 25 feet depth, which is the maximum draft that could be carried into San Diego Harbor on June 30, 1905, at mean lower low water. The average height of all high waters above the plane of reference is 4.8 feet. The increase of depth on the outer bar, 7 feet at the conclusion of dredging, now amounts to 4 feet; the increase of depth on the middle ground amounts to 9 feet.

The effect of this work of improvement will be to make the entrance of deep-draft vessels into this harbor easy and safe.

It is estimated that to maintain the bar channel and the channel across the middle ground will cost $15,000 annually.

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The river and harbor act of March 3, 1905, appropriated $10,000 for the maintenance of these channels. No work has as yet been done under this appropriation.

The commerce of this harbor was 121,686 tons for the calendar year 1904, a decrease of 7.6 per cent from that of the previous year. In character the commerce is unchanged since the preceding year. It consists principally of lumber, general merchandise, coal, and cement received, and of lumber, general merchandise, and ore shipped. The value of this commerce is estimated to be $4,092,000.

The coastwise trade is carried in vessels drawing from 12 to 18 feet of water, and is benefited but little by the improvement of the harbor. The American-Hawaiian steamers, of 8,000 to 10,000 tonnage, each enter this port once a month. These vessels draw about 26 feet of water and carry 1,000 to 2,000 tons of freight per month for San Diego. Freight for San Diego carried by the Panama steamers is delivered by coastwise steamers from San Francisco. The American-Hawaiian steamers and the Panama steamers have a rate from the Atlantic ports to San Diego averaging about 30 per cent cheaper than railroad rates. Foreign cements are received in this port in sailing vessels drawing 22 and 23 feet of water.

For reference to reports on examinations and surveys, see Annual Report of the Chief of Engineers for the year 1904, page 632.

July 1, 1904, balance unexpended	$55,871.80
Amount appropriated by river and harbor act approved March 3, 1905	10,000.00
	65,871.80
June 30, 1905, amount expended during fiscal year, for works of improvement	55,733.48
July 1, 1905, balance unexpended	10,138.32

(See Appendix S S 1.)

2. Deep-water harbor at San Pedro Bay, California.—The river and harbor act of June 3, 1896, provided for the appointment of a Board to determine upon the location of a deep-water harbor for commerce and for refuge in Santa Monica Bay, California, or at San Pedro, in the same State, the decision of a majority of the Board as to location to be final. The Board was to make plans, specifications, and estimates for said improvement. After the Board should have rendered its decision and submitted its report the Secretary of War was empowered to make contracts for the completion of the selected harbor in accordance with the project of the Board, at a cost not exceeding in the aggregate $2,900,000.

In accordance with the provisions of this act a Board was appointed, which submitted its report March 1, 1897, deciding in favor of San Pedro Bay. The report of the Board is printed in Senate Document No. 18, Fifty-fifth Congress, first session.

The plan of the Board (the present project of improvement) was to construct, to the eastward of Point Fermin, a breakwater about 8,500 feet long, or as much longer as could be constructed within the authorized limit of cost, $2,900,000, and it has been decided that a breakwater 9,000 feet long should be built. In plan the breakwater is to consist of two straight arms connected by a curve 1,800 feet in length, of 1,910 feet radius. The westerly arm is to be 3,000 feet long, pointing S. 72° E. (magnetic); the easterly arm, 3,700 feet

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long, pointing N. 54° E. (magnetic). A gap of about 2,000 feet is to be left between the east shore of Point Fermin and the westerly end of the breakwater.

Originally San Pedro Bay was an open roadstead exposed to southeasterly, southerly, and southwesterly winds. The effect of the breakwater will be to afford a place of refuge, easy of access, and secure from storms, for vessels of the largest size. It will also shelter the entrance to the inner harbor of San Pedro.

On August 12, 1898, a continuing contract was entered into with Heldmaier & Neu, of Chicago, Ill., for the construction of the breakwater, for $1,303,198.54. This contract was annulled on March 19, 1900, on account of unsatisfactory progress. Up to that time 84,581 tons of stone had been placed in the substructure, at a cost, including inspection, etc., of $51,537.43.

On June 7, 1900, a continuing contract for completing the breakwater was entered into with the California Construction Company, of San Francisco, Cal. The estimated cost of work under this contract, using the quantities on which bids were canvassed and the prices bid for stone and concrete, and allowing 10 per cent for engineering expenses and contingencies, is $2,613,100.66, in addition to expenditures under the former contract.

The amount expended under the project up to the close of the fiscal year ending June 30, 1905, is $1,848,955.01, including the expenditures of the Board referred to above.

Work was begun at the westerly end of the substructure. Up to June 30, 1905, 1,887,547 long tons of stone, at $0.844 per ton, had been deposited in the substructure under the present contract, and the substructure was about completed for a distance of 8,212 feet, and some stone had been deposited for a farther distance of 288 feet.

The superstructure was begun at a distance of 628 feet from the westerly end and is being built to the eastward. To June 30, 1905, 72,165 tons of stone had been placed in the superstructure, which was partially completed for a length of 2,872 feet. The amount of work done is the equivalent of 2,659 feet of completed work.

The protected area is used by vessels which have to lighter a part of their cargo or have to await a favorable tide before they can enter the inner harbor. The effect of continuing work under the existing project will be to enlarge the protected area and to increase the shelter afforded the entrance to the inner harbor.

For commercial statistics, see report on Wilmington Harbor. There are, as yet, no commercial wharves in the outer or breakwater harbor.

For reference to report on examinations and surveys, see Annual Report of the Chief of Engineers for the year 1904, page 634.

July 1, 1904, balance unexpended	$523,848.20
Amount appropriated by sundry civil act approved March 3, 1905	460,000.00
	983,848.20
June 30, 1905, amount expended during fiscal year, for works of improvement	415,718.16
July 1, 1905, balance unexpended	568,130.04
July 1, 1905, outstanding liabilities	46,742.51
July 1, 1905, balance available	521,387.53

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July 1, 1905, amount covered by uncompleted contracts	$820,869.35
Amount (estimated) required for completion of existing project	482,914.95
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	300,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix S S 2.)

3. Wilmington Harbor, California.—Wilmington is situated at the head of a small estuary which has its outlet in the bay of San Pedro, and is 393 nautical miles to the southward of San Francisco.

Previous to the commencement of the improvement, in 1871, there was a depth of less than 2 feet of water at low tide at the entrance.

The original project, approved July 1, 1871, contemplated gaining a depth of 10 feet at mean low tide. This depth was obtained in 1881, at a cost of $555,000, when a further project to increase depth of channel to 15 feet at mean low tide by dredging a reef between the jetties, raising existing works, and extending the jetties to 18 feet of water in San Pedro Bay, was submitted. This project was completed in 1893, at a cost of $399,497.68.

The river and harbor act of June 3, 1896, appropriated $50,000 for improving the harbor in accordance with a project submitted in 1894 for a channel depth of 18 feet at mean low tide, at an estimated cost of $392,725. Owing to certain provisos, however, this money was not available without further action by Congress.

The present project was adopted by the river and harbor act of June 13, 1902, and contemplates providing a channel 20 feet deep and 400 feet wide from the outer harbor to the foot of the wharves; and 24 feet deep between harbor lines from the foot of the wharves to and including a turning basin 1,600 feet in diameter just below Mormon Island. It also provides for repairs to the east jetty and for the construction of a dike to divert the waters of the Los Angeles River from Wilmington Lagoon. The same act made available the $50,000 appropriated by the act of June 3, 1896.

Changed conditions have rendered the building of the dike inadvisable.

The estimated cost of the work called for by the present project, including the procurement of a dredge, is $550,000.

The amount expended under the existing project to June 30, 1905, is $251,743.33.

Repairs have been made to the east jetty at a cost of $3,700. Dredging, under contract, to the depth of 21 feet has been done along the greater part of the dock fronts of San Pedro and East San Pedro, and to the depth of 20 feet at the entrance at a cost (contract payments only) of $100,215.40.

A 20-inch suction dredge has been built, at a cost, including inspection, of $99,453.33. The necessary discharge pipe line (2,048 feet long) and floating plant (pontons, barges, launch) have been added at a cost of $17,299.35.

The dredge was completed and turned over to the United States on March 10, 1905, since which time 243,914 cubic yards of material has been dredged in front of the wharves at Terminal and East San Pedro, at a cost of $17,788.42, office expenses not included.

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Work under the various projects above mentioned has resulted in increasing the depth at the entrance from 2 to slightly more than 18 feet, which is the maximum draft that could be carried into the inner harbor June 30, 1905, at mean lower low water. The average rise of the tides above this plane of reference is 5.1 feet.

The river and harbor act of March 3, 1905, appropriated $100,000 for continuing this work and authorized contracts in the sum of $150,000 more for completing it. About $70,000 will be expended in dredging the entrance to the harbor under contract, and the remainder in dredging with Government dredge and for contingencies.

For the calendar year 1904 the commerce of this port amounted to 845,220 tons, an increase of 9.9 per cent over the preceding year. In character the commerce is unchanged since the previous year. It consists principally of lumber, crude oil, and general merchandise received, and of general merchandise and crude oil shipped. Its value is estimated at about $9,000,000.

It is difficult to estimate accurately the effect of this improvement on freight rates. The principal traffic of the harbor is in lumber received from northern California, Oregon, and Washington and shipped inland by rail, and amounts for the calendar year 1904 to more than 780,000 tons. The water rate on lumber from Puget Sound points to Los Angeles is about $4.55 per ton; the railroad rate, $12.20 per ton. Without the improvement of Wilmington Harbor lumber would have to be unloaded at exposed piers or brought to Wilmington in vessels of light draft or lightered ashore. The saving in freight, lighterage charges, and insurance is large, but can not be definitely stated.

For reference to reports on examinations and surveys, see Annual Report of the Chief of Engineers for the year 1904, page 635.

July 1, 1904, balance unexpended	$191,687.67
Amount appropriated by river and harbor act approved March 3, 1905	100,000.00
Received from sale of property	7.50
	291,695.17
June 30, 1905, amount expended during fiscal year, for works of improvement	142,927.68
July 1, 1905, balance unexpended	148,767.49
July 1, 1905, outstanding liabilities	2,018.14
July 1, 1905, balance available	146,749.35
July 1, 1905, amount covered by uncompleted contracts	8,542.57
Amount (estimated) required for completion of existing project	149,496.68
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	100,000.00

(See Appendix S S 3.)

4. San Luis Obispo Harbor, California.—San Luis Obispo Harbor is 9 miles to the southward and westward of the town of San Luis Obispo and 216 nautical miles from San Francisco.

It is a bight of the coast about 18 miles long between Point San Luis on the north and Point Sal on the south. The upper end, where Port Harford is situated, has a wharf and is the part used for commercial

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purposes. Whaler reef, extending nearly half a mile to the southward and eastward of Point San Luis, forms more or less of a natural breakwater, but during the winter season the landing was exposed to the heavy swell caused by southerly gales.

The original project was adopted by the river and harbor act of August 11, 1888, and provided for the construction on Whaler reef of a breakwater of rubblestone rising to mean lower low water and extending from Point San Luis to Whaler Island and thence to a point where the outer reef rises above high water. Exclusive of Whaler Island, which is 245 feet long, the breakwater was to have a length of about 1,736 feet, and its estimated cost was $284,898.

This project was modified January 17, 1893, to provide for raising the structure to the height of 6 feet above mean high water, with a top width of 20 feet, and such side slopes as might be formed under the action of the sea. The estimated cost was increased to $568,660. This is the existing project.

The breakwater has been built to full section from Point San Luis to Whaler Island and for 1,160 feet beyond Whaler Island, or a total distance of 1,741 feet, including the island. The partially protected area has an available depth of 21 to 27 feet at low water and there is 22 feet at the Port Harford wharf. The result has been to give increased security to vessels in the anchorage and at the landing.

The amount expended on this work up to the close of the fiscal year ending June 30, 1905, is $279,503.35.

For the expenditure of the $25,000 appropriated by the river and harbor act of March 3, 1905, a contract was entered into with the City Street Improvement Company of San Francisco, Cal., on May 24, 1905, for the delivery in the breakwater of 8,868 tons of stone, at $2.65 per ton. No work under this contract has as yet been done.

Further work under the project will afford increased shelter, and further appropriations should be applied to the extension of the breakwater to its full projected length.

The commerce consists principally of lumber and general merchandise received, and grain and crude oil shipped. Its volume for 1904, 81,620 tons, exceeds that for 1903 by 35.4 per cent. The value of the commerce is estimated at $2,386,000.

It is impracticable to give definite figures relative to the influence of the project on freight rates. The following, however, may throw some light on the matter. The Union Oil Company pumps crude oil through a 6-inch pipe from its wells in the northern part of Santa Barbara County, a distance of 40 to 45 miles, to the landing at Port Harford, and thence ships it in tank vessels to the Hawaiian Islands and coast points. The Standard Oil Company also ships oil from this port. The cost of delivery of oil in San Francisco is about 6 cents per barrel and the oil is sold there for from 50 to 60 cents per barrel. The railway rate to San Francisco is about 60 cents per barrel. The present shipment of oil from this harbor is about 200,000 barrels per month, which will be greatly increased at an early date.

Reference to reports on examinations and surveys will be found in Annual Report of the Chief of Engineers for the year 1904, page 636.

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July 1, 1904, balance unexpended	$667.39
Amount appropriated by river and harbor act approved March 3, 1905	25,000.00
	25,667.39
June 30, 1905, amount expended during fiscal year, for works of improvement	169.79
July 1, 1905, balance unexpended	25,497.60
July 1, 1905, amount covered by uncompleted contracts	23,500.00
Amount (estimated) required for completion of existing project	263,659.05

(See Appendix S S 4.)

IMPROVEMENT OF RIVERS AND HARBORS IN CALIFORNIA TRIBUTARY TO AND NORTH OF SAN FRANCISCO BAY.

This district was in the charge of Col. W. H. Heuer, Corps of Engineers, having under his immediate orders First Lieut. Douglas MacArthur, Corps of Engineers, since April 30, 1905.

1. Harbor at Alviso, California.—A description of the locality and a history and description of the work are printed in the Annual Report of the Chief of Engineers for 1904, page 637.

Before improvement the channel depths at low water varied from 3 to 7 feet and widths from 40 to 800 feet. The tidal range varies from 7 to 11 feet.

There has been very little commerce on the slough since 1901. In that year about 16,000 tons, consisting of lumber, stone, coal, and tan bark, was received, and 11,500 tons of hay, barley, fruit, and vegetables was shipped out.

The village of Alviso is at the head of navigation. On June 30, 1905, 7-feet depths could be carried at low tide and fully 16 feet at high tide to the head of navigation.

On March 3, 1899, Congress appropriated $48,000 for the improvement. Contract for dredging was let in 1899. The contractor failed to do any work under it, and the contract expired by limitation. The surety company paid $10,000, the amount of its bond, to the Government. In 1900 the work was again contracted for and work was completed in June, 1901, at a cost of $27,543.47, furnishing a good channel 7 feet deep at low water and 60 to 80 feet wide throughout the length of the slough. On June 13, 1902, Congress made the unexpended balance available for extension and further improvement of the channel heretofore made.

In October, 1904, bids were opened for redredging the slough and contract was made at 17 cents per cubic yard for dredging in the channel and 35 cents per cubic yard for dredging hardpan in the turning basin.

Work under this contract was commenced on January 30, 1905, and completed on June 5, 1905. A total of 134,960 cubic yards of material was dredged from the channel, which is now 7 to 8 feet in depth at low water and 70 to 100 feet wide, to the former lumber yards at the upper end of Alviso. The turning basin, which was made at the lower end of the town, is 220 feet long, 150 feet wide, and 7 feet deep at low water. The total expenditure to June 30, 1905, was $54,293.97.

There has been no reduction in freight rates in consequence of the improvement. There is less commerce and navigation now than

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there was four years ago. The existing channel will readily accommodate all there is. The engineer officer in charge of the work considers Alviso Harbor and Slough at present unworthy of further improvement.

In accordance with requirement in the river and harbor act of March 3, 1905, the unexpended balance of this appropriation was turned into the surplus fund of the Treasury on June 30, 1905.

July 1, 1904, balance unexpended		$30,051.13
June 30, 1905:		
Amount expended during fiscal year, for works of improvement	$26,345.10	
Covered into surplus fund United States Treasury	3,706.03	
		30,051.13

(See Appendix T T 1.)

2. Redwood Creek, California.—Before improvement, there were shoals in the creek which were bare at low tide, and vessels used it only during medium and high stages of the tide. Project for improvement was made in 1882 to obtain, by dredging, channels aggregating 6,000 feet in length, 50 to 60 feet in width, and 2 to 3 feet in depth at low water, estimated to cost $15,400. From 1884 to 1888 appropriations aggregating $15,400 were made, and the work was completed in August, 1889. The channel was not self-maintaining, and in 1890 an additional appropriation of $8,000 was made by Congress. Channels were redredged and work was completed in 1892. The total amount expended to June 30, 1895, was $23,400.

In 1896 Congress ordered an examination which resulted in the existing project, which provides for a new channel to have a depth of about 5 feet at low water through a middle ground which was bare at low tide; dredging in front of the city wharf at Redwood City; building a dam of sheet piling across a navigable slough, and constructing a dike of timber and brush near but outside of the foot of the channel to be dredged through the middle ground. The estimated cost of the work was $8,400.

By act of June 13, 1902, Congress appropriated $8,400 for completing this improvement in accordance with the above project. Thereafter it was found that if one of the channels were closed by a dam it would interfere with free tidal movement necessary to maintain the larger channel to be dredged and that the dike contemplated outside of the foot of said channel might not be necessary. Contract was made for the dredging required, and a good channel, approximately 7 feet deep at low water and 100 feet wide through the middle ground, measuring 54,482 cubic yards, was completed on June 30, 1903. In front of the city wharf a channel was cut 60 feet wide by 5 to 10 feet deep and 150 feet long, containing 4,180 cubic yards. In Smiths Creek a cut was made 1,200 by 100 by 5 feet—13,092 cubic yards. The work was finished July 15, 1903. Total quantity of material removed, 72,154 cubic yards.

To June 30, 1905, $8,042.66 has been expended on the existing project.

The maximum draft that can be carried in the creek at mean low water is 5 feet, and the tide has a range of 5 feet. The head of navigation is in front of the tannery, a few hundred yards above the city wharf. The improvement is sufficient for all existing requirements. There is no adequate tidal basin above this improvement,

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and as the sewers of the town empty into the creek alongside the wharf there will be a gradual shoaling, and occasional dredging at several years' interval may be necessary.

Reports of examinations and surveys are found in the Annual Report of the Chief of Engineers for 1884, page 2204; for 1891, page 2966; for 1893, page 3225; and for 1897, page 3349.

The commerce of Redwood Creek during the year 1904 is reported by the shippers as 19,905 tons, the principal receipts being supplies for tannery and the principal shipments tannery products and salt.

July 1, 1904, balance unexpended	$357.34
July 1, 1905, balance unexpended	357.34

(See Appendix T T 2.)

3. Harbor at San Francisco, Cal.—This improvement contemplated the removal of the two Shag rocks and of Arch rock and Blossom rock to a depth of 30 feet below mean low water. A description of the rocks is printed in the Annual Report of the Chief of Engineers for 1898, page 2923. The estimated cost of the removal of all four of the rocks was $731,220.

The removal of Shag rock No. 1 was completed July 30, 1900; that of Shag rock No. 2 on April 5, 1901; that of Arch rock on April 30, 1903, and that of Blossom rock on December 27, 1903. The work was done by contract.

Originally Shag rock No. 1 had a small pinnacle extending just above high-water level. Shag rock No. 2 had a low-water depth of 17 feet over its crest. Arch rock projected out of water about 30 feet, and Blossom rock had a depth of between 5 and 6 feet over its crest. Blossom rock was removed to a depth of 24 feet in 1870. Each was a menace to navigation, especially in foggy weather.

The existing project (now completed) was adopted by Congress on March 3, 1899.

The total amount spent on the work up to June 30, 1905, is $316,529.68.

All of the rocks have been removed to a depth of 30 feet below mean lower low water. The range of the tide is 4.1 feet. Navigation interests have been greatly benefited.

The project has been completed and no further work is necessary.

July 1, 1904, balance unexpended	$3,470.32
July 1, 1905, balance unexpended	3,470.32

(See Appendix T T 3.)

4. Oakland Harbor, California.—A project for making a harbor at Oakland, Cal., was submitted in 1874 in compliance with an act of Congress. The project called for an enlargement or development of the San Antonio estuary, which was located in a marsh about 3 square miles in area, in which the tide ebbed and flowed in volume sufficient to maintain a channel at its throat in San Francisco Bay of about 2 feet in depth at low tide, which estuary or creek had in some narrow places in its windings depths as great as 20 to 23 feet at low water.

The report, with project and estimate of cost, is printed in the Annual Report of the Chief of Engineers for 1874, page 378.

The harbor was to consist of (*a*) two mid-tide training walls at the entrance, (*b*) a tidal canal about 1½ miles in length to connect with

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tide water in San Leandro Bay, (*c*) a dam at the entrance to San Leandro Bay, and (*d*) dredging a tidal basin and then a channel to have a depth of 20 feet at low water to San Francisco Bay. The estimated cost of the work was, in round numbers, $1,815,000.

This was approved by Congress, and during the progress of the work slight modifications were made, which consisted of raising the training walls to full high-tide level, of increasing the tidal canal to a width of 400 feet, of building three steel drawbridges across the tidal canal, and of diverting the silt-laden waters of Sausal Creek from the tidal canal by means of a separate channel into San Leandro Bay.

This project, with the exception of the dam across the entrance to San Leandro Bay, which may not be necessary, and a slight extension of one of the training walls farther into San Francisco Bay, is now practically completed, and up to June 30, 1905, has cost $2,643,032.41.

Before improvement vessels drawing 5 to 8 feet could enter San Antonio estuary at high tide. The commerce in 1874 aggregated 154,300 tons; in 1894 it had increased to 2,319,435 tons, and in 1904 it amounted to 3,522,681 tons.

In the river and harbor act of 1900 Congress provided for an examination of Oakland Harbor with a view to its improvement to meet the needs of present and prospective commerce. Three alternative plans and estimates for channel enlargement were submitted, estimated to cost, respectively, $646,293, $1,687,818, and $968,203. The report, with estimates, is printed in the Annual Report of the Chief of Engineers for 1901, pages 3448–3449.

On June 13, 1902, Congress appropriated $100,000 and authorized continuing contracts for $150,000 additional for the work, but failed to specify to which of the above projects the funds were to be applied. Contract was made to the extent of the money available and authorized for dredging work which was common to all of above projects. By act of March 3, 1905, Congress specifically named project No. 3, estimated to cost $968,203, appropriated $100,000, and authorized continuing contracts for $250,000 additional for continuing the improvement, with a view to obtaining a channel 300 feet wide and 25 feet deep from San Francisco Bay to Fallon street, Oakland. The project calls for a channel from San Francisco Bay 500 feet wide and 25 feet deep to Chestnut street, Oakland; thence 300 feet wide and 25 feet deep to Fallon street; thence 300 feet wide and 17 feet deep to tidal basin; thence 300 feet wide and 12 feet deep around tidal basin.

On June 30, 1905, at low-tide level, channels 400 feet wide and 20 feet deep had been obtained to Chestnut street, 300 feet wide and 17 feet deep to tidal basin, 300 feet wide and 12 feet deep on south side of tidal basin, and 300 feet wide and 8 feet deep on north side of tidal basin. The above depths could be carried at low water on June 30, 1905.

The money available and authorized will probably be sufficient to produce a channel 300 feet wide and 25 feet deep at low tide to Fallon street.

The length of Oakland Harbor from its entrance at 25 feet depth in San Francisco Bay to Park Street Bridge, which is just inside the west end of the tidal canal, is 6.53 miles.

The money thus far spent is practically all for extensions in channel widths and depths for the benefit of commerce. Very little, or none, has been spent for maintenance.

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The increase in commerce since 1874, when work was projected, is shown in the following table:

Year.	Traffic by ferries.				Traffic by vessels.		
	Number.	Trips.	Passengers.	Freight.	Number.	Register.	Freight.
				Tons.		*Tons.*	*Tons.*
1874	1	600		60,000	1,415	70,750	94,300
1878	3	5,400	216,240	129,000	1,085	109,125	211,627
1888	3	8,520	200,000	1,876,635	1,384	162,967	295,932
1892	3	8,600	96,000	2,202,170	2,277	223,148	443,011
1893	3	10,250	506,126	2,142,460	1,686	195,090	306,860
1894	4	9,561	554,932	2,119,267	1,741	175,750	309,350
1895	4	9,600	335,868	2,188,908	1,966	200,070	249,788
1896	5	10,500	249,843	2,131,491	1,946	208,155	366,098
1897	5	10,500	248,160	2,283,171	1,852	226,325	340,660
1898	5	10,500	226,068	2,374,546	1,598	288,787	414,849
1899	4	9,600	186,360	2,890,249	1,660	223,764	363,966
1900	4	9,600	164,491	3,111,396	2,025	313,523	489,112
1901	5	10,320	183,390	3,297,210	1,861	473,458	549,541
1902	5	10,320	180,760	3,128,263	2,483	.....	702,516
1903	5	10,320	178,204	3,262,955	2,768	.....	974,900
1904	5	10,320	279,216	3,522,681	2,745	.....	1,185,991

It is difficult to estimate what increase of commerce is likely to result from an increased depth and width of channel in Oakland Harbor. At present nearly 75 per cent of the total tonnage of Oakland Harbor is overland railroad freight, transferred on ferryboats drawing about 12 feet of water. It will permit of deeper draft vessels carrying to the city of Oakland coal, wood, coke, oil, hay, grain, flour, lumber, building material, and sundries, which in 1903 is reported as having amounted to 974,900 tons, and it should induce a considerable increase in manufacturing industries on the shores of this harbor.

The work is being carried on by contract at a cost of 8.44 cents per cubic yard. During the year 1,192,331 cubic yards has been dredged and placed ashore. It is expected that the existing contract will be completed about the end of July, 1905.

July 1, 1904, balance unexpended	$153,838.80
Amount appropriated by river and harbor act approved March 3, 1905	100,000.00
	253,838.80
June 30, 1905, amount expended during fiscal year, for works of improvement	96,271.21
July 1, 1905, balance unexpended	157,567.59
July 1, 1905, amount covered by uncompleted contracts	20,681.28
Amount (estimated) required for completion of existing project	[a]250,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	250,000.00

(See Appendix T T 4.)

5. San Pablo Bay, California.—Preliminary examination was ordered by Congress in March, 1899. Report and estimate are printed in the Annual Report of the Chief of Engineers for 1900, page 4260.

[a] The estimate for completion has reference only to the amount pledged by the river and harbor act of March 3, 1905, to be provided under contracts authorized.

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The project contemplates a channel 300 feet bottom width, 30 feet deep at low tide, and 27,000 feet long; estimated to cost $381,000, and about $16,000 per year thereafter for maintenance. Congress adopted this project on June 13, 1902, by appropriating $100,000, and authorizing continuing contracts for $281,000 additional.

Contract for the work was let in 1902, and was annulled in 1903, owing to the contractor failing to do the work required. Contract was re-let on June 21, 1904, at 14.48 cents per cubic yard. Work was commenced in August, 1904, and has since been in progress with two powerful clam-shell machines, which have, up to June 30, 1905, removed 1,110,176 cubic yards of material from the channel, which has resulted in a channel at least 30 feet deep and 120 feet wide over the entire shoal. It is now being made wider, and should be completed to its full width in August, 1906.

Before work was commenced there was only 19 feet depth over this shoal. All the commerce passing into and from the Sacramento and San Joaquin rivers, as well as all navy vessels bound to or from Mare Island, pass over this shoal.

Thirty feet at low water can now be carried over the shoal.

The tidal range averages about 4½ feet.

The sum of $300,000 has thus far been appropriated for this work; $81,000 is yet required to complete it.

The total expenditure to June 30, 1905, was $125,529.18.

July 1, 1904, balance unexpended	$294,798.40
June 30, 1905, amount expended during fiscal year, for works of improvement	120,327.58
July 1, 1905, balance unexpended	174,470.82
July 1, 1905, amount covered by uncompleted contracts	217,039.00
Amount (estimated) required for completion of existing project	81,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	81,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix T T 5.)

6. San Joaquin River, California.—Before improvement the channel below Stockton was 6 feet in depth, very crooked, and difficult to navigate. The upper river, above Stockton, was navigable only at high water, which lasted but a few months each year and carried but little commerce.

Project for improvement was made in 1877, with slight modifications made in 1881–82, and was to maintain, by dredging and cut-offs, a channel 9 feet deep and 100 feet wide to Stockton, and one 4 feet deep and 80 feet wide in Mormon channel up to Miller's warehouse, as well as temporary improvement of the upper river by snagging, scraping, removal of bars, and the partial closing by weirs of Lairds Slough and Paradise Cut. Eight cut-offs below Stockton have been made by the Government and several by the State of California. The depths have been fairly well maintained in the river proper, but it has been impracticable in the past year, in consequence of the enormous lodgment of débris, to continually maintain these

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depths in the Stockton Slough, which is about 1½ miles in length, and on which the city of Stockton is situated.

The existing project is essentially the project of 1877, extended to cover the construction and keeping in repair of the weirs across Lairds Slough and Paradise Cut. No continuing-contract work has been done or authorized.

Up to June 30, 1905, $496,456.23 has been expended on this project. The sum of $22,170.35 was expended during the fiscal year for dredging a bar in Stockton Slough, and for repairing by contract a weir at Lairds Slough the cost was $3,872.83.

A heavy freshet caused detritus to flow down Mormon channel, which material lodged in Stockton channel and made a bar across and throughout same, which caused a stoppage to navigation. Boats could not drag across it even at high-water freshet stage. Emergency contracts for dredging were made in February, 1905. The work was completed on May 15, 1905, at a cost for dredging of $22,170.35. A total of 154,880 cubic yards of material, place measurement, was placed ashore, leaving a channel 100 feet wide, 7,300 feet long, and 9 feet deep at low water. A pump or suction dredge was used for doing the work. The contract price was 14 to 14¾ cents per cubic yard, depending on locality and distance which the material had to be pumped.

The existing least depth to Stockton on June 30, 1905, is 8 feet at low water. The tidal range is about 2 feet. The river is navigable in fact at high water to Firebaugh. At low water about 3 feet can be carried to the bridge or railroad crossing, which is about 20 miles by river above Stockton.

As the levees on both sides of Stockton channel have all the dredged material which they can carry, any dredging in this locality in future will probably have to be done by a pump machine and will have to be transported through pipes for a maximum distance of about 2 miles, which makes the work expensive.

The commerce on the lower San Joaquin River between Stockton and San Francisco is large and important. During the year 1904 344,019 tons of freight, principally grain, mill stuffs, merchandise, and lumber, was reported to have been carried by the two transportation companies running regular boats. The commerce of the upper river is small. The amount of freight carried during the year 1904, as reported, was only 16,467 tons.

July 1, 1904, balance unexpended	$37,331.37
Amount appropriated by river and harbor act approved March 3, 1905	20,000.00
	57,331.37
June 30, 1905, amount expended during fiscal year, for works of improvement	29,117.60
July 1, 1905, balance unexpended	28,213.77

(See Appendix T T 6.)

7. Stockton and Mormon channels, San Joaquin River, California.—The act of June 13, 1902, provided for the diversion of the waters of Mormon channel into the Calaveras River. The project is printed in the Annual Report of the Chief of Engineers for 1899, page 3189. Its estimated cost is $255,016. Congress has now appropriated $224,316 for the work. The act of 1902 requires that the city

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of Stockton or the State of California shall first furnish to the United States the right of way for the canal. The legislature of the State of California has appropriated funds for acquiring the necessary rights of way, and its commissioner of public works is negotiating for the purchase of the property required. Some of the property has been acquired by condemnation.

No work by the General Government has been done as yet, and can not be until rights of way are furnished.

The amount required for the completion of the existing project has all been appropriated.

July 1, 1904, balance unexpended	$175,000.00
Amount appropriated by sundry civil act approved March 3, 1905	49,316.00
July 1, 1905, balance unexpended	224,316.00

(See Appendix T T 7.)

8. Mokelumne River, California.—This is a tributary of the San Joaquin River, is a tidal stream, navigable in the main stream, including its south branch or fork, for a length of 34 miles. The head of navigation is now at the Galt-New Hope bridge, 20 miles above the mouth of the river. Six feet depth at low tide can be carried to the mouth of Snodgrass Slough, about 13 miles above the mouth of the river; then a shoal is found less than a half mile in length with a depth of 2 feet over it to New Hope Landing, which for many years past has been the upper terminus or regular landing for a line of steamboats.

In the past year, owing to the removal by order of the supervisors of Sacramento and San Joaquin counties of the Benson Ferry bridge, which was an obstruction to navigation, located about 5 miles above New Hope Landing, the State of California, together with the landowners bordering on the river, have jointly expended about $50,000 in removing snags, cutting down overhanging trees, cutting off points of land, or dredging through points of land where sharp bends existed, and by building levees along the banks have made the river navigable for steamboats fully 7 miles above New Hope Landing. The least depth of water in this improved part of the river is 3 feet, and there is also a tidal range varying from 2 to a maximum of 4 feet in height. Therefore, with the exception of the shoal near New Hope Landing, the river is in good navigable condition for 20 miles of its length.

Before improvement navigation was difficult on account of snags and overhanging trees. Project for removing these was made in 1881, the estimated cost being $8,250. In 1891 project was enlarged to close a small slough or canal and remove by dredging a tongue of land opposite New Hope Landing and to continue the work of snagging.

Appropriation was made in 1884 and continued at irregular intervals since until a total of $20,500 has been thus appropriated. A total of $17,635.76 has been spent in carrying out the project.

The shoal at New Hope Landing interferes somewhat with navigation. A channel dredged through it would be liable to refill. It is thought regulating works to produce a scour over the shoal may be necessary. No examination for project or estimate for work of this character has yet been authorized or made.

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Last year, in consequence of a crevasse in the Sacramento River, the flood waters of the latter poured into and through the Mokelumne River. The levees surrounding the reclaimed islands on the latter river were broken and crops destroyed. Staten Island is yet unwatered, and the closure of the break in Bouldin Island alone is said to have cost upward of $160,000. The total damage to property by this flood is said to have exceeded $5,000,000. In consequence of the flood the commerce on this river in the past year has been light.

Freight rates on this river are about one-half as large as railroad rates. The annual river tonnage varies between 40,000 and 50,000 tons. The saving to the residents on the river in freight is between $40,000 and $50,000 per year. The up freights are generally merchandise; the down freights are grain, fruits, vegetables, and dairy products.

July 1, 1904, balance unexpended	$364.24
Amount appropriated by river and harbor act approved March 3, 1905	2,500.00
July 1, 1905, balance unexpended	2,864.24

(See Appendix T T 8.)

9. Sacramento and Feather rivers, California.—An act of Congress of June 3, 1896, provided for the appointment of a Board of three engineer officers for the purpose of carrying on the improvement of the Sacramento and Feather rivers.

In the earliest days of California, before the advent of railroads, handsome, commodious, and fast river steamboats, drawing from 6 to 7 feet, ran regularly to Sacramento. All travel was necessarily by boats, which were crowded with passengers and freight at rates very greatly in excess of present prices. The depth of water at that time in the shoalest places below Sacramento was about 7 feet at low river and low tide. Thereafter, largely in consequence of hydraulic mining, shoaling resulted, until on the worst bars at certain low-water periods only 4 feet channel depth could be carried to Sacramento. In 1875 appropriations began to be made by Congress for improving the river, and have continued at irregular intervals ever since. The object sought was to improve the depths over the bars, generally by the construction of wing dams, scraping, closing of crevasses or breaks in the levees, and principally to aid navigation by the removal of snags. In work of this character a total of $800,979.29 has been spent up to June 30, 1905. The work has resulted in obtaining at the present time a least low-water channel depth of 7 feet to Sacramento, 4 to 5 feet depths to Colusa, and 24 to 30 inch depths to Redbluff.

These low-water depths are as great as ever existed in the shoalest portion of the channel, although on the river below the mouth of the Feather the shoals are now more dangerous than they were in the early days of steamboating. The present depths accommodate all commerce existing and that in sight for several years to come. There have been no boats reported aground in the lower Sacramento River below Sacramento for many years; in the upper river when boats were aground it was due to overloading or to getting out of the channel or to getting snagged. The head of navigation is at Redbluff, which is by river 262 miles above the mouth of the river. The extreme range of the river at Redbluff is 22+ feet; at Sacramento it is 22+ feet; at Collinsville, its mouth, the range is 8+ feet.

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The commerce of the Sacramento River is variable and depends principally on the crops. Upriver freight is generally merchandise, groceries, and farming implements; down-river freight consists of wheat, barley, fruit, vegetables, cordwood, and brick.

The total tonnage carried on the Sacramento River in 1904 is reported as something in excess of 300,000 tons. The average yearly tonnage for the past ten years has been 442,482 tons. The maximum tonnage reported carried was in 1892, which amounted to 579,574 tons.

The total expenditure to June 30, 1905, was $838,081.55.

The Sacramento River is now in good navigable condition.

The Feather River freight is rapidly decreasing. In 1895 it was 5,866 tons; in 1901 it was reported as amounting to 4,411 tons; in 1904 it is reported as being 1,665 tons.

The Board recently made an examination of the Feather River, and believes the very limited navigation on the river is due more to a lack of commerce and low freight rates than to any serious difficulties in the way of navigation. Previous Boards have repeatedly reported that work on the Feather River was not justifiable until the sands and other débris in the Yuba River were controlled.

For the Sacramento River the most important feature in the interests of navigation is the removal of snags and concentration of water by means of wing dams for producing greater channel depths. A permanent annual appropriation of $25,000, as recommended by all previous Boards and repeatedly urged in former annual reports, is recommended to maintain this river in good navigable condition. The improvements made have maintained a navigable river, and have therefore had a beneficial effect in regulating and maintaining a reasonable freight rate.

The river and harbor act of March 3, 1905, authorized the expenditure of the balance remaining to the credit of the Sacramento and Feather rivers, California, and the Sacramento River below Sacramento, Cal., for the improvement and maintenance of both of said rivers, including snagging, and for such projects as have been heretofore adopted in the Feather River and in the Sacramento River, both above and below Sacramento. This balance on March 3, 1905, amounted to $59,692.07.

The act of 1905 also directed the appointment of a Board of three engineer officers, one of whom should have had experience on the Sacramento and two on the Mississippi River, for the purpose of making examination of the Sacramento, San Joaquin, and Feather rivers with a view to controlling the overflow of said rivers and their tributaries. The Board has been appointed and its report will be submitted when received.

SACRAMENTO AND FEATHER RIVERS, CALIFORNIA.

July 1, 1904, balance unexpended	$22,008.56
June 30, 1905, amount expended during fiscal year, for works of improvement	15,907.05
July 1, 1905, balance unexpended	6,101.51

Amount (estimated) required for completion of existing project.. Indeterminate.

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SACRAMENTO RIVER, CALIFORNIA.

July 1, 1904, balance unexpended	$52,890.74
July 1, 1905, balance unexpended	52,890.74

(See Appendix T T 9.)

10. Petaluma Creek and Napa River, California.—(*a*) *Petaluma Creek.*—This creek has a length of 16 miles, and is an estuary of San Pablo Bay. Its head of navigation is Petaluma, a town of 4,000 inhabitants.

Before improvement it was very crooked, dry in many places at low tide, and could be navigated only at medium or high tide stages. The extreme tidal range is a little less than 9 feet.

Project was made in 1880 for straightening the creek by making cut-offs and dredging, so as to obtain a channel 50 feet wide and 3 feet deep at low water, estimated to cost $25,868. In 1892 the project was extended to dredge the channel as deep as funds would permit. Dredging to obtain and maintain depths was done in 1881, 1884, 1888, 1891, 1893, 1895, 1896, and 1900. The total amount expended on the project to June 30, 1905, is $67,754.77; the balance available is $2,245.23.

Contract for redredging the creek was made in May, 1904, with the Pacific Reclamation Company, at 8 cents per cubic yard, place measurement, and cost $2,500. A total of 31,250 cubic yards of material was removed. In July and August, 1904, 7,200 linear feet of channel dredging was done between a point 800 feet above McNears Canal and another point 4,800 feet below Haystack Landing, which furnished a good channel 50 feet wide and 4 feet deep at low water.

In consequence of the improvements heretofore made, a maximum low-water depth of 6 feet has been obtained as far as Haystack Landing, and a depth of 4 feet to the landing in the town. As there is no tidal basin in the upper part of the creek, and as the drainage area is about 83 square miles of rich agricultural land, these depths can not be maintained without periodical dredging. The existing low-water depths on June 30, 1905, are 4 feet to Haystack Landing and about 3 feet to the town of Petaluma.

There has been very little interference with navigation, as practically all the commerce is carried at high and medium stages of the tide.

The total commerce reported during the calendar year 1904 is 44,000 tons, practically all of which is dependent on the improvement and maintenance of this creek.

Freight rates are reasonable, due to the maintenance of the improvement and also to railroad and steamboat competition. In the past year, owing to the construction of electric railways, two steamboats have been running regularly to Petaluma, where one formerly sufficed.

(*b*) *Napa River.*—Before improvement the river had a low-water depth of 5 feet for about 12 miles above the Mare Island Navy-Yard, and about 1 foot depth on the crest of the bars in the next 4 miles of its length to the head of navigation in front of the town of Napa.

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The ordinary range of the tides is about 5 feet. Spring tides reach a height of 7 feet.

Project for the improvement was made in 1888, which contemplated the dredging of the bars and cutting off projecting points of land so as to obtain a channel 75 feet wide, with a least depth of 4 feet at low tide, and to remove logs, snags, and other obstructions. The estimated cost was $27,600. Examinations were again ordered by Congress and made in 1896, 1899, and 1902. Report on the latter is printed in the Annual Report of the Chief of Engineers for 1904, page 3427.

Navigation on the river is possible and profitable only at medium and high stages of the tide. The existing project and old project are identical. Appropriations were made by Congress in 1888, 1890, 1894, and 1896, aggregating $25,500, and in 1902 $6,000 was appropriated jointly for Petaluma Creek and Napa River, from which $3,000 was allotted to Napa River. An allotment of $4,500 was made from the appropriation made by the river and harbor act of April 28, 1904, and a further allotment of $1,000 from the river and harbor act of March 3, 1905, which appropriated for Petaluma Creek and Napa River jointly $3,000, making the total appropriated and allotted for Napa River $34,000.

Work was begun in accordance with the project in 1889, and has progressed since whenever funds became available. To June 30, 1905, the amount expended has been $28,942.13. The unexpended balance available is $2,481.62.

The drainage area of this river is between 300 and 400 square miles.

In May, 1904, with funds available, contract at 20 cents per cubic yard was made for dredging some of the most troublesome bars in the river. Work was commenced on August 22 and completed on September 9, 1904. Channels 75 feet wide and 4 feet deep were obtained from Tannery wharf to Jacks bend, and also a similar channel below the Asylum wharf. In this contract 14,200 cubic yards of material was removed, at a cost of $2,840. The money available was not sufficient to remove the bars in front of the town of Napa.

When allotment from the appropriation made by the river and harbor act of 1904 was made bids for further dredging were invited and opened on December 8, 1904. Only one bid was received, which was rejected, the price of 20 cents per cubic yard being deemed too high. In March, 1905, bids were again invited, and contract was made for removing about 19,500 cubic yards of material at 14¾ cents per cubic yard. Work was begun on May 25, 1905, and is still in progress. At the close of the year 13,482 cubic yards of material had been dredged, and the work will be completed in July, 1905. This will furnish a good channel to Napa, the head of navigation, 75 feet wide and 4 feet deep at low tide.

In March, 1905, a dangerous snag, which had lodged on one of the bars in the river, was removed by hired labor, at a cost of $63.40.

Freight rates are reasonable, due to the maintenance of navigation.

The depths obtained can be maintained only by occasional dredging and removal of snags. On June 30, 1905, the depth to Napa was about 4 feet, and boats, by taking advantage of the tide, reached that locality without trouble.

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July 1, 1904, balance unexpended	$6,466.96
Amount appropriated by river and harbor act approved March 3, 1905	3,000.00
Amount allotted from appropriation for maintenance of river and harbor improvements, act of April 28, 1904	4,500.00
	13,966.96
June 30, 1905, amount expended during fiscal year, for works of improvement	6,663.86
July 1, 1905, balance unexpended	7,303.10
July 1, 1905, amount covered by uncompleted contracts	2,576.25
Amount (estimated) required for completion of existing project	Indeterminate.

(See Appendix T T 10.)

11. Humboldt Harbor and Bay, California.—A description and history of the work done at this locality is printed in the Annual Report of the Chief of Engineers for 1900, page 4237.

Before improvement the entrance to the harbor was obstructed by a bar having channel depths of 12 to 25 feet. This channel was not fixed in direction, and sometimes for weeks at a time vessels were bar bound. Inside the harbor, in front of the towns of Eureka, Arcata, and Hookton, the channels were very shoal. In 1881 project for deepening the channels by dredging in front of these towns was adopted. The work was done by contract, was completed in *1884*, at a cost of $80,884.69, and resulted in channels 200 feet wide and 12 feet deep in front of Eureka, and 100 feet wide and 10 feet deep in front of Arcata and Hookton.

In 1882 project for improving the entrance to the harbor was adopted. It called for a low jetty, estimated to cost $600,000, which was to be about 6,000 feet in length, to extend from the south spit seaward. This was somewhat modified in 1888 and again in *1891* so as to build nearly parallel high jetties, each about 8,000 feet in length, to extend seaward to the crest of the bar. The estimated cost of the work was $2,057,615. Congress adopted this project in 1892 and authorized work under the continuing-contract system.

The work on the jetties was commenced in 1889 and was completed in August, 1899, at a cost of $2,040,203.35. It resulted in a fine channel having a least depth of 28 feet at low water. A resurvey made in August, 1903, showed a channel through the entrance having a least low-water depth of 31 feet. In the past six months the channel has deteriorated. A bar has formed outside the entrance whose longer axis is nearly at right angles to the former jetty channel. The result is that vessels, instead of going straight out to sea, as formerly, now make a sharp turn to the right, broadside to the sea, immediately on passing the outer end of the north jetty. The depth of water in the channel between the bar and the north jetty is ample, and exceeds 24 feet at very low tide, but on account of its direction makes it dangerous for vessels passing in or out during rough weather. A resurvey of the bar, which has been authorized, will be made in July and August, 1905.

In March, 1899, project for dredging a channel 15 feet deep, 200 feet wide, and 8,900 feet long in front of Eureka, estimated to cost $50,000, was adopted. Work was done by contract, and a channel of the dimensions contemplated was completed in March, 1901, and has since been well maintained.

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In consequence of the improved channel at the entrance to the bay vessels drawing 19 feet now enter the harbor, but on account of greater draft can not lie in the channel at the wharves to load and unload in front of the town of Eureka. Preliminary examination of this inside channel was authorized at the recent session of Congress and has been made. Report and estimate for channel of increased dimensions will be made later.

The least depth of water at the entrance to the harbor is a little more than 24 feet at extreme low water; at the wharves at Eureka it is 15 feet; the tidal range is about 5.5 feet.

Since the improvement and within the past five years the population of Eureka has increased from 7,000 to a little more than 11,000 persons. The commerce has increased; deeper-draft steam vessels and more of them now run regularly to Humboldt Bay. The following table shows the amount of annual commerce in five-year periods:

Year.	Passengers.	Freight.	Year.	Passengers.	Freight.
		Tons.			*Tons.*
1885	4,195	162,614	1900	16,356	300,087
1890	12,215	277,498	1904	30,753	529,720
1895	11,514	226,378			

The tonnage in 1904, valued at $11,751,000, was carried in 1,403 steam and 264 sail vessels.

To June 30, 1905, the total expended on Humboldt Bay improvement has been $2,177,381.30.

The amount expended in the past fiscal year has been for pay of watchman on the work and for office expenses. Nothing has been expended for maintenance.

Additional work at the entrance and in the channel in front of Eureka will be necessary to increase channel depths and maintain them. The character and cost of the additional work can be determined only by survey, which is authorized and which will be made in July and August, 1905.

July 1, 1904, balance unexpended	$10,473.70
June 30, 1905, amount expended during fiscal year, for works of improvement	240.00
July 1, 1905, balance unexpended	10,233.70

(See Appendix T T 11.)

IMPROVEMENT OF RIVERS AND HARBORS IN WESTERN OREGON, OF COLUMBIA RIVER ABOVE THE MOUTH OF WILLAMETTE RIVER, AND OF SNAKE RIVER, OREGON, WASHINGTON, AND IDAHO.

This district was in the charge of Maj. W. C. Langfitt, Corps of Engineers, having under his immediate orders Capt. Amos A. Fries, Corps of Engineers. Division engineer, Col. W. H. Heuer, Corps of Engineers.

1. Coquille River, Oregon.—This stream empties into the Pacific Ocean at Bandon, Coos County, Oreg., about 375 miles north of San Francisco. Once safely across the bar at the mouth of the river vessels drawing 11 feet can ascend the stream, at high tide, to the town

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of Coquille, about 25 miles above Bandon. Light-draft river steamers can ascend to Myrtle Point, about 12 miles above Coquille.

Before improvement the channel at the mouth of the river skirted the south headland for some distance, as shown on map opposite page 2682 of the Annual Report of the Chief of Engineers for 1882, and was shoal, shifting, and studded with dangerous rocks.

The depth of water on the ocean bar at the original mouth of the river was usually about 3 feet at low tide or a little over 7 feet at high tide.

The original project for improvement was approved in 1878, and provided for the construction of two converging high-tide jetties, built of rubblestone, 800 feet apart, so located as to cause the river to empty into the sea about one-half mile north of the original mouth of the river, these jetties to run out to sea a sufficient distance to create and maintain a channel 12 feet deep at low tide. In 1880 the proposed depth of 12 feet at low tide was reduced to 10 feet; in 1888 it was reduced to 8 feet, and under date of May 8, 1891, the plan was changed to provide that the jetties should be 600 feet apart at their outer ends, instead of 800 feet.

The amount expended on original and modified projects, prior to operations under existing modified project, was $102,299.98, including $6,883.90 for snagging.

The existing modified project may be said to date from 1892, when the lengths of the proposed jetties were definitely fixed and the character of the construction changed by adopting jetties more in conformity with those at Coos Bay and Yaquina Bay.

The estimated cost for completing the improvement, including previous appropriations (and including $6,883.90 expended in removing snags in the river between Coquille and Myrtle Point, under acts of Congress of August 11, 1888, and September 19, 1890), was increased from $164,200 to $285,000. The modified project was approved by the Chief of Engineers February 20, 1892.

A rock about 120 feet long by about 50 feet wide exists in the channel near the mouth of the river, the top of which is about 2 feet below the plane of mean low tide. This rock is a menace to navigation, several vessels having suffered injuries thereby. It should be removed to a low-water depth of at least 8 feet, or a spur jetty built between it and the south jetty, and thus divert the channel farther to the north.

Two shoals in the river channel, one immediately above Bandon, the other about 7 miles farther upstream, have become so shallow that commerce is greatly impeded, vessels being frequently delayed and lighterage resorted to in many cases.

The expenditures on the original and modified projects to June 30, 1905, amount to $239,997.21, of which the sum of $23,799.77 was for maintenance.

The expenditures during the fiscal year have been for repairs and maintenance of plant; in making part payment for construction of a tug boat; in making survey of the mouth of the river, and in preparing specifications, etc., in connection with resumption of work under contract for extension of the north jetty with funds appropriated by act of March 3, 1905. The maximum draft that can be carried across the bar at low tide, as shown by the survey of June, is about 8 feet.

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Vessels usually cross the bar at high tide. The average daily range of the tide is about 4.2 feet.

No work is contemplated after completion of the north jetty to the projected length of 1,570 feet, which is to be done with available funds, and no further funds are required at present.

The total expenditures to date on the orginal and modified projects have resulted in completing the south jetty throughout its projected length of 2,700 feet, in constructing about 1,065 feet of the north jetty, and in removing some of the obstructing snags in the river channel between Coquille and Myrtle Point.

The work so far done has resulted in closing up the dangerous old channel at the mouth of the river and opening up a new channel straight out to sea, with a controlling bar depth ranging from 6 to 9 feet at mean low tide.

The river and ocean form the only practicable means of transporting commerce. The head of navigation for light-draft boats is Myrtle Point, 12 miles above Coquille City. The principal articles of export are coal, lumber products, live stock, and farm produce. This commerce is loaded on small coasting vessels along the 25 miles of river between its mouth and Coquille City, and is usually taken to San Francisco to market. The total for the calendar year 1904 was 55,962 tons, valued at $838,858. The principal articles of import are mill and farm machinery and general supplies, the total amount of which was 4,982 tons; estimated value, $498,200.

For further details as to the original and modified projects see Annual Reports of the Chief of Engineers for 1879, page 1806, and 1892, pages 2664 and 2665.

Comparative statement of traffic.

Calendar year—	Tons.	Calendar year—	Tons.
1895	16,256	1901	32,975
1896	21,106	1902	37,458
1897	25,620	1903	48,249
1898	24,556	1904 (estimated value, $1,332,058)	60,944
1899	26,654		
1900	30,727		

July 1, 1904, balance unexpended	$2,454.15
Amount appropriated by river and harbor act approved March 3, 1905	55,000.00
	57,454.15
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	2,451.36
July 1, 1905, balance unexpended	55,002.79
July 1, 1905, outstanding liabilities	2,400.00
July 1, 1905, balance available	52,602.79

(See Appendix U U 1.)

2. Entrance to Coos Bay and Harbor, Oregon.—Coos Bay is a tidal estuary on the Pacific coast in Oregon about 400 miles north of San Francisco. It is the principal harbor between the mouth of the Columbia River and San Francisco. Before improvement the obstructions consisted of the usual bar in the ocean at the entrance to the bay and shoals inside the bay near its entrance formed by sand which accumulated during northwesterly winds. Under the influence of

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these winds the sand spit on the north side of the entrance advanced toward the south, contracting the channel under the high stone headland known as Coos Head, on the south side of the entrance, to a very narrow width and usually causing the channel across the bar in the ocean at the entrance to follow the west side of the north spit in a tortuous course. The depth on the ocean bar was often but 10 feet at low tide.

The original project for the improvement of Coos Bay received the approval of the Secretary of War November 24, 1879.

It provided for the construction of a jetty from a point about 250 yards below the southern extremity of Fossil Point, on a line toward the east end of Coos Bay, this line curving so as to be directed at its outer end to the head, or a little north of it, the structure to be of wood and stone, or stone, as should be found best. The estimated cost was $600,000.

The amount expended on the original project was $213,750. Under the original project 1,760 feet of timber-crib and rubblestone jetty was built.

The existing project provides for obtaining and maintaining a channel 20 feet deep at low tide through the ocean bar at the entrance to the bay by confining the entrance between two high-tide rubblestone jetties, the north jetty to be 9,600 feet long and the south jetty 4,200 feet long.

The estimated total cost of the existing project, exclusive of the amount expended on the original project, is $2,466,412.20. This project was approved by the Chief of Engineers September 23, 1890. The amount expended thereon up to the close of the fiscal year ending June 30, 1905, is $691,897.13, of which $166,897.13 was for maintenance of improvement.

The expenditures on this improvement to date have resulted in the construction of the submerged jetty near Fossil Point, under the original project, and in completing the 9,600-foot north jetty, running out to sea from the southern end of the north sand spit, as provided for in the present project.

Since the completion of the north jetty a straight channel through the ocean bar has been maintained, having ordinarily a least depth of from 17 to 22 feet at mean low tide.

A comparison of the maps printed in Annual Reports of the Chief of Engineers for 1884 (p. 2264) and for 1900 (p. 4278) will show the improved condition of the bar channel.

Vessels which can cross the bar can pass up to Marshfield, the principal town on the bay, about 13 miles from the entrance, but complaints are made that when fully loaded they are somewhat delayed by a shoal in the channel opposite Marshfield. An allotment from the emergency funds has been made for dredging this shoal, as stated in the report for the harbor at Coos Bay.

A recommendation that the funds available be withheld, owing to the relatively small amount and to the fact that the depths contemplated by the project had been obtained and fairly well maintained, was approved.

The funds available will therefore be used for maintaining the present north jetty until such time as further funds are appropriated and necessity for their expenditure shown. No work has been done

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during the year except to properly care for the plant, make a survey of the bar, and construct a small tug boat for survey work, a part of the cost of which was charged to other coast works.

The ruling depth over the bar, as shown by the survey completed in June, 1904, is about 19 feet, and this depth can be carried to Empire, 4 miles. Vessels drawing 14 to 16 feet can reach Bay City, 14 miles on high tide, above which point there is about 50 miles of available navigation for boats of light draft. The mean rise and fall of the tide is 4.8 feet.

The export commerce of Coos Bay consists principally of coal, lumber products, farm and dairy produce, live stock, woolen goods, and fish. It amounted during the year to 118,165 tons, valued at $1,656,583. The imports, consisting of farm and mill machinery and miscellaneous merchandise, amounted to 18,783 tons, valued at $1,901,401.

The bay and ocean form the only means of transportation, and San Francisco is the principal market.

For further information as to project, etc., see Annual Report of the Chief of Engineers for 1890, pages 2936–2965.

Comparative statement of traffic.

Calendar year—	Tons.	Calendar year—	Tons.
1895	128,544	1901	97,500
1896	144,934	1902	122,232
1897	115,896	1903	135,178
1898	103,039	1904 (estimated value, $3,557,984)	136,958
1899	116,567		
1900	104,294		

July 1, 1904, balance unexpended	$50,945.38
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	17,578.47
July 1, 1905, balance unexpended	33,366.91
July 1, 1905, outstanding liabilities	1,023.00
July 1, 1905, balance available	32,343.91
Amount (estimated) required for completion of existing project	1,741,412.20

(See Appendix U U 2.)

3. Harbor at Coos Bay, Oregon (dredging).—An appropriation of $13,000 was made by act of August 18, 1894, for construction of a dredge for operation on Coos Bay, and the act of June 3, 1896, appropriated $14,390, and the sundry civil act of July 1, 1898, contained the following proviso:

> That the provisions of the river and harbor Acts of August eighteenth, eighteen hundred and ninety-four, and June three, eighteen hundred and ninety-six, making appropriations for improving harbor at Coos Bay, Oregon, by deepening harbor and removing obstructions therefrom, are hereby so amended as to authorize the Secretary of War, in his discretion, to expend any or all of the funds so appropriated in carrying on the required dredging and other work by contract, or in any manner that in his judgment may be most economical and advantageous to the Government

The funds were made available for the purpose of removing shoals in Coos Bay, the principal one being opposite Marshfield and known as "Hogsback," where there was a least low-tide depth of about 5 feet. Another mud shoal existed, with a least depth of 8 feet, in

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Isthmus Slough and interfered with navigation of the upper bay and Isthmus Slough. Dredging was also required at two or three other places.

The project approved by the Secretary of War August 16, 1898, provided for dredging such shoals and removing such obstructions as existed at that time, instead of limiting operations to dredging.

The work was all completed in 1899, most of the work being done under contract. At the close of operations a least depth of 13 feet at mean low tide had been obtained.

An allotment of $10,000 was made under date of July 30, 1903, from the emergency appropriation of June 6, 1900, for the purpose of deepening the channel over a shoal at the mouth of Pony Slough, the channel at this place being such that coasting vessels were obliged to lighter. The funds were insufficient to obtain the desired results, and an additional allotment of $3,500 was made from the appropriation of June 13, 1902, on May 17, 1904.

The amount expended from previous appropriations for dredging and removing shoals to June 30, 1905, was $40,899.75, of which amount $13,570.72 was for maintenance.

The expenditures during the year were for completing the dredging provided for by allotment of May 17, 1904, and resulted in obtaining a channel over the shoal of sufficient depth to allow of uninterrupted traffic.

An allotment of $5,000 was made under date of May 17, 1904, from the emergency funds for dredging the shoal opposite Marshfield, but no work is contemplated until after the close of the fiscal year.

At the close of the year the maximum draft that could be carried over the shoal was about 12 feet at low tide.

For commercial statistics, see report on improving entrance to Coos Bay and Harbor, Oregon.

July 1, 1904, balance unexpended	$3,692.65
Amount allotted from appropriation for maintenance of river and harbor improvements, act of March 3, 1905	5,000.00
	8,692.65
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	3,692.65
July 1, 1905, balance unexpended	5,000.00

(See Appendix U U 3.)

4. Coos River, Oregon.—Coos River is the principal tributary of Coos Bay, and empties into the bay at its head, opposite the town of Marshfield. At a point 5½ miles from its mouth the river divides into two branches, known as the North and South forks, up each of which tidal influence extends for about 8½ miles. Before improvement was commenced the small light-draft steamboats and launches plying between Marshfield and the head of tide on each fork experienced considerable difficulty in navigating on account of the many snags, bowlders, etc., in the stream.

The original plan of improvement, based on the survey made in 1894 (Annual Report of the Chief of Engineers for 1895, pp. 3502–3505), proposed the removing of all snags and bowlders from a selected channel way 50 feet wide. It was approved by the Chief of Engineers September 28, 1896. The estimated cost was $5,000.

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In the Annual Report of the Chief of Engineers for 1898, page 2967, it was stated that $3,000, in addition to the $5,000 appropriated June 3, 1896, would be required to complete the project. It was further stated in the Annual Report of the Chief of Engineers for 1900, page 4284, that an appropriation of $1,500 every two years would be required for maintenance.

The amount expended to June 30, 1905, was $9,541.25, of which $1,541.25 was applied to maintenance, and resulted in the removal of the obstructing snags and bowlders in the main river and the two forks, so that light-draft steamboats could navigate the stream with greater ease and at lower stage of the tide than formerly.

The river and harbor act of March 3, 1905, allowed the expenditure of so much as might be necessary of the balance remaining to the credit of appropriation for improving entrance to Coos Bay, but no work was done during the fiscal year and nothing is contemplated until low water during the coming season.

The maximum draft that can be carried at low tide over the upper reaches of Coos River is about 1½ feet at low water. The tide varies about 2½ feet, so that boats drawing 4 feet navigate to head of tide water on both the North and South forks, a distance of about 14 miles above the mouth.

Coos River flows through a narrow but productive valley and is the only means of transportation. Both the North and South forks are navigable for light-draft boats for a distance of about 14 miles from the mouth. The commerce is carried on small steamers to Marshfield, where it is loaded into ocean steamers and taken to San Francisco market. This commerce is mostly farm and dairy products, logs, and lumber, and amounted during the year, including supplies, machinery, etc., received, to 39,907 tons, valued at approximately $1,033,758.

Comparative statement of traffic.

Calendar year—	Tons.	Calendar year—	Tons.
1896	13,204	1901	62,402
1897	16,534	1902	[c]46,000
1898	22,674	1903	28,109
1899	[a]70,007	1904 (estimated value, $1,033,758)	49,907
1900	[b]229,225		

July 1, 1904, balance unexpended	$458.75
Amount allotted under river and harbor act approved March 3, 1905, from appropriation for Coos Bay and Harbor	3,000.00
July 1, 1905, balance unexpended	3,458.75

(See Appendix U U 4.)

5. Mouth of Siuslaw River, Oregon.—The Siuslaw River empties into the Pacific Ocean at a point about 475 miles north of San Francisco, Cal. It enters the sea through a shifting sand beach without headlands or other fixed points to mark the entrance, which is obstructed by a shoal outer bar. Before the work of improvement was commenced the channel across this outer bar frequently shifted

[a] Includes 21,852 tons of stone for the Government jetty at the entrance to Coos Bay, Oregon.

[b] Includes 170,400 tons of stone for the Government jetty at the entrance to Coos Bay, Oregon.

[c] Approximate.

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its position up or down the coast as much as 1 mile, and the depth of water on the bar varied from 5 to 12 feet at low tide.

Coasting vessels ascend the river to Florence, about 6 miles from the mouth.

The original and present project for improvement was approved by the Secretary of War August 4, 1891 (report printed in the Annual Report of the Chief of Engineers for 1891, pp. 3175–3182), and provided for confining the mouth of the river in the ocean between two high-tide rubblestone jetties, the north jetty to be 7,500 feet long, including a tramway approach at its shore end 3,000 feet long, and the south jetty to be 5,600 feet long, including a tramway approach at its shore end 2,400 feet long. These jetties were designed to hold the channel across the bar in the ocean at the mouth of the river in one position, and to maintain the depth of 8 feet at low tide in the bar channel.

The estimated cost of the improvement under the original project was $700,000. The charts opposite page 3174 and page 3178 of the Annual Report of the Chief of Engineers for 1891 show the positions of the proposed jetties of the original project.

The amount expended on the original project to June 30, 1905, is $151,700.83, which completed about 4,090 feet of north jetty and includes the cost of the tramway approach, 3,029 feet long. In addition $10,549.55 has been expended for maintenance and in making surveys, etc.

The river and harbor act of June 13, 1902, contains the following item relative to the improvement of this stream:

Continuing improvement, thirty-five thousand dollars, and the Secretary of War is authorized and directed to cause to be made a reexamination and survey of said river at its mouth, and at the shoals at or near Florence, with a view to the adoption of a project for the improvement of said river which will provide for its commerce at a less cost than the existing project.

The reexamination and survey were made in August and September, 1902, and a report thereon dated February 5, 1903, submitted to the Chief of Engineers. The Board of Engineers for Rivers and Harbors, to which this report was referred, reported March 26, 1903, that, in its opinion, it is not desirable to continue the improvement of the Siuslaw River with the view of obtaining a depth of 8 feet.

These are published in the Annual Report of the Chief of Engineers for 1903, pages 2229–2239.

The river and harbor act of March 3, 1905, provides that the unexpended balance shall be returned to the Treasury, except that an amount may be retained sufficient for maintenance for two years.

At the close of the year the Government property had all been removed, ready for condemnation or distribution to other works, preparatory to abandoning the work.

The expenditures during the fiscal year 1905 were for expense of closing up the work and distributing and caring for the property and for part payment for constructing tugboat.

The expenditures made have resulted in somewhat checking the tendency of the bar channel to shift its position as far to the north as frequently occurred before the work of improvement was commenced.

No work has been done on the projected south jetty, as the original

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project provides that the north jetty shall be constructed first, at least in part.

The maximum draft that could be carried over the bar at mean low tide on June 30, 1904, was about 7 feet. The average range of the tide on the bar is 5.2 feet, and vessels generally choose the time of high water for crossing it.

Vessels which cross the bar can ascend the river to a point a short distance above Florence, which is about 5 miles from the entrance, and light-draft steamboats can navigate the river to the head of tide, about 15 miles above Florence.

The commerce of Siuslaw is limited at present, the country being thinly settled. There is considerable timber tributary to the river and lumber is the principal article of commerce at this time, and the industry is growing. The lumber is transported to San Francisco in small coasting vessels. The river and ocean form the only means of transporting the commerce to market, there being no railroad in the vicinity.

Comparative statement of traffic.

Calendar year—	Tons.	Calendar year—	Tons.
1896	7,184	1901	22,351
1897	2,239	1902	25,213
1898	4,350	1903	25,337
1899	4,907	1904 (estimated value, $584,165)	24,816
1900	18,675		

July 1, 1904, balance unexpended	$31,141.90
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	6,392.28
July 1, 1905, balance unexpended	24,749.62
July 1, 1905, outstanding liabilities	61.00
July 1, 1905, balance available	24,688.62

(See Appendix U U 5.)

6. Yaquina Bay, Oregon.—Yaquina Bay is a small tidal estuary of about 5 square miles area lying on the Oregon coast, about 110 miles south of the mouth of the Columbia River. The usual bar exists in the ocean at the entrance to the bay. Prior to improvement the prevailing depth on this bar was only about 7 or 8 feet at low tide, and three distinct channels existed at the entrance to the bay.

The original project for the improvement of Yaquina Bay was approved by the Secretary of War January 14, 1881, and provided a plan for expending the appropriation of $40,000 by act of June 14, 1880, by the building of a short wooden crib jetty on the south side.

The project was amended in 1882, when the amount estimated for completion was $355,000.

The project was modified again in 1888 and in 1892.

Under the original and modified projects there were constructed a rubblestone jetty running out to sea 3,500 feet from the south beach and a rubblestone jetty running out to sea about 2,800 feet from the north head.

The total amount expended on the original and modified projects prior to operations under existing project is about $690,000.

The existing project was approved by act of Congress of June 6, 1900, and provided for removing a cluster of rocks located about 2,000

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feet beyond the sea end of the south jetty, at an estimated cost of $20,000, in accordance with report submitted by a Board of Engineers, November 14, 1899. This work has been completed.

In pursuance of a resolution of the Committee on Rivers and Harbors of the House of Representatives, a special Board of Engineer officers was convened by Special Orders, No. 20, Headquarters Corps of Engineers, July 10, 1903, to consider the improvement of Yaquina Bay. The report of this Board, dated September 26, 1903, was referred to the Board of Engineers for Rivers and Harbors. The latter Board, under date of October 30, 1903, reported that in its opinion—

> It is not desirable for the United States at present to continue the improvement of Yaquina Bay with a view to securing increased depth at the harbor entrance, but that it is desirable that existing works should be kept in such state of efficiency as will maintain existing favorable conditions until such time as it may be shown that further improvement is warranted or that the work should be abandoned altogether.
>
> To provide for maintenance of the existing works for several years, including the repair of damage occasioned by storms, it is recommended that there be appropriated the sum of $25,000.

The Board's report is printed in Annual Report of the Chief of Engineers for 1904, page 3449 et seq.

The amount expended on the existing project to June 30, 1905, is $20,017.37, of which approximately $5,814.86 was for maintenance.

The expenditures to date have resulted in completing the two jetties provided for by the original and modified projects, as stated above, and in removing the cluster of rocks in the bar channel, under the provision of the act of June 6, 1900, to a depth of 12 or 13 feet below mean low tide.

The river and harbor act of March 3, 1905, provides that the unexpended balance shall be returned to the Treasury, except that an amount may be retained sufficient for maintenance for two years. At the close of the year arrangements had been made for closing out the work and distributing the serviceable property to other works of improvement. No expenditures were made during the fiscal year and no work was done except on account of care and distribution of the property and in part payment for the construction of a tugboat.

A report on a preliminary examination of Yaquina River from its mouth up to Elk City, made in August, 1902, is printed in the Annual Report of the Chief of Engineers for 1904, page 3520 et seq.

The construction of the jetties resulted in closing up two of the three channels formerly existing, in developing the third channel, and in obtaining from 13 to 15 feet of water on the bar at mean low tide, or from 21 to 22 feet at high tide.

As the project called for but 17 feet at high tide, it is considered to have been satisfactorily completed.

The maximum draft that could ordinarily be carried during the fiscal year ending June 30, 1904, at mean low tide over the shoalest part of the locality under improvement was about 13 feet. The average range of the tide is 5.9 feet. Small steamboats can navigate Yaquina Bay and River to the head of tide, about 24 miles from its mouth in the ocean.

For extended information see Annual Report of the Chief of Engineers for 1893, Part 4, page 3314, and House Document No. 110,

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Fifty-sixth Congress, first session, also House Document No. 158, Fifty-eighth Congress, second session.

Comparative statement of traffic.

Calendar year—	Tons.	Calendar year—	Tons.
1895	24,589	1901	576
1896	17,883	1902	1,152
1897	15,364	1903	835
1898	10,380	1904 (estimated value, $67,826)	1,113
1899	5,990		
1900	691		

July 1, 1904, balance unexpended	$4,431.55
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	3,114.86
July 1, 1905, balance unexpended	1,316.69
July 1, 1905, outstanding liabilities	94.00
July 1, 1905, balance available	1,222.69

(See Appendix U U 6.)

7. Tillamook Bay and bar, Oregon.—Tillamook Bay is an indentation of the Oregon coast, about 6 miles long by about 3 miles wide, and lies about 50 miles south of the mouth of the Columbia River. The usual bar exists in the ocean at the entrance to the bay, but generally has about 14 feet of water over it at mean low tide. At low tide the bay inside is a succession of sand and mud flats, separated by four channels, which latter shoal to a low-tide depth of but 1 or 2 feet near the east end of the bay. Coasting vessels drawing about 14 feet reach Hobsonville, a short distance inside the entrance.

Tillamook is on Hoquarten Slough and is the distributing point for a very fertile valley lying between the Pacific Ocean and the Coast Range of mountains, and is reached on favorable tides by small coasting vessels drawing about 9 feet.

The original project for the improvement of Tillamook Bay was approved by the War Department October 4, 1888, and provided for a survey of the entrance and the improvement of Dry Stocking bar by building pile dikes. The estimated cost was $5,200.

The expenditures on the original project prior to operations under existing project amounted to $5,700.

The existing project provided for connecting the north and middle channels nearly opposite Bay City, putting in dikes at Junction and Dry Stocking bars, and aimed to obtain a least depth in the channel of 9 feet at mean high tide from Hobsonville up to Tillamook, at an estimated cost of $100,000.

The total amount expended up to the close of the fiscal year ending June 30, 1905, is $105,658.20, of which $32,184.83 was for maintenance and includes $9,471.63 expended during the year in dredging shoals and repairing existing dikes.

From the beginning of the fiscal year to October 31, 1904, snagging and dredging operations were in progress. The shoals at Ox Bow bend and Junction jetty were removed and Hoquarten Slough and the South Fork of Trask River were thoroughly snagged. At that time a channel of about 10 feet at ordinary high tide could be carried to Tillamook. The winter freshets made snagging and redredging necessary, and in May and June Hoquarten Slough was again cleared

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out and preparations made to begin dredging. The work accomplished furnished navigation at high tide to Tillamook for vessels drawing about 10 feet until the formation of shoals lessened the draft about 9 feet.

The maximum draft that could be carried at low water over the shoalest part of the channel is about 3½ feet. The variation of the tides is about 6.2 feet.

The head of navigation is Tillamook, about 12 miles from the entrance.

The commerce on Tillamook Bay consists of general supplies brought by the coasting steamers and lumber, farm and dairy products sent to Portland and San Francisco markets.

During the fiscal year this traffic amounted to 13,823 tons, valued at $658,489.

There is no railroad in the vicinity at this time, and the bay and ocean are the only means of transportation.

The act of Congress of June 13, 1902, in making an appropriation for completing this work directed that a survey of the ocean bar be made with a view of making estimates of the cost of securing channels across it of 15 and 20 feet depths, respectively.

This survey was made in September and October, 1902, and report thereon published in the Annual Report of the Chief of Engineers for 1903, pages 2239–2246.

Comparative statement of traffic.

Calendar year—	Tons.	Calendar year—	Tons.
1896	25,977	1901	21,147
1897	29,405	1902	24,883
1898	35,885	1903	16,862
1899	36,835	1904 (estimated value, $658,489)	13,823
1900	17,640		

July 1, 1904, balance unexpended	$9,518.11
Amount appropriated by river and harbor act approved March 3, 1905	10,000.00
	19,518.11
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	9,471.63
July 1, 1905, balance unexpended	10,046.48
July 1, 1905, outstanding liabilities	2,391.00
July 1, 1905, balance available	7,655.48

(See Appendix U U 7.)

8. Improving the various harbors on the coast of Oregon south of the Columbia River by the construction and equipment of a dredging plant for use thereon.—The harbors under improvement and for which the plant is intended are Tillamook Bay and bar, Yaquina Bay, Siuslaw River, Coos Bay and Harbor, and the Coquille River, Oregon.

Navigation is often greatly delayed by the forming of shoals, the material deposited in most instances being of such a nature that it can not be easily handled with a dipper dredge.

It is estimated that a combination suction and dipper dredge could be advantageously used and so constructeed that it could be taken from harbor to harbor as the necessities demand.

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The cost of such a plant, with two dump scows, would be approximately $50,000, and it is thought that the necessity for its use will fully justify the expenditure, the funds to be provided by special appropriation, the operating expenses to be paid from funds available for maintenance of the harbor upon which it may be used.

There are no private dredging plants at any of the coast harbors mentioned, and the expense of taking a plant from the Columbia River, with the attendant risk in towing, would make the cost of dredging prohibitive if undertaken by contract.

(See Appendix U U 8.)

9. Upper Columbia and Snake rivers, Oregon, Washington, and Idaho.—The designation "upper Columbia and Snake rivers, Oregon and Washington" now covers the 116 miles of the Columbia River from Celilo, Oreg., up to the mouth of Snake River at Ainsworth, Wash., and the 221 miles of the Snake River from its mouth up to Pittsburg Landing, Oreg.

Both the Columbia and Snake rivers, between Celilo and Asotin, a small settlement about 5 miles above Lewiston, and the limit of regular navigation in the past, are more or less obstructed by rock and gravel bars, which cause rapids, the controlling depth over some of which at low water is from 2 to 3 feet, while some (particularly in the 67 miles of the Snake, between its mouth and Riparia, Wash.) are not safely navigable at extreme low-water stages.

The Snake River between Asotin and Pittsburg Landing, 76 miles, falls about 7 feet to the mile at low-water stage. The channel in some places is narrow and crooked and is obstructed by many rapids and rocks.

No formal project for improving the two streams between Celilo and Pittsburg Landing has ever been adopted by Congress. The first appropriation for the upper Columbia was made by act of June 10, 1872.

The Snake River has been surveyed between its mouth and the mouth of the Imnaha River, but a continuous survey of the Columbia between Celilo and the mouth of the Snake has never been authorized or made.

Owing to the construction of railroads along and adjacent to both streams and the difficulties of navigating the Snake River below Riparia and some portions of the Columbia between Celilo and the mouth of the Snake, steamboats abandoned the stream between Celilo and Riparia for purposes of regular navigation about 1882.

The expenditures to June 30, 1905, $344,861.07, resulted in removing some of the worst obstructions to steamboat navigation between Celilo and Asotin, and in the construction of several dikes to deflect and concentrate the flow over shoals.

The existing project, approved by Congress by act of June 13, 1902, provides for completing and maintaining the improvement of the Snake River between Riparia and Lewiston, and for the improvement of the Snake River between Lewiston and Pittsburg Landing.

The estimated cost of the project of improvement between Riparia and Lewiston is $23,000, with $5,000 additional for maintenance for two years.

No estimate or detailed project has ever been made for improvement of the Snake between Lewiston and Pittsburg Landing, but the

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act of June 13, 1902, appropriated $25,000 for that portion of the stream.

A survey between Lewiston and the mouth of the Imnaha has been made, and the project for improvement of that portion of the stream was approved by the Secretary of War on May 29, 1903; estimated cost, $33,690. The project, therefore, now includes the river between Riparia and Lewiston and between Lewiston and Imnaha, now called Eureka, and also provides for a dredge which was completed and put into commission on November 29, 1904. The survey between Eureka and Pittsburg Landing will be completed during the coming low-water season, this survey having been previously delayed owing to the lack of funds.

The expenditures during the fiscal year were for properly caring for the plant used in former years and for constructing a dredge and operating it for about two months between Lewiston and Riparia. This work furnished uninterrupted navigation between those points, while above Lewiston no work was done and the river was very little used.

The controlling depth between Riparia and Lewiston at low water is about 3½ feet, while low-water navigation is not possible above Asotin, 5 miles above Lewiston, and is only attempted on higher stages. The present head of low-water navigation then is Asotin, 261 miles above Celilo, or 473 miles above the mouth of the Columbia, while the completion of the project will extend the benefits to Pittsburg Landing, 77 miles, and furnish a low-water depth of about 24 inches over the most obstructive rocks and reefs. The removal of a number of isolated rocks in the rapids above Asotin will make the river safely navigable with about 24 inches as the controlling low-water depth to the mouth of the Grande Ronde River, and it is hoped to accomplish the removal of these obstructions during the present low-water season.

The river is subject to very high rises during the spring and summer, varying from 9 to 26 feet.

The Oregon Railroad and Navigation Company operates its steamers regularly between Lewiston and Riparia, and the steamer *Imnaha*, constructed the past year in the interest of a mining company, has made intermittent trips to Eureka, a mining settlement near the mouth of the Imnaha River.

The commerce transported during the fiscal year amounted to 43,547 tons, and consisted principally of farm and mill machinery and general merchandise distributed, and farm and lumber products sent to market. The value of these commodities is estimated at $1,798,677.

The completion of the project can have no appreciable effect on freight rates, except possibly over the portion of the river between Riparia and Celilo, which may now be used owing to the completion of The Dalles-Celilo portage road by the State of Oregon. This road was completed and ready for operation on June 3, 1905, and will bring the river below Riparia into competition with rail transportation from the latter point.

For information in detail concerning the immense territory drained by and tributary to the Columbia and Snake rivers, commerce, transportation, etc., attention is particularly invited to the Annual Report

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of the Chief of Engineers for 1901, Part 5, pages 3525–3544; for details of the project between Lewiston and Imnaha, see Report for 1903, Part 3, pages 2246–2255.

Comparative statement of traffic.

Calendar year—	Tons.	Calendar year—	Tons.
1895	37,100	1901	36,723
1896	25,977	1902	37,824
1897	31,531	1903	44,379
1898	36,923	1904 (estimated value, $1,798,677)	43,547
1899	45,654		
1900	35,920		

July 1, 1904, balance unexpended		$43,658.01
Amount appropriated by river and harbor act approved March 3, 1905		25,000.00
		68,658.01
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$14,082.90	
For maintenance of improvement	27,066.07	
		41,148.97
July 1, 1905, balance unexpended		27,509.04
July 1, 1905, outstanding liabilities		582.00
July 1, 1905, balance available		26,927.04
Amount (estimated) required for completion of existing project		Indefinite.

(See Appendix U U 9.)

10. Columbia River between the foot of The Dalles Rapids and the head of Celilo Falls, Oregon and Washington.—The object of this improvement is to overcome the obstructions in the 12 miles of the Columbia River between the foot of Threemile Rapids and the head of Celilo Falls. In this stretch of river there is Threemile Rapids, a crooked channel, 1,500 feet in length, narrow and much obstructed by rocks and currents; then Fivemile Rapids (The Dalles), where for 1½ miles the river rushes with great velocity between precipitous walls of basalt 150 to 300 feet apart; next comes Tenmile Rapids, a similar gorge, but only one-half mile in length, and last of all Celilo Falls, with a sheer fall of 20 feet. In this 12 miles of river the total fall is about 81 feet in low water and in high stages 60 feet.

There have been a number of projects submitted, the first of which is printed in the Annual Report of the Chief of Engineers for 1882, Part 3, page 2690.

The first project, adopted by act of Congress of August 18, 1894, was for a boat railway capable of transporting boats of 600 tons, and $100,000 was appropriated for purchasing the right of way and for beginning construction. This project is based on a minority report of a Board of Engineers printed in the Annual Report of the Chief of Engineers for 1894, Part 4, page 2664.

By act of Congress of June 3, 1896, $150,000 additional was appropriated for the "construction and equipment of a boat railway from the foot of The Dalles Rapids to the head of Celilo Falls," for which plans were commenced and the right of way partially acquired.

The act of June 6, 1900, directed a preliminary examination and survey of the "Columbia River between The Dalles Rapids and the head of Celilo Falls, Oregon and Washington, with a view to the construction of a canal and locks to overcome the obstructions to navigation." The report and project submitted under this act is found in the

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Annual Report of the Chief of Engineers for 1901, Part 5, page 3502. It provided for a short canal and locks around "The Dalles," or Fivemile, Rapids, and another around the falls at Celilo, with intermediate river improvement, at an estimated cost of $3,969,371.

By act approved June 13, 1902, Congress adopted the project of 1900 and authorized the use of all available funds, and, in addition, authorized contracts for construction purposes to the extent of $100,000. It also made provision for the appointment of a Board of Engineer officers to revise the project, if possible, with a view to reducing its cost.

The project submitted by this last Board was for a continuous canal with four locks located on the Oregon shore and extending from Big Eddy, at the foot of The Dalles, or Fivemile, Rapids, to the head of Celilo Falls, with river improvement of Threemile Rapids. The proposed canal is about 8½ miles long, 65 feet mide on the bottom, and 8 feet deep. The locks are to be 250 feet long between quoin posts and 40 feet wide in the clear, with a depth of 7 feet of water over the miter sills. The estimated cost is $4,125,000. The report of the Board is printed in the Annual Report of the Chief of Engineers for 1904, page 3475 et seq.

The project was approved by the Secretary of War November 6, 1903, with a proviso that "no work shall be begun until the right of way and release from damages have been conveyed to the United States free of cost," and was adopted by the river and harbor act of March 3, 1905. At the close of the year the title to right of way had been vested in the United States by deeds from the State of Oregon.

The approval of the project for beginning actual canal construction by the Chief of Engineers on May 8, 1905, included increasing the length of the locks to 300 feet between hollow quoins, with a clear width of 45 feet.

The amount expended to June 30, 1905, was $121,450.40, of which $27,112.83 was applied to previous projects, $31,279.81 in surveys for the Board of Engineers in preparation of a plan for improvement, and $63,057.76 on the existing project.

The river and harbor act of March 3, 1905, appropriated $50,000 for continuing the improvement and authorized contracts not to exceed in the aggregate $250,000, and at the close of the fiscal year the work proposed under this appropriation is being advertised, with a view to constructing approximately 2,500 feet of the canal walls at the upper end.

The only results in the way of increased depth and width of channel was in Threemile Rapids. The channel there was straightened, widened, and deepened, so as to increase the width of the low-water channel 50 to 100 feet along a length of about 800 feet.

The amount estimated as a profitable expenditure will be applied to excavation and the construction of locks, walls, etc., over that portion of the canal immediately below the work now proposed.

The variations in water surface from extreme low water to the extreme high water of freshets varies at different points from about 32 to 90 feet. River boats now reach the foot of Threemile Rapids, about 1½ miles above The Dalles, Oregon, but navigation is expected to be extended at once to Big Eddy to connect with the State Portage Railway, which was constructed during the year between Celilo and Big Eddy and is now open for traffic.

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The projected improvement will extend the benefits of an all-water route to the sea to points on the Snake River that are between 240 and 550 miles distant therefrom. Asotin, on the Snake River, 473 miles from the sea, is the head of low-water navigation, while intermittent trips are made during higher stages to Imnaha, 516 miles from the sea. The country affected now has or will undoubtedly soon develop resources as follows:

Grain, 40,000,000 bushels per annum.
Wool, 16,000,000 pounds per annum.
Live stock, valued at $1,500,000 per annum.
Lumber, white and yellow pine, 5,000,000,000 feet in sight.

In addition to the above, there are the products, such as hops, potatoes, fruits and berries, sugar beets, hay, etc., that are now being produced from about 4,000,000 acres out of an estimated total of 9,500,000 acres of tillable land. The above is taken from House Document No. 228, Fifty-sixth Congress, second session.

Irrigation as now contemplated should increase considerably the above both in total acreage and output per acre.

The completion of this improvement will undoubtedly reduce the freight rates on the enormous quantities of produce annually shipped by rail from the extensive territory drained by the upper Columbia and Snake rivers.

For extended information attention is invited to the following references:

Annual Reports of the Chief of Engineers for 1875, Part 2, page 787; 1882, Part 3, page 2690; 1890, Part 4, page 3028; 1894, Part 4, page 2664; 1901, Part 5, page 3501.

For maps and sketches, see House Executive Document No. 65, Fifty-first Congress, first session; House Document No. 228, Fifty-sixth Congress, second session.

July 1, 1904, balance unexpended	$291,682.36
Amount appropriated by river and harbor act approved March 3, 1905	50,000.00
	341,682.36
June 30, 1905, amount expended during fiscal year, for works of improvement	63,132.76
July 1, 1905, balance unexpended	278,549.60
July 1, 1905, outstanding liabilities	5,529.00
July 1, 1905, balance available	273,020.60
July 1, 1905, amount covered by uncompleted contracts	75,500.00
Amount (estimated) required for completion of existing project	3,783,392.64
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	250,000.00

(See Appendix U U 10.)

11. Canal at the Cascades, Columbia River, Oregon.—In passing through the Cascade Mountain Range, the channel of the Columbia River, for a distance of about 4½ miles, is so contracted in width that that portion of the stream partakes of the nature of a gorge. In the

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upper 2,500 feet of this gorge there is a fall of about 24 feet at low water, which, on account of the rapids and huge bowlders, can not be navigated. Throughout the lower portion of the gorge, about 4 miles, the channel, while not as contracted nor of as steep slope as the upper 2,500 feet, was nevertheless so contracted and of such slope that rapids were formed that could not be navigated at the higher stages. This lower portion of the gorge, also, was originally much obstructed by large bowlders and reefs.

The original project was for canal and locks, at an estimated cost of $2,544,545, and was approved by the Secretary of War on October 12, 1877, and modified by a Board of Engineers in 1886 and 1888 to include the improvement of the rapids below the falls to secure a low-water channel of 8 feet, with a lock 462 feet long and 90 feet wide. The project was again modified in 1894 to provide for utilizing the 462 feet of the incomplete canal above the upper lock gates as a second lock. It also provided for raising the protection work of the canal, the height of which had been based on the flood of 1876, the highest water known previous to 1894, in order to make the height of walls conform to the flood level of the latter year, which was 6 feet above that of 1876. The estimated cost of this modification ($413,360 additional) was approved by act of June 3, 1896, and $50,000 was appropriated therefor.

The work of constructing the locks was prosecuted since the adoption of the original project, both by hired labor and by purchase of materials and under contract, until the walls and slopes were partially completed and the locks opened to navigation in the fall of 1896, at which time the work was under contract with the Cascades Construction Company.

The amount expended on original modified project up to the close of the fiscal year ending June 30, 1905, was $3,781,094.36.

There has been a total of $3,808,000 appropriated for this work. The amount estimated as required to complete the walls and place the grounds in good condition is $199,260, thus making the estimated total cost $4,007,260.

The expenditures during the year were for caring for plant; in blasting rocks at Sheridans Point, and in grading the grounds preparatory to construction of buildings under project for expenditure of funds appropriated by act of March 3, 1905.

The principal work remaining to be done is raising the land wall of the upper lock, constructing three sets of steps, completing the paving and grading on the land side of the canal, and constructing three new quarters for the lock hands, new shop and stable.

The head of navigation for boats passing the locks is at Three-mile Rapids, 1½ miles above The Dalles. This is expected to be extended to Big Eddy to connect with the State Portage road, completed June 3, 1905. The road is constructed around the obstruction between The Dalles and Celilo, and it is expected that this will increase the benefits, and that navigation of the Columbia between Celilo and the up-river points will be resumed. The head of low-water navigation will then be Asotin, on the Snake River, 145 miles above its junction with the Columbia, and approximately 473 miles from the sea. On higher stages boats ascend the Snake to Imnaha, 516 miles distant from the sea.

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The down-river commerce through the locks consists principally of live stock, hay, grain, wool, and country produce. The amount of this commerce for the fiscal year was 24,174 tons, valued at approximately $1,571,245.

The up-river commerce is principally machinery and supplies, consisting of 10,992 tons, value, approximately, $714,880.

The maximum draft that can be carried through the locks at the close of the fiscal year is about 6 feet.

The yearly rise in the Columbia takes place in May, June, or July, and its usual height above extreme low water is about 40 feet.

For further details of project and modifications, attention is invited to the following references:

Original condition, Annual Report of the Chief of Engineers for 1884, page 2246.

Original project, Annual Report of the Chief of Engineers for 1889, pages 2551–2559.

Modified project of 1894, Annual Report of the Chief of Engineers for 1895, pages 3571–3582.

The following is a comparative statement of the commerce passing through the locks:

Comparative statement of traffic.

Fiscal year ending June 30—	Merchandise.		Passengers.
	Tons.	Estimated value.	
1898	18,812	----------	30,327
1899	16,700	----------	23,908
1900	17,710	----------	30,639
1901	22,426	----------	34,762
1902	19,710	----------	52,730
1903	36,181	----------	50,821
1904	31,967	----------	76,971
1905	35,166	$2,286,125	64,408

July 1, 1904, balance unexpended		$7,491.54
Amount appropriated by river and harbor act approved March 3, 1905		30,000.00
Deposited account proceeds Government property		317.60
		37,809.14
June 30, 1905, amount expended during fiscal year, for maintenance of improvement		4,485.90
July 1, 1905, balance unexpended		33,323.24
July 1, 1905, outstanding liabilities		1,759.00
July 1, 1905, balance available		31,564.24
Amount (estimated) required for completion of existing project		199,260.00

(See Appendix U U 11.)

12. Operating and care of canal and locks at the Cascades of the Columbia River, Oregon.—The obstructions in the Columbia River at the Cascades are described in the preceding report. The canal and locks which pass steamboats around these obstructions were opened to navigation on November 5, 1896, although incomplete in many details, and have been in condition to be used ever since that date, with the exception of a few days when minor repairs were in progress and a few days in June, 1903, when the water was too high.

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The total amount expended up to June 30, 1904, was $47,194.68. These expenditures were for operating and properly caring for the locks and in payment of salaries of employees engaged thereon; also for purchase of material and making repairs to machinery and slope pavement, repainting the steel lock gates, renewing cables, etc., and for dredging in the upper entrance to the canal.

During the fiscal year ending June 30, 1905, the expenditures amounted to $8,931.67, which were for payment of salaries of employees, in operating and caring for the locks and grounds, etc., and included expenditures for making repairs to the valve of the lower lock gate on the south side. The sum of $3,000 was allotted for the latter item on May 12, 1905, and at the close of the fiscal year the work had not been completed.

The estimate for the fiscal year 1905 provided for dredging in the canal entrance, but no dredge was available for the work and temporary relief was obtained by sluicing out the sand and silt.

The estimate for the fiscal year 1906, in addition to the regular expense of operating and caring for the lock and canal, includes the repairs to the valve of the lower lock on the north side and the construction and operation of a small dredge for removal of deposits.

The commerce through the locks during the year amounted to 35,166 tons, valued at approximately $2,285,725.

(See Appendix U U 12.)

13. Columbia River between Vancouver, Wash., and the mouth of Willamette River.—The city of Vancouver, Wash., is located on the Columbia River about 103 miles above its mouth and 5 miles above the junction of the Willamette and Columbia rivers. Vessels drawing up to 23 feet ascend the Columbia from its mouth up to a point 2½ miles below the town of Vancouver, where there is a bar which had originally but 9 feet of water over it at lowest river stage.

The original project, adopted in 1892, provided for constructing a pile, brush, and rubblestone dike about 3,000 feet long from the Oregon shore to the head of Hayden Island, opposite Vancouver, at an estimated cost of $100,000, to stop the flow south of the island during low-water stages and deflect it down the main channel north of the island, so as to scour the bar below Vancouver and obtain a depth over it sufficient to permit ascending vessels drawing 20 or more feet to reach Vancouver. It was approved by the Chief of Engineers August 6, 1892.

On June 18, 1901, the additional sum of $8,000 was allotted from the appropriation of June 6, 1900, for emergencies in river and harbor works, and was applied to repairing the dike during the low-water period of the winter of 1901–2.

The Board of Engineers for Rivers and Harbors, after considering a report submitted under date of July 22, 1902, on an examination with a view to ascertaining the effects of the dikes and other works, and after a personal inspection of the locality on May 10, 1903, by a committee thereof, was of the opinion that the United States should undertake what further work may be necessary to secure a 20-foot channel through the shoal below Vancouver, provided the work could be done at a cost not greatly to exceed the estimate made by the district officer. This project is printed in the Annual Report of the Chief of Engineers for 1904, pages 3497–3505, and as approved pro-

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vides for dredging to secure a channel 150 feet wide and 20 feet deep, at a cost of $60,000, with $10,000 annually for maintenance of said channel and the dike at head of Hayden Island.

No operations have been carried on during the year except to establish a gauge at Vancouver, Wash., and keep a record of the readings.

The river and harbor act of March 3, 1905, appropriated $30,000 and authorized expenditure of $30,000 additional under continuing contract. These amounts will be applied to dredging, and operations will be begun during the coming low-water season.

The amount expended on the project to June 30, 1905, is $109,441.99, of which the sum of $23,908.83 was for maintenance.

The expenditures to date on this work have resulted in completing the dike and in revetting the head of Hayden Island to prevent erosion. The map following page 3230 of Annual Report of the Chief of Engineers for 1899 shows the work as completed May 2, 1899. Although the dike has caused considerable scouring on the shoals below Vancouver, it has increased the controlling channel depth only about 1 foot.

The maximum draft that could be carried at extreme low water during the past year was about 10 feet.

The average range of tide in the Columbia River at Vancouver at extreme low stage is about 0.8 foot. During the summer freshet, which generally occurs in June, the usual rise is about 20 feet.

Steamboats drawing 8 feet can navigate the river as far as The Dalles, about 210 miles from its mouth, by passing through the locks at the Cascades.

The dredging of the channel will furnish low-water navigation to Vancouver for ships drawing 20 feet, and will be of great benefit to the lumber industry. Vast forests of virgin timber are within easy reach of the latter point, and the country also produces great quantities of fruit, hay, grain, etc. Vancouver has railroad connections, but it is not believed that the improvement will affect the rates on local or transcontinental shipments.

The amount named in the money statement as a profitable expenditure is the $30,000 authorized for continuing contracts, which is to be applied to dredging.

For further information reference is invited to Annual Report of the Chief of Engineers for 1896, pages 3264 and 3265.

For report on examination made by the Board of Engineers, attention is invited to report of the Chief of Engineers for 1904, page 3497 et seq.

July 1, 1904, balance unexpended	$634.01
Amount appropriated by river and harbor act approved March 3, 1905	30,000.00
	30,634.01
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	75.00
July 1, 1905, balance unexpended	30,559.01
July 1, 1905, outstanding liabilities	15.00
July 1, 1905, balance available	30,544.01
Amount (estimated) required for completion of existing project	30,000.00

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Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905 ..... $30,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix U U 13.)

IMPROVEMENT OF WILLAMETTE RIVER, AND OF COLUMBIA RIVER BELOW THE MOUTH OF THE WILLAMETTE, AND THEIR TRIBUTARIES, OREGON AND WASHINGTON.

This district was in the charge of Maj. W. C. Langfitt, Corps of Engineers, having under his immediate orders Capt. Amos A. Fries, Corps of Engineers. Division engineer, Col. W. H. Heuer, Corps of Engineers.

1. Willamette River above Portland, and Yamhill and Long Tom rivers, Oregon.—The Willamette River rises in the Cascade Range, about 150 miles southward of the Columbia River, and flows northerly generally parallel to and about 50 miles east of the coast line. It enters the Columbia about 100 miles above its mouth and 12 miles north of the city of Portland.

The Yamhill River rises in the Coast Range, flows in a northeasterly direction, and enters the Willamette about 40 miles above its mouth.

The Long Tom River is also a tributary of the Willamette. It rises on the eastern slope of the Coast Range, drains an area of about 430 square miles, including a large amount of very productive valley land, and empties into the Willamette River 122 miles distant from Portland by river.

A detailed description of the Willamette River, together with that of its condition prior to improvement, may be found in the Annual Reports of the Chief of Engineers for 1876, page 654, and for 1880, page 2280.

The Willamette River drains an exceedingly fertile valley. Prior to improvement the channel was obstructed by snags and rocks, which were removed under the project of 1892 to enable boats to reach Dayton, on the Yamhill River, about 5 miles above its mouth, at all seasons on a draft of about 2½ feet. Above Dayton and about 1 mile below Lafayette the channel of the Yamhill was obstructed by rapids, so that boats could reach Lafayette, 9 miles, and McMinnville, about 18 miles above its mouth, only during extreme high water.

The original project for improvement of the Willamette was adopted in 1870 and modified in 1878 and 1879, and in 1892 was extended to include the removal of obstructions in the Yamhill River to McMinnville.

On the above project $247,747.51 has been expended.

The project of 1896 provided for the improvement of the Willamette River from Portland to Eugene, at an estimated cost of $131,697, and on the Yamhill (see Annual Report of the Chief of Engineers for 1895, p. 3602) provided for the removal of obstructions and the construction of a lock and dam in the Yamhill River, to obtain a draft of 3½ feet from the mouth of the river to McMinnville. Estimated cost, $69,000.

The construction of controlling works under the old project has without doubt afforded relief and alone made navigation possible

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during recent years. However, it is believed that the physical features of the river are such that the depths proposed by the project can not be obtained at reasonable cost.

The work done on the Willamette and Yamhill rivers during the fiscal year 1905 consisted in making repairs to existing dams, commencement of work on the unfinished portion of Independence revetment, dredging, and snagging.

The snag boat was operated from July 7 to October 21, and the dredge from September 1 to October 19, also from May 10 to the close of the fiscal year. The channel was snagged and the troublesome shoals dredged out between Portland and Independence. The dredge used in this work, and which was under construction at the beginning of the fiscal year, was completed under contract. The use of the dredge has demonstrated that this will be an economical means of keeping the gravel bars open.

The work performed has enabled boats to operate during extreme low water from Portland to Salem on the Willamette and to Dayton on the Yamhill River, and at the close of the year boats drawing 3 feet can make daily trips to Independence.

The total amount expended on the project of 1896 up to the close of the fiscal year ending June 30, 1905, was $281,736.45. In this amount is included $3,000 expended on the improvement of the Long Tom River, and $76,115.77 for maintenance in snagging, constructing and operating dredge, and making repairs to dams.

It is proposed to continue work on these rivers in accordance with the revised plan presented by the district officer under date of October 15, 1903, printed in the Annual Report of the Chief of Engineers for 1904, page 3529 et seq. This provides for improvement of the Willamette below Corvallis for a distance of 119 miles to the head of deep-water navigation in Portland Harbor (about 1 mile above Madison Street Bridge), with a view of obtaining by snagging and dredging, with auxiliary dam and revetment construction, a low-water depth of 2½ to 3½ feet from Corvallis to Oswego (8 miles above Portland) and a low-water depth of 12 feet thence to Portland. The district officer found it impracticable to outline a plan for permanent improvement which can be completed at a given cost, but an estimate of $213,500 was presented for prosecuting the work as indicated. Only maintenance is proposed for the Yamhill.

The funds appropriated by the river and harbor act of March 3, 1905, will be applied to work under the revised project.

The upper Willamette River is navigable during high water to Harrisburg, 152 miles above Portland; during medium water stages to Corvallis, 119 miles above Portland, and during low water, with aid of dredging, to Independence, 83 miles above Portland.

The Yamhill River is navigated to McMinnville, 18 miles above its mouth and 59 miles above Portland, except at certain stages of high water, when the lock near Lafayette is filled and the fall is too great to permit of navigation of the river over the dam.

The variation of level of water surfaces on the Willamette at Salem from extreme summer low water to average winter high water is 23 feet, and on the Yamhill below the lock and dam 35 feet.

The commerce consists principally of farm products raised on the rich valley lands adjacent to the river, and which are generally

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shipped to the Portland market. There is also a great deal of lumber and lumber products from the surrounding forests. These items, together with the general supplies and merchandise distributed, amounted, during the calendar year 1904, to 332,130 tons, valued at approximately $11,260,196.

This improvement affords water transportation for most of the commodities produced in the valley and is instrumental in reducing freight on railroad shipments from valley points. Lines of the Southern Pacific Railway Company practically parallel the river on each side.

For further information, see Annual Reports of the Chief of Engineers for 1896, pages 3309–3320; 1901, page 3553.

For report of the Board relative to acquisition by the United States of improvements at Willamette Falls, see House Document No. 99, Fifty-eighth Congress, third session.

For preliminary examinations, attention is invited to the Annual Report of the Chief of Engineers for 1904, as follows: Between Portland and Oregon City, page 3559 et seq.; opposite Albany, Oreg., page 3564 et seq.; Yamhill River, Oregon, with a view to modification of lock and dam in Yamhill River, page 3569 et seq.

Comparative statement of traffic.

Calendar year.	Merchandise.		Passengers.	Calendar year.	Merchandise.		Passengers.
	Tons.	Estimated value.			Tons.	Estimated value.	
1895	130,870		57,376	1900	182,458		47,324
1896	218,480		48,465	1901	191,901		108,971
1897	186,621		87,960	1902	192,227		95,221
1898	112,154		67,524	1903	236,823		66,510
1899	117,782		50,738	1904	332,130	$11,260,196	65,947

July 1, 1904, balance unexpended	$35,194.82
Amount appropriated by river and harbor act approved March 3, 1905	50,000.00
	85,194.82
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	31,178.78
July 1, 1905, balance unexpended	54,016.04
July 1, 1905, outstanding liabilities	1,579.00
July 1, 1905, balance available	52,437.04
Amount (estimated) required for completion of existing project	163,500.00

(See Appendix V V 1.)

2. Operating and care of lock and dam in Yamhill River, Oregon.—The Yamhill lock is situated on Yamhill River near Lafayette, Oreg., about 8 miles above its junction with the Willamette and some 10 miles below the town of McMinnville, the head of steamboat navigation. The lock was completed under contract in September, 1900.

The funds for operating and care of the lock and dam during the fiscal year 1905 were provided by allotment of June 25, 1904. The amount allotted was $700, the total amount of the estimate being $1,700, which included approximately $1,000 left over from previous allotment. Of this amount $922.13 was expended during the year in operating the lock and making minor repairs. The total amount

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expended to the end of the fiscal year 1905 under allotments for operating and care, including repairs, is $31,038.34.

No work has been done during the fiscal year except to attend to minor repairs and to operating the lock.

The total amount of traffic that passed through the lock during the year amounted to 4,109 tons of freight and 44 passengers. This freight was made up largely of cord wood on barges for paper fiber and of log rafts. The largest year's traffic (1901) was 2,455 tons of miscellaneous freight and 1,199 passengers. The practical suspension of steamer traffic since 1902 is owing to the fact that the Oregon City Transportation Company has taken its boats for use on the Willamette River and has abandoned the McMinnville route because it is claimed the uncertainty of lock operation during the winter makes it impossible to compete with railroad rates.

For report on examination of this lock and dam, with a view to correcting this feature, see Annual Report of the Chief of Engineers for 1904, page 3569 et seq.

(See Appendix V V 2.)

3. Columbia and lower Willamette rivers below Portland, Oreg.—The Columbia River rises in British Columbia, flows southerly and westerly, and forms in its lower portion, for 330 miles, the boundary between Oregon and Washington, emptying into the Pacific Ocean between these two States.

The Willamette River rises in the Cascade Range, about 150 miles southward of the Columbia River, flows northerly, entering the Columbia about 100 miles above its mouth and 12 miles north of the city of Portland.

The portions of these rivers covered by this improvement include the 12 miles of the Willamette between Portland and its mouth and 98 miles of the Columbia from the mouth of the Willamette to the sea.

The original condition of these rivers from Portland to the sea was such that only from 10 to 15 feet could be carried over the shoal places at low water. Numerous sand bars obstructed navigation by deep-water craft and distributed the water over an extended area, so that the channels were comparatively narrow.

The value and the availability of this waterway for purposes of commerce are proved by the quantities of grain and produce that through it find an outlet to the markets of the world from Oregon, Washington, and Idaho. Its improvement to navigation for deep-water craft is of the utmost importance to the entire northwest section of the country, whose inhabitants find the natural outlet for their produce through the valley of the Columbia.

Prior to adoption of a project dredging had been done for temporary relief, and the sum of $221,780.46 expended for that purpose.

The original project was adopted in 1877, and was prepared by the Board of Engineers for the Pacific coast with a view of obtaining a channel depth of 20 feet. In 1891 the project was extended to obtain a low-water channel depth of 25 feet, at an estimated cost of $772,464, and the Port of Portland Commission, a corporation existing under the laws of the State of Oregon, was granted permission to assist in carrying it into execution.

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On the original and modified project, exclusive of amounts expended in dredging prior to 1877 and by the Port of Portland Commission, there had been expended to June 30, 1903, the sum of $1,080,874.11.

The existing project, adopted by the act of June 13, 1902, is based on survey authorized by act of March 3, 1899, and proposes a 25-foot channel to the sea by construction of controlling works and by dredging at an estimated cost of $2,796,300, with $175,000 as cost of a new dredge and accessories and $50,000 annually for maintenance.

The expenditures on this work from beginning of the fiscal year 1903 and up to the end of the fiscal year 1905 amounted to $261,682.21. As these funds were expended for dredging and repairs to old work, it may be said that nothing has as yet been expended on the project for permanent improvement, and as the amounts now available are sufficient only for maintenance no change has been made over the figures given last year as the amount required for completion of the existing project.

The river and harbor act of March 3, 1905, appropriated $100,000 for continuing the improvement and authorized contracts not exceeding in the aggregate $125,000. These amounts will be expended in dredging and such other work as may be deemed most advisable.

The funds appropriated since the adoption of the project have been insufficient to allow of the construction of a new dredge, pay operating expenses of the dredges, and construction of permanent works. Operations have therefore been confined almost exclusively to dredging.

A contract is in force for the hire of either of the dredges belonging to the Port of Portland Commission, and their 30-inch suction dredge is used when funds are available and conditions require it.

The U. S. dredge *W. S. Ladd* was operated during the year except from January 11 to April 8, 1905, and removed 536,920.28 cubic yards from some of the most obstructive shoals.

The 30-inch dredge of the port of Portland was operated under contract with funds allotted from the appropriation made by act of April 28, 1904, from August 1 to December 20, 1904, and removed 1,089,076 cubic yards.

Work was also done at the mouth of the Willamette River in removing and replacing old revetment.

The Port of Portland Commission also operated with its 20-inch and 30-inch suction dredges when the latter was not in use by the United States and when conditions required it and funds were available therefor, and reports having removed 325,082 cubic yards.

The improvement has been beneficial to deep-draft navigation and has reduced the delay to shipping.

The amount estimated as a profitable expenditure will be applied to the construction of permanent works of improvement and in dredging.

The head of deep-sea navigation for ships crossing the bar at the mouth of the Columbia is at Portland, Oreg., on the Willamette River, 110 miles above the mouth of the Columbia. From the latter place light-draft river boats ascend the Willamette River for 150 miles. From the mouth of the Willamette, by using the State Portage road, 12 miles in length, the Columbia and Snake rivers are navigable for light-draft river boats at low water to a point on the Snake River about 473 miles from the mouth of the Columbia.

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The ruling depth at the end of the fiscal year between Portland and the sea is about 20 feet at low water. The increase in depth since commencement of improvement is about 6 feet, with a good navigable width of channel.

The usual variations of water level due to tide are from 2 feet at Portland to 7 feet at Astoria, and the difference in water levels on account of freshets ranges from 20 feet at Portland to zero at Astoria.

The export commerce using this waterway consists principally of grain and lumber, while the imports are, in a great measure, composed of the products of the oriental countries, also cement, coal, lime, sulphur, etc. The river tonnage consists mostly of dairy, farm, and lumber products, also miscellaneous machinery and mercantile supplies.

The total commerce handled during the calendar year 1904 amounted to 2,683,779 tons, the estimated value of which was $58,056,911.

For further information as to original condition, etc., attention is invited to the following references:

Project of 1877, see Annual Report of the Chief of Engineers for 1877, page 1001 et seq.

Project of 1891, see Annual Report of the Chief of Engineers for 1892, page 2850 et seq.

Project of 1902, see Annual Report of the Chief of Engineers for 1900, page 4418 et seq.

Comparative statement of traffic.

Calendar year.	Handled by river vessels.		Handled by seagoing vessels.				Handled by river and seagoing vessels.	
	Tons.	Estimated value.	Receipts.	Shipments.	Total.	Estimated value.	Tons.	Estimated value.
			Tons.	*Tons.*	*Tons.*			
1895	1,040,022	.....	40,238	395,954	436,192	.....	1,476,214	.....
1896	1,129,673	.....	49,011	329,102	378,113	.....	1,507,786	.....
1897	1,499,337	.....	47,345	290,412	337,757	.....	1,837,094	.....
1898	1,121,161	.....	27,776	488,818	516,594	.....	1,637,755	.....
1899	1,489,708	.....	36,253	336,134	372,387	.....	1,862,095	.....
1900	1,287,582	.....	32,905	489,385	522,290	.....	1,809,872	.....
1901	1,534,780	.....	29,548	639,736	669,284	.....	2,204,064	.....
1902	1,567,336	.....	145,514	985,912	1,131,426	.....	2,698,762	.....
1903	1,596,220	.....	173,006	659,178	832,184	.....	2,428,404	.....
1904	1,905,451	$30,775,609	229,883	548,495	778,328	$27,281,302	2,683,779	$58,056,911

July 1, 1904, balance unexpended	$95,557.54
Amount appropriated by river and harbor act approved March 3, 1905	100,000.00
Deposited account proceeds Government property	56.00
	195,613.54
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	89,395.44
July 1, 1905, balance unexpended	106,218.10
July 1, 1905, outstanding liabilities	4,951.00
July 1, 1905, balance available	101,267.10
Amount (estimated) required for completion of existing project	2,673,509.93

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Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905 ..... $125,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix V V 3.)

4. Columbia River, Oregon, below Tongue Point.—This improvement covers a stretch of the river about 5½ miles long, beginning just below Tongue Point and extending down along the water front of Astoria.

The principal obstruction was a rocky point known as Sylvia de Grasse reef, about 1 mile below Tongue Point, around which ships were obliged to make a short turn. The ruling depth over this reach is about 20 feet at mean lower low water, with ample width, except where the channel is tortuous around the reef. The channel is no longer used for deep-draft through shipping.

The existing and original project adopted in 1896 contemplated the removal of the wreck of the *Sylvia de Grasse* and the outer portion of the reef, supplemented by dredging to obtain a 25-foot channel, 250 feet in width, extending along the water front of Astoria. Estimated cost, $121,550.

The total expenditure to June 30, 1905, was $96,742.62.

Nothing was expended for maintenance. The expenditures during the fiscal year 1905 were for part payment in making improvements at the United States moorings.

No results in the way of increased depth or width have been obtained during the fiscal year 1905.

Practically little result in the way of increase of ruling depth or width has been obtained as a result of the work done at this locality, but the removal of the point of Sylvia de Grasse has been equivalent to a widening of the channel at that place.

The maximum draft that can be carried June 30, 1905, at mean lower low water is about 20 feet.

The usual variations of level of water surface are from 6½ to 7 feet. The head of navigation for seagoing vessels of deep draft is Portland, Oreg.

No additional work is necessary at this locality on account of through navigation, as vessels now use the channel across the estuary above Upper Sands and Taylor Sands. This channel is used by shipping going to and from the wharves and mills along the water front.

The tonnage for these waters is shown in the report for improving Columbia and lower Willamette rivers below Portland, but the conditions are changed from what they were at the time of the adoption of the project, inasmuch as the commerce for this portion of the river does not now include the through shipping carried by the ocean-going craft and which consists principally of wheat and lumber exports.

For further information see Annual Reports of the Chief of Engineers for 1895, pages 3605 to 3608, and for 1900, page 4360.

July 1, 1904, balance unexpended	$24,588.75
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	331.37
July 1, 1905, balance unexpended	24,257.38

(See Appendix V V 4.)

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5. Mouth of Columbia River, Oregon and Washington.—Prior to commencing the work of construction in 1885 there were from one to three channels across the bar at the mouth of the Columbia River, and these channels varied both in location and depth, the latter being usually from 19 to 21 feet, while the location shifted through nearly 180° from Cape Disappointment to Point Adams.

The project for improvement, adopted in 1884, contemplated securing a low-water channel depth of 30 feet across the bar at the mouth of the river by the construction of a jetty to extend from the shore near Fort Stevens across Clatsop Spit in the direction of a point about 3 miles south of Cape Disappointment, the jetty to be built of rubble and random blocks of large size, resting upon mattresses of brush.

The original project, adopted in 1884, provided for a single jetty on the south side of the entrance, built to low-water level and about 4½ miles long. This was modified in 1893 to provide for practically a high-tide jetty, in which was included the construction of four low groins built out from the main jetty. The estimated cost of the jetty in the original project was $3,710,000.

The jetty was completed in 1895 to the length of 4½ miles and full projected height, with four low-tide groins, 1,000 feet, 1,000 feet, 600 feet, and 500 feet long, respectively. This work caused an increase in depth over the bar of from 20 to 31 feet at mean lower low water from 1885 to 1895.

Annual surveys since 1896 have shown each year marked shoaling of the depths over the bar, the greatest depth obtained having been 31 feet in 1895, being 1 foot in excess of the depth proposed by the original project.

A survey was made and detailed project, with estimate, was submitted in 1899. Estimated cost, $2,531,140.51. This project consisted in an extension of 3 miles to the jetty previously constructed.

Funds were made available as follows: By act of June 6, 1900, $250,000; act of June 13, 1902, $500,000, with authority to contract for work to the extent of $1,000,000 additional, and repairs to plant and tramway were authorized pending a report and recommendation of a Board of Engineers. The Board made its report under date of January 24, 1903, and the sundry civil act of March 3, 1903, made an additional appropriation of $1,000,000 for the work.

This project of the Board, approved by the Secretary of War on March 16, 1903, and adopted by the river and harbor act of March 3, 1905, is but a slight modification of the project of 1899, and provides for extension of the present jetty and construction of a north jetty if necessary. Dredging is also recommended as a temporary expedient to give early relief, and the thought is also expressed that the construction of a north jetty may be necessary at some future time to secure the desired depth of 40 feet with a practicable width of channel. The estimated cost of south jetty is $2,260,000; of the north jetty, $1,205,000; of remodeling and operating dredge, $250,000; total, $3,715,000. This does not include repairs to plant, tramway, etc., for which $250,000 was provided by sundry civil act of June 6, 1900.

The report of the Board is printed in Annual Report of the Chief of Engineers for 1903, page 2275 et seq.

The amount expended on the old project was $1,968,753.14, of which the expenditures from 1895 to 1902, which were for care of

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plant, surveys, and contingencies, may be considered as having been applied to maintenance.

On the present project, including repairs under the project of 1899, and on conversion and operations of the dredge *Chinook*, there has been expended to June 30, 1905, the sum of $1,707,048.48.

Prior to the report of the Board of Engineers approved March 16, 1903, the work of repairing the jetty tramway was authorized with funds previously appropriated, and this was so far accomplished that when the Board's project was adopted plant and materials had been assembled and everything was in readiness for rapid extension of the jetty.

At the beginning of the present fiscal year the jetty tracks had been repaired to the original end of the jetty and had also been extended a distance of 4,218 feet beyond this point or to station 292+26.

Operations during the fiscal year were carried on with a view to extension of the jetty to the greatest distance that could be thoroughly enrocked. Active work was in progress with this end in view until October, when a portion of the jetty tracks was carried away during a severe storm. The jetty tracks were extended during this time to a total of 7,576 feet beyond the end of the old jetty. Portions were again carried away during November and December, and further operations were suspended for the winter, except to make such repairs as the weather conditions permitted.

The redriving of the jetty tramway tracks was again commenced early in the spring on a line a little to the north of and branching from the old tracks at station 210+35. The new trestle crosses the previous line at the end of the old original jetty and then turns westerly and runs along the partially completed extension constructed last year.

At the close of the fiscal year this work had advanced to station 279+22, or a distance of 6,887 feet from the point where it leaves the old work. As fast as received rock is deposited on the work, it being hoped to complete this season the extension of 7,576 feet underway when work was suspended last season. The rock is being received under two contracts at a daily rate of approximately 2,500 tons.

The dredge *Chinook* also operated on the bar from the beginning of the year until the end of November, when she was laid up on account of the approach of the winter season and in order to make repairs to the boilers and machinery. After the repairs were completed authority was obtained for discontinuation of dredging operations. She was accordingly laid up on April 22, 1905.

The total amount of material removed during the fiscal year by the dredge *Chinook* was 245,220 cubic yards.

The annual survey of the bar, completed at the close of the fiscal year, shows that some deepening over the bar at different places has occurred since last year and the varying depths and irregular contours show that scouring action is taking place. The jetty work has not yet advanced sufficiently to control and concentrate this action in one channel.

A map of the survey is transmitted with the district officer's report, and further details are given therein.

For further detailed information attention is invited to the following references: Map of locality before improvement, Annual Report

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of the Chief of Engineers for 1886, page 1978; project of 1884, Report of Board of Engineers, Annual Report of the Chief of Engineers for 1883, page 2012 et seq.; modified project of 1893, Annual Report of the Chief of Engineers for 1893, page 3489 et seq.; map of completed project of 1884–1893, Annual Report of the Chief of Engineers for 1895, page 3560; survey and project, House Document No. 94, Fifty-sixth Congress, first session; latest approved project, report of the Board of Engineers dated January 24, 1903, Annual Report of the Chief of Engineers for 1903, page 2275 et seq.

For commercial statistics, see report on "Improving Columbia and lower Willamette rivers below Portland, Oreg."

July 1, 1904, balance unexpended	[a]$756,791.36
Amount appropriated by river and harbor act approved March 3, 1905	400,000.00
	1,156,791.36
June 30, 1905, amount expended during fiscal year, for works of improvement	706,847.17
July 1, 1905, balance unexpended	449,944.19
July 1, 1905, outstanding liabilities	112,200.00
July 1, 1905, balance available	337,744.19
July 1, 1905, amount covered by uncompleted contracts	484,883.00
Amount (estimated) required for completion of existing project	1,815,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	300,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix V V 5.)

6. Clatskanie River, Oregon.—The Clatskanie River rises in the Coast Range and is a tributary of the Columbia River, which it enters by means of connecting sloughs at a point on the south bank, about 65 miles below Portland.

At the time the present original project was adopted a depth of 5 feet could be carried to the town of Clatskanie, except over a shoal near that place, where but 2 to 3 feet was found. Large quantities of lumber and shingles find a market through this natural outlet. The channel is very narrow and exceedingly winding.

The river and harbor act of March 3, 1899, appropriated $13,000, being the total estimated cost of completing the improvement.

The project submitted for its expenditure and approved by the Secretary of War May 27, 1899, provided for cutting a short channel across the bend immediately below Manzanillo and another from the bend above this first point to the first bend below the town of Clatskanie, and for dredging above the latter bend, the work to be done by contract. It was expected to secure thereby a depth of 6 feet to the town of Clatskanie, 3 miles from the mouth.

The amount expended on this work up to the close of the fiscal year ending June 30, 1905, was $11,930.52, of which $123.15 was expended during the fiscal year 1905 and applied to fitting up new mooring

[a] Increased $6,442.39, allotted for dredge, but not expended, and $26.75, erroneously deducted for dredge in the report for 1904.

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grounds, the amount expended being outstanding liabilities from th previous year.

The results in the way of increased depth and width due to the com pletion of the project in 1900 were an increase of 2 feet in depth ove that portion below the town of Clatskanie where work was done, and a shortening of the distance to the head of navigation by about 4,50(feet by straightening the channel.

No increase in depth or width has been obtained during the fiscal year 1904.

The maximum draft that can be carried over the shoalest place at mean low water is about 5 feet.

The usual variation of level of water surface due to tides only is about 5 feet, and due to combination of tides and freshets in the Columbia River about 10 feet.

The head of navigation is the town of Clatskanie, about 3 *miles* from the mouth.

No additional work is necessary to make the improvement available.

The commerce carried on the Clatskanie River consists of lumber and farm products sent to the Portland market and general supplies received. It amounted during the calendar year 1904 to 18,861 tons, valued at approximately $444,210.

The Astoria and Columbia River Railroad crosses the valley *near* the town of Clatskanie, but the river being the cheapest means of transportation most of the products are shipped by boat.

For further information, see Annual Report of the Chief of Engineers for 1898, pages 3049 to 3050.

Comparative statement of traffic.

Calendar year.	Merchandise.		Passengers.	Calendar year.	Merchandise.		Passengers.
	Tons.	Estimated value.			Tons.	Estimated value.	
1896	117,242		8,460	1901	51,967		2,138
1897	112,803		11,545	1902	28,790		1,180
1898	153,257		12,250	1903	25,765		494
1899	68,126		5,210	1904	18,861	$444,210	525
1900	88,622		5,305				

July 1, 1904, balance unexpended	$1,192.63
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	123.15
July 1, 1905, balance unexpended	1,069.48

(See Appendix V V 6.)

7. Cowlitz and Lewis Rivers, Washington.—(*a*) *Cowlitz River.*—The Cowlitz River rises in the Cascade Range and flows into the Columbia River about 64 miles from its mouth.

Prior to improvement the ruling depth at low water to Toledo, 40 miles above the mouth, was 14 inches. The channel was narrow and tortuous and obstructed by sand bars, numerous snags, drift, logs, etc.

The valley is exceedingly fertile, and any improvement of the river is a direct benefit to the farmers, who ship great quantities of produce to market by boat.

The existing and original project, adopted in 1880 (report dated December 15, 1879), contemplated the removal of sand bars and other

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obstructions to a point about 50 miles above the mouth, at a cost of $5,000 for the first year and an annual expenditure thereafter of $2,000 for maintenance.

The expenditure on the project to the close of the fiscal year 1905 was $35,406.29.

No work has been done during the fiscal year, as the available balance was not sufficient to allow of economical operations.

The expenditures for the fiscal year amounted to $475.42, and were for expense in making repairs to dredge and in fitting up the new mooring grounds.

The maximum draft that could be carried on June 30, 1904, over the shoalest part at low water was about 16 inches.

The usual variations of level of water surface due to tide range from 4 feet at the mouth to zero about 9 miles above the mouth. The variations due to freshets in the Cowlitz River are about 22 feet, except near its mouth, where the water spreads out over a large area.

The head of navigation for light-draft boats at the higher stages is about 10 miles above Toledo, or 50 miles above the mouth.

The work proposed may be considered as an extension of benefits in providing a better channel to Toledo.

The commerce consists principally of lumber and farm products, and the river is practically the only means of transportation.

During the calendar year 1904 the commerce amounted to 26,120 tons, not including the logs floated down the stream. The value is estimated at approximately $1,069,020.

For further information attention is invited to references as follows:

Annual Report of the Chief of Engineers for 1880, page 2332.

Annual Report of the Chief of Engineers for 1880, pages 2331 to 2333 (report of examination dated December 15, 1879).

Annual Report of the Chief of Engineers for 1897, page 3464 (mention of survey above Toledo, made in September, 1896).

Comparative statement of traffic.

Calendar year.	Merchandise.		Passengers.	Calendar year.	Merchandise.		Passengers.
	Tons.	Estimated value.			Tons.	Estimated value.	
1895	17,940			1900	17,279		
1896	14,776			1901	14,211		
1897	17,582			1902	15,932		
1898	16,210			1903	41,515		
1899	26,511			1904	26,120	$1,069,020	6,875

This statement does not include 80,345,000 feet B. M. (160,690 tons) of logs floated down this stream in 1904, having an estimated value of $482,070.

(*b*) *Lewis River.*—The Lewis River rises in the Cascade Range. It is a tributary of the Columbia, drains an exceedingly fertile valley, and enters the Columbia from the north about 14 miles below the mouth of the Willamette, or 25 miles from Portland, Oreg.

At the time of the adoption of the present and original project 4 feet could be carried at normal stage to the forks, 3¾ miles from the

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mouth; about 2 feet at a stage of 2 feet 10 inches above the normal for the East Fork to Lacenter, on the East Fork 7 miles from the mouth, and 1 foot at normal stage to Woodland, on the North Fork. The channel was obstructed by trees, snags, and occasional shoals. The river was navigable for light-draft vessels at medium stages to Lacenter and to Woodland.

The original project for the improvement of the Lewis River, adopted in 1897 (see Annual Report of the Chief of Engineers for 1897, p. 3475), contemplated the removal of snags and obstructions, dike and dam work, and dredging, with a view to obtaining 6 feet in the main river to the forks, and 4 feet thence to Lacenter, on the East Fork. Estimated cost, $20,460.

The existing project is the same as the original project, with the addition of the improvement of the North Fork, which was included in the river and harbor act of June 13, 1902. No estimate has been made of the cost of improving the North Fork.

The amount expended on the original modified project up to the close of the fiscal year 1905 was $13,662.97.

No work has been done on the river during the fiscal year and no results since the last report have been accomplished.

The expenditures during the year were in connection with making repairs to the dredge to be used on this work and for part of the expense of fitting out the new mooring grounds.

The maximum draft at normal stage that could be carried on June 30, 1905, is as follows: Mouth to the forks, 4 feet; East Fork to 225 feet above the flume, near Kinder rock, 6 feet; North Fork to Woodland, 1 foot.

The usual variations of level of water surface, due to tides, are: At the mouth, 2 feet; at Lacenter, 1¼ feet; at Woodland the tide has no effect. The freshets vary from 15 to 20 feet in height, except near the mouth, where the water spreads out over a large area.

The heads of navigation for light-draft vessels during the higher stages of river are: Lacenter, on the East Fork, about 7 miles from the mouth, and Woodland, on the North Fork, about 7½ miles from the mouth. The heads of navigation at normal stage are: On the East Fork, 225 feet above the flume; on the North Fork, Woodland.

Obstructions have been removed and the channel deepened where necessary to a point 225 feet above the flume on the East Fork and to Woodland on the North Fork.

To make the improvement available in the East Fork it will be necessary to continue the dredging of the channel up to Lacenter.

The river is the only means of transporting the products of the valley to the Portland market. The commerce consists altogether of lumber and farm products. During the calendar year 1904 the commerce amounted to 27,245 tons, not including large quantities of logs floated down the stream. The estimated value is approximately $834,492.

For further information, attention is invited to references as follows:

Annual Report of the Chief of Engineers, 1897, pages 3474 to 3478.

Annual Report of the Chief of Engineers, 1902, pages 2406 to 2407.

Preliminary examination, Lacenter on the East Fork to the mouth, Annual Report of the Chief of Engineers, 1895, pages 3600–3601.

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Preliminary examination, North Fork, Annual Report of the Chief of Engineers, 1893, pages 3533 to 3536.

Examination, North Fork, Annual Report of the Chief of Engineers, 1897, pages 3470 to 3472.

Comparative statement of traffic.

Calendar year.	Merchandise.		Passengers.
	Tons.	Estimated value.	
1896	2,374	.....	12,990
1897	3,881	.....	15,306
1898	6,303	.....	15,938
1899	6,549	.....	12,351
1900	12,698	.....	14,129
1901	17,277	.....	15,532
1902	13,831	.....	13,098
1903	29,063	.....	13,058
1904	27,245	$834,492	12,885

This statement does not include 17,584,000 feet B. M. (35,168 tons) of logs floated down this stream in 1904, having an estimated value of $105,504.

July 1, 1904, balance unexpended	$2,233.12
Amount appropriated by river and harbor act approved March 3, 1905	10,000.00
	12,233.12
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	802.38
July 1, 1905, balance unexpended	11,430.74
July 1, 1905, outstanding liabilities	115.00
July 1, 1905, balance available	11,315.74

(See Appendix V V 7.)

8. Gauging waters of Columbia River, Oregon and Washington.—The object of this gauging is to obtain data for use in connection with the improvement of the river and to supply information to persons interested in its navigation.

The self-registering gauge was established at Astoria in November, 1888, where it was kept in operation up to August, 1899, and then moved to Fort Stevens, where it could be more economically maintained. Daily bulletins have been exhibited for the benefit of shipping interests. A river gauge was also established at the mouth of the Willamette River and daily records of the readings kept. In view of the benefit to commerce the maintenance of these gauges is considered a worthy object.

The amount expended on this work up to June 30, 1905, was $7,856.52.

July 1, 1904, balance unexpended	$1,292.99
Amount appropriated by river and harbor act approved March 3, 1905	1,000.00
	2,292.99
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	149.51
July 1, 1905, balance unexpended	2,143.48
July 1, 1905, outstanding liabilities	11.00
July 1, 1905, balance available	2,132.48

(See Appendix V V 8.)

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REPORT OF BOARD OF ENGINEERS, MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT OF JUNE 13, 1902, RELATIVE TO THE EFFECT OF FURTHER IMPROVEMENT BY THE UNITED STATES OF THE CANAL AND LOCKS AT WILLAMETTE FALLS, WILLAMETE RIVER, OREGON, ON MANUFACTURING ENTERPRISES NOW IN OPERATION OR CONTEMPLATED THERE.

The Board submitted report dated November 29, 1902. This report, with the opinion of the Attorney-General, dated November 11, 1904, prepared in pursuance of law, was transmitted to Congress and printed in House Document No. 99, Fifty-eighth Congress, third session. (See also Appendix V V 9.)

IMPROVEMENT OF CERTAIN RIVERS AND HARBORS IN WASHINGTON.

This district was in the charge of Maj. John Millis, Corps of Engineers. Division engineer, Col. W. H. Heuer, Corps of Engineers.

1. Willapa River and Harbor, Washington.—Willapa Harbor connects with the Pacific Ocean in the extreme southwestern part of the State of Washington. Willapa River flows into the bay at its eastern extremity about 10 miles from the sea entrance to the harbor.

South Bend, the principal town on the bay and the terminus of a branch railroad running from Chehalis, is near the mouth of the river. Willapa is a small town some 10 miles above. North River is a stream flowing into the bay from the north, and the Nasel River is a sort of arm making off southeasterly from the southeast part of the bay proper.

Originally shoals existed in the river below Willapa, and there was a log jam in North River.

The original and existing project contemplates dredging 100 feet wide and to a depth of 8 feet at low water through the reef just below Willapa, and the closing of side sloughs near South Bend by means of dikes, with the object of increasing channel depths by scour. Project adopted by act of July 13, 1892.

Under acts of August 18, 1894, and March 3, 1899, removal of the log jam in North River was authorized.

The estimated cost is $36,350.

The amount expended on existing project to close of fiscal year ending June 30, 1905, was $34,800.78, of which $2,670.42 was applied to maintenance of dikes.

The best channel depth at low water is now about 14 feet to South Bend and to Willapa about 9 feet. The average tidal variation is about 8 feet.

The North and Nasel rivers are navigable only for small boats of light draft for a comparatively short distance above their mouths, and this distance is extremely variable with the tides. The principal business on these rivers is the rafting and floating of logs. The log and lumber business on Willapa Bay and tributary streams is by far the most important part of the water traffic.

The river and harbor act of March 3, 1905, provides for a survey from South Bend to Raymond, with a view to obtaining depths of 12 and 18 feet, respectively.

Raymond is at the junction of the Willapa and South Willapa rivers, about 4 miles above South Bend.

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Exports and imports.

Calendar year.	Tons.	Value.	Calendar year.	Tons.	Value.
1898	32,999	$374,050	1902	51,999	$402,050
1899	51,150	755,682	1903	74,475	446,800
1900	42,090	266,080	1904	73,808	389,377
1901	39,538	229,686			

The direct effect on freight rates of the work done is not known definitely.

Detailed reports on this work are given in Annual Reports of the Chief of Engineers for 1893, pages 3402 to 3408, and for 1895, pages 3399 to 3405. Maps of the locality are published with Annual Report of the Chief of Engineers for 1891, pages 3264 and 3268.

Reports of examinations and surveys are referred to in the Annual Report of the Chief of Engineers for 1904, page 687.

The full amount for improvement as heretofore authorized by Congress has been appropriated.

By the act of June 13, 1902, the balance on hand to the credit of this improvement may be used in snagging and otherwise improving North and Nasel rivers.

July 1, 1904, balance unexpended	$1,886.06
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	336.84
July 1, 1905, balance unexpended	1,549.22

(See Appendix W W 1.)

2. Grays Harbor and bar entrance, Washington.—Grays Harbor is a large bay in the southwestern part of the State of Washington, connecting with the Pacific Ocean. It has a total length from east to west of 17 miles, and its greatest breadth north and south is 14 miles.

A large part of the bay is occupied by tide flats, bare at low water. At low tide the area covered by water is estimated at 30.6 square miles, or less than one-third of the total area. There are two main channels crossing the bay from east to west. The north channel is the principal one, and this is being improved under a special appropriation. A short distance within the harbor entrance are large areas affording anchorages for deep-draft vessels.

The harbor entrance is between two low sandy peninsulas, which are about 12,500 feet apart, measured between high-tide lines.

Through this entrance there is a channel having a maximum depth of 100 feet or more. A single broad waterway extends for more than 2 miles out to sea from the entrance, with depths gradually diminishing to 30 feet. At the outer end of this deep waterway lies a bar convex to the sea and extending each way to the sand spits on the two sides of the harbor throat.

Across the bar there was originally no good permanent channel, but there were several variable, shifting channels having depths of about 12 or 13 feet. The general average width of the bar between the inner and outer 18-foot curves was one-half mile.

The original and existing project, adopted by Congress June 3, 1896, provides for the control of the tidal currents by means of a single jetty extending out to sea from the point on the south side of the harbor

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throat a distance of about 3½ miles, with a view to improving and maintaining the channel over the bar by scour. The jetty is to be of rubblestone, built above high-tide level. This project contemplates a depth of 24 feet at mean low water.

The estimated cost was $1,000,000. The act making the first appropriation for this work authorized the making of a continuing contract or contracts. In accordance with this authority a contract for the entire work was entered into after due advertisement. This contract was approved by the Chief of Engineers February 23, 1898. Work under it commenced in March, 1898, and terminated September 15, 1902. No construction work has been done since.

The amount expended to June 30, 1905, was $998,865.32.

The work of maintenance consisted only in care of the property.

The bar channel has shown variations in depth and position during the year. The maximum draft that could be carried June 30, 1905, at mean low water over the shoalest part of the channel was about 13½ feet.

The commerce benefited by the work consists at present principally of exportation of lumber carried in sail vessels and steam schooners. This is a large and important business.

Exports and imports.

Calendar year.	Tons.	Value.	Calendar year.	Tons.	Value.
1898	168,468	$1,252,089	1902	527,047	$3,601,168
1899	265,918	1,979,998	1903	458,268	4,073,338
1900	259,692	2,077,087	1904	495,495	4,200,784
1901	290,607	1,877,800			

The direct effect on freight rates of the work done is not known, but there are now two companies engaged in the business of towing vessels in and out over the bar, which indicates greater business and greater competition, as the business was formerly all in the hands of one towboat company.

To make the improvement fully available and to extend its benefits, additional work will be necessary to rectify and deepen the existing bar channel and to fix its location.

A report of the original survey, giving a full description of this work, with plan, is published in the Annual Report of the Chief of Engineers for 1895, pages 3517 to 3528, and in Senate Executive Document No. 112, Forty-seventh Congress, first session.

The plans for this work and proposed modification of same were considered by a special Board of Engineer officers and by the Board of Engineers for Rivers and Harbors. Their reports were transmitted to Congress on February 29, 1904, and are printed in House Document No. 576, Fifty-eighth Congress, second session, and in Appendix W W 2 of the Annual Report of the Chief of Engineers for 1904, pages 3585 to 3601.

The full amount originally authorized by Congress—$1,000,000—has been appropriated.

By the act of March 3, 1905, $30,000 was appropriated for this work for maintenance. Project for the application of this appropriation was completed and was under consideration at the close of the year.

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July 1, 1904, balance unexpended	$2,385.02
Amount appropriated by river and harbor act approved March 3, 1905	30,000.00
	32,385.02
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	1,250.34
July 1, 1905, balance unexpended	31,134.68
July 1, 1905, outstanding liabilities	208.25
July 1, 1905, balance available	30,926.43

(See Appendix W W 2.)

3. Grays Harbor, inner portion between Aberdeen and the entrance to said harbor, and Chehalis River, Washington.—There are two main channels traversing the inner or eastern part of Grays Harbor from east to west—the North and South channels. There was also formerly a Middle channel connecting the North and South channels. The South channel is shoal and is but little used. The North channel is used by all ocean-going vessels entering the harbor. There are two shoals in the North channel, one about 2½ miles below Hoquiam and one between Hoquiam and Aberdeen. The ruling depth over these shoals was 8 feet at mean low water. The channel widths were ample.

Two middle dikes and a protecting sill, with an aggregate length of 13,986 feet, had been constructed in the inner harbor, and six high-tide dikes, with an aggregate length of 1,476 feet, had been constructed in the Chehalis River. The depth of water over the shoals in the inner harbor was increased about 2 feet and over the shoals in the Chehalis River from 2½ to 7 feet, but these depths were not permanent.

The Chehalis River is in the southwestern part of Washington. It has a westerly course and empties into Grays Harbor Bay at its eastern extremity.

From the mouth to Montesano, 15 miles, there is about 10 feet of water at high tide. From Montesano to Elma, 16 miles, there is generally sufficient water for light-draft boats. There is practically no navigation above Elma and no regular boats go above Montesano. The river is used extensively for floating saw logs.

The original project for the inner harbor, adopted by Congress July 13, 1892, provided for the construction of pile, brush, and stone dikes to partly close up the South and Middle channels and concentrate the flow of water in the North channel, thereby increasing the depth of water by scour. The shoals above and below Hoquiam were to be dredged to a depth of 16 feet at half tide.

The amount expended prior to operations under existing project was $93,999.06.

The original and present project for Chehalis River, adopted by Congress August 2, 1882, contemplates the removal of snags and other obstructions which may accumulate in the portion of the river regularly used by boats. The estimated cost is indefinite.

The act of June 13, 1902, making appropriation for the work now in progress and consolidating the two works, did not specify any project or estimate of ultimate cost, but under the project approved by the Department November 10, 1902, and modified by Board of Engineer officers on December 4, 1903, a channel about 100 feet wide and 15 feet deep at low water was to be dredged through the shoals

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below Aberdeen, the dikes were to be put in repair, and snags and obstructions were to be removed from the Chehalis River.

Up to June 30, 1905, $49,970.20 had been expended under the above project for Grays Harbor, inner portion, of which $14,208.74 was applied to maintenance.

The Chehalis River up to Montesano has been cleared of snags. The maximum draft that could be carried June 30, 1905, at mean low water at Montesano was about 5 feet. The tidal variation is 5 feet.

The channels through Cow Point and Hoquiam shoals have been completed. The maximum draft that could be carried June 30, 1905, over these shoals at low water was about 15 feet.

The tidal variation is 7 feet in the inner harbor and 5 feet in Chehalis River. The amount expended to June 30, 1905, was $143,969.26, of which $31,626.98 was for maintenance.

The commerce benefited by this improvement consists very largely of floating and towing logs and carrying lumber in sailing vessels and steam schooners.

Exports and imports.

Calendar year.	Tons.	Value.	Calendar year.	Tons.	Value.
1898	2,730	$293,610	1902	3,529	$157,582
1899	2,232	352,816	1903	4,972	139,151
1900	4,376	132,157	1904	5,637	248,825
1901	5,708	200,264			

No definite information of reduction of freight rates on account of the improvement has been received.

Report of examination and survey of the inner harbor and the Chehalis River, with maps, was published in the Annual Report of the Chief of Engineers for 1891, pages 3297 to 3305.

Other reports are referred to in Report of the Chief of Engineers for 1904, page 690.

To make this improvement available and to extend the benefits the channels through the shoals below Aberdeen should be made wider and deeper, and some dredging should be done in the Chehalis River below Montesano.

By the act of March 3, 1905, $30,000 was appropriated for continuing this improvement. Project for the application of this appropriation has been submitted and was under consideration at the close of the year.

July 1, 1904, balance unexpended		$32,183.97
Amount appropriated by river and harbor act approved March 3, 1905		30,000.00
		62,183.97
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$26,662.25	
For maintenance of improvement	5,490.98	
		32,153.23
July 1, 1905, balance unexpended		30,030.74
July 1, 1905, outstanding liabilities		15.00
July 1, 1905, balance available		30,015.74

(See Appendix W W 3.)

4. Puget Sound and its tributary waters, Washington.—Most of the channels of Puget Sound proper have ample depths for purposes of

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navigation, but the extensive lumber and fishing industries in these waters render it very important to maintain a general supervision over the navigable channels to regulate the construction of fish traps, log booms, and other structures incident to these important industries and to prevent obstructions which are detrimental to general navigation interests. A number of streams and rivers tributary to Puget Sound are of great value to boat navigation and for logging purposes so far as depth and width are concerned, but they are all liable to be obstructed by the débris generally found in streams flowing through a heavily wooded country.

Former projects were as follows: That of November 18, 1880, for the improvement of the Nooksak River; of June 30, 1880, for the Skagit River; of November 19, 1880, for the Stilaguamish River. These were adopted by act of August 2, 1882. By act of June 14, 1880, $2,500 was made available for removal of obstructions in the Skagit River, based on an examination made in 1875.

By act of July 13, 1892, and in subsequent acts, the appropriation has been made in its present general and comprehensive form, greatly to the advantage and economy of the work.

The act of June 13, 1902, authorized the removal of the log jam in Nooksak River or the cutting of a new channel around the jam, in the discretion of the Secretary of War. The former was done.

The act of March 3, 1905, authorized the removal of Star rock, Bellingham Bay, and rock obstructions at the entrance of Roche Harbor.

The existing project for the general improvement of Puget Sound contemplates the removal of snags and other obstructions in any of the waters or channels where such removal may become necessary. The work is mostly attended to by a snag boat owned by the Government. The estimated cost is indefinite, as the maintenance of the channels and the necessary supervision over them require constant work.

The amount expended to June 30, 1905, was $241,870.39.

The snag boat has been in operation during the entire year, except when laid up temporarily for repairs, and the rivers and streams have been kept clear of obstructions. The streams worked on were the Skagit and its tributaries, the Snohomish, Snoqualmie, Stilaguamish, Duwamish, and Nooksak rivers, and Sullivans, Swinomish, and Hat sloughs.

All these streams are used for floating logs and shingle bolts to a greater or less extent, and for towing log rafts, and the timber naturally constitutes the main part of the commerce. The distance upstream to which boats run is extremely variable, depending on the stage of water and tide. Steamboat navigation on the Skagit does not extend above Sedro Woolley, a distance of 25 miles, except at high stages. On the Stilaguamish boats do not go above Florence, 6 miles from the mouth. The Snohomish is navigable for river boats to the Forks, 22 miles, and the lower portions of its tributaries, the Snoqualmie and Skykomish, are navigable at high stages. On the Duwamish small boats go as far as the junction of the White and Black rivers, about 12 miles from the mouth. Under favorable conditions they can go several miles up the White. In case of each river, the distance to which steamboat navigation actually extends is generally less and the distance over which towing and floating of logs extends is greater than the distances above named. None of these

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streams is closed in winter by ice. All streams are affected by the tidal variation in Puget Sound, which is large and extremely irregular.

The water traffic on Puget Sound and its tributary waters is very large and rapidly growing. It includes vessels of about every type and size in use throughout the world, but it is quite impracticable to give in the form of concise statistics a condensed statement of the amount and value of the commerce more or less directly benefited by work under this appropriation. Statistics have been complied only for the tributary streams on which the snag boat has mostly worked.

Exports and imports.

Calendar year.	Tons.	Value.	Calendar year.	Tons.	Value.
1898	12,676	$539,406	1902	61,794	$2,324,980
1899	18,500	577,586	1903	94,274	3,198,458
1900	35,086	1,324,926	1904	92,465	1,790,823
1901	30,155	1,499,420			

No definite information relative to effect of the work on freight rates is available, but the increasing number of vessels engaged indicates greater competition.

Reports of examinations and surveys of the rivers of Puget Sound are referred to in Annual Report of the Chief of Engineers for 1904, page 692.

By the act of March 3, 1905, $20,000 was appropriated for continuing this work, including removal of rocks in Bellingham Harbor and Roche Harbor. Project for the application of this appropriation has been approved and work was in progress at the close of the year.

GENERAL IMPROVEMENT.

July 1, 1904, balance unexpended	$1,437.11
Amount appropriated by river and harbor act approved March 3, 1905	20,000.00
	21,437.11
June 30, 1905, amount expended during fiscal year, for works of improvement	2,807.50
July 1, 1905, balance unexpended	18,629.61
July 1, 1905, outstanding liabilities	391.20
July 1, 1905, balance available	18,238.41

EMERGENCIES IN RIVERS AND HARBORS.

July 1, 1904, balance unexpended	$12,000.00
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	12,000.00

(See Appendix W W 4.)

5. Harbor at Olympia, Wash.—Olympia is situated at the extreme southern point of Puget Sound, at the head of Budd Inlet. The upper end of this inlet is shoal. Shoal water extends northward from the Fourth Street Bridge for a distance of 8,750 feet to a depth of 12 feet at mean lower low water in Budd Inlet. Originally nothing but shallow-draft boats could reach the wharves near Fourth Street Bridge, and those only at high tide.

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The original and existing project, adopted by Congress by act of July 13, 1892, contemplates dredging a channel 250 feet wide and 12 feet deep at the mean of the lower low waters from the vicinity of the Fourth Street Bridge to deep water in Budd Inlet.

Near its inner end the channel is to be widened to 500 feet so as to provide a turning basin for boats using it. The estimated cost is $147,000.

The amount expended to June 30, 1905, was $139,217.79, of which $338.56 was for maintenance.

The dredging of the channel and basin was completed in accordance with the project, under contract. The maximum draft that could be carried through the channel and basin on June 30, 1905, at low water was 12 feet. The tidal variation is about 20 feet.

The commerce of the harbor is of general character, and is carried on by ocean-going sailing vessels engaged in lumber trade and by a variety of the smaller classes of boats plying between the ports of Puget Sound. Sufficient depth for seagoing vessels has not yet been secured in the dredged channel and basin; though vessels of the deepest draft can go as far as the entrance of the dredged channel, and sailing vessels carrying lumber now reach wharves near the entrance to the dredged channel at high tide and lie in a dredged basin while loading.

Calendar year.	Tons.	Value.	Calendar year.	Tons.	Value.
1898	52,335	$1,208,226	1902 a		
1899	42,694	1,173,684	1903	40,333	841,685
1900	35,466	848,708	1904	20,152	856,450
1901	44,559	951,495			

a Not obtainable.

No definite information as to the effect on freight rates of the work done is available.

Description and map are published in Annual Report of the Chief of Engineers for 1900, pages 4481 to 4483.

Reports on examination and survey of Olympia Harbor are referred to in Annual Report of the Chief of Engineers for 1904, page 694.

The full amount for this improvement as heretofore authorized by Congress has been appropriated.

July 1, 1904, balance unexpended	$8,120.77
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	338.56
July 1, 1905, balance unexpended	7,782.21
July 1, 1905, outstanding liabilities	360.00
July 1, 1905, balance available	7,422.21

(See Appendix W W 5.)

6. Tacoma Harbor, Washington.—At the southern end of the harbor are extensive tide flats which are bare at low water. Outside of these tide flats the depth increases very rapidly up to depths of 200 feet or more, reaching depths as great as 600 feet at the mouth of the bay, about 3 miles distant from the low-water line at its southern end.

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The principal water front of Tacoma is along the southwestern shore of the bay. Harbor lines have been established around the south end of the bay and along its western side. In order to facilitate commerce several waterways extending into the flats or tide lands have been laid out. One of these is known as the City or West waterway. The harbor of Tacoma may be considered to embrace all of Commencement Bay, including the waterways mentioned.

The original and existing project for improvement of the City waterway, approved by Congress by the act of June 13, 1902, contemplates dredging in the City waterway from deep water in Commencement Bay to Eleventh street to a depth of 25 feet, from Eleventh street to Fourteenth street to a depth of 18 feet, and from Fourteenth street to the south end of waterway to a depth of 15 feet at extreme low water. The dredging was done under a continuing contract.

The amount expended to June 30, 1905, was $149,846.21, none of which was for maintenance.

About 1,155,608 cubic yards of material was taken out during the year and deposited on lands adjacent, the land filling being under arrangement between the contractor and owners of same, as permitted by the contract. The City waterway channel was completed according to the project and the prescribed depths could therefore be carried for the whole length and width of the waterway on June 30, 1905. The contract was completed April 15, 1905.

The extreme tidal variation is some 18 feet.

The act of March 3, 1905, provided as follows:

Improving Tacoma Harbor, Washington: For improvement of the Puyallup waterway by dredging a channel five hundred feet in width and three thousand six hundred and fifty feet in length from its northern end, and to a depth of twenty-eight feet at extreme low water, in accordance with the report submitted in House Document Numbered Five hundred and twenty, Fifty-eighth Congress, second session, forty thousand dollars: *Provided*, That a contract or contracts may be entered into by the Secretary of War for such materials and work as may be necessary to complete said project, to be paid for as appropriations may from time to time be made by law, not to exceed in the aggregate two hundred thousand dollars, exclusive of the amounts herein appropriated: *Provided further*, That the United States shall be under no expense for the construction of bulkheads, groins, or filling; and before any portion of this appropriation shall be expended, or any contract let for this improvement, suitable provision shall be made, to be approved by the Secretary of War, that in the prosecution and completion of the work of dredging said channel the cost and charges for the construction of necessary bulkheads and groins, or for necessary filling, will be furnished upon the demand of the United States engineer in charge, and the design and location of said bulkheads and groins shall be subject to his supervision; and all necessary filling shall be made in accordance with the plans and specifications furnished by said engineer: *And provided further*, That no expenditure shall be made under this appropriation unless provision satisfactory to the Secretary of War is made for the permanent maintenance of said project, when completed, without expense to the United States.

The project for the improvement of the Puyallup waterway in accordance with the above contemplates dredging a channel 500 feet wide and 3,650 feet long from its northern end, and to a depth of 28 feet at extreme low water, the estimated cost being $240,000. This was approved on May 10, 1905, and at the close of the year negotiations were in progress between the local authorities and owners of property adjacent to the channel to secure compliance with the terms of the act.

The commerce to be benefited by this improvement is of a large and extremely varied character, including that carried on by sound and

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river types of boats, as well as that of the largest steam and sailing vessels. A very important item is the export of grain, in which the port of Tacoma exceeds all other ports on Puget Sound.

Exports and imports.

Calendar year.	Tons.	Value.
1903	1,715,085	$58,153,845
1904	1,561,074	53,726,772

No definite information is available as to the effect of the improvement on freight rates.

Report of a survey of "mouth of Puyallup River, Washington," is published in Annual Report of the Chief of Engineers, 1898, pages 3098–3102.

Description of proposed work is published in Annual Report of the Chief of Engineers for 1901, pages 3593–3602.

Report on examination and survey is published in House Document No. 76, Fifty-sixth Congress, second session.

Report of examination and survey of the Puyallup and other waterways is referred to in the report of the Chief of Engineers for 1904, page 695.

July 1, 1904, balance unexpended	$114,423.34
Amount appropriated by river and harbor act approved March 3, 1905	40,000.00
	154,423.34
June 30, 1905, amount expended during fiscal year, for works of improvement	89,269.55
July 1, 1905, balance unexpended	65,153.79
July 1, 1905, outstanding liabilities	185.65
July 1, 1905, balance available	64,968.14
Amount (estimated) required for completion of existing project	200,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	200,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix W W 6.)

7. Waterway connecting Puget Sound with lakes Union and Washington, Washington.—Lakes Union and Washington are bodies of fresh water near Puget Sound, in the immediate vicinity of the city of Seattle. Lake Union is entirely within the city limits. The proposed improvement originally contemplated a ship canal connecting both lakes with the Sound. There is no navigable connection at present.

The river and harbor act of September 19, 1890, contained an item directing the appointment of a Board of three officers of the Corps of Engineers to select and survey the most feasible location and to estimate the expense of constructing the canal, and the sum of $10,000 was appropriated for the necessary expenses.

Subsequently a detailed survey and location of the proposed canal were made in compliance with a clause in the sundry civil act of March 2, 1895.

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The western end of the canal through Salmon or Shilshole Bay, instead of through Smiths Cove, as once proposed, and a modification of the location of the lower lock were recommended by a Board of Engineer officers and approved by the Secretary of War August 14, 1898.

At this stage the project for the work as adopted by Congress was understood to contemplate the construction of a ship canal from the waters of Puget Sound through Salmon Bay to Lake Union, and thence to Lake Washington, to include dredging through the flats immediately outside of Salmon Bay to a lock in the lower end of Salmon or Shilshole Bay, the construction of this lock, dredging inside of the lock through Salmon Bay, the digging of a canal from the upper end of Salmon Bay to Lake Union, dredging to the eastern end of Lake Union, and the construction of a canal and lock between lakes Union and Washington. The canal section and the lock dimensions were to be such as would accommodate the largest merchant vessels and ships of war.

The act of June 13, 1902, provided for a dredged channel 10 feet deep at low water extending to the wharves at Ballard, and directed the appointment of a Board of Engineer officers to reexamine the whole question of a ship canal connecting with Lake Washington by various routes, including proposals from a private company to construct such canal, and stipulated that nothing in said act should be construed as adopting any project for construction of the waterway.

A channel 50 feet wide on the bottom and 16 feet deep below low water was cut from deep water in Puget Sound along the axis of the proposed canal for a distance of 6,000 feet. It was then extended from this point to the wharves at Ballard, with a depth of 10 feet at low water and a turning basin at the inner end, a total length of dredged channel of 10,200 feet.

A cut 10 feet wide on the bottom and 10 feet above the bottom of the proposed canal was excavated between the head of Salmon Bay and Lake Union. The total length of this cut is 4,500 feet, but it is not deep enough for navigation. It takes the drainage from Lake Union and part of that of Lake Washington.

Amount expended to June 30, 1905, $321,457.64. Of this amount $6,313.15 was expended in maintenance and $6,000 was expended on improvement of drainage of Lake Washington, under authority of the Chief of Engineers of December 28, 1903.

The Lake Union outlet gates and the small canal and gates at the Portage were repaired. The latter were enlarged and three large siphons were installed to increase the outflow capacity.

Descriptions of the work, etc., are published in Annual Reports of the Chief of Engineers for 1892, pages 2762 et seq., and for 1896, page 3356 et seq. Estimate of approximate cost, $6,331,672, with map showing main features of canal, is published in House Document No. 335, Fifty-seventh Congress, first session, and in the Annual Report for 1902, at page 2419.

The report of the last Board of Engineers is published in Senate Document No. 127, Fifty-seventh Congress, second session, and is printed in Annual Report of the Chief of Engineers for 1903, page 2340 et seq.

Reports of examinations and surveys are referred to in the Report of the Chief of Engineers for 1904, page 696.

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The act of March 3, 1905, provides as follows:

Improving the waterway connecting Puget Sound with Lakes Union and Washington, Washington: Continuing improvement, one hundred and twenty-five thousand dollars: *Provided*, That this appropriation, together with the unexpended balance to the credit of said improvement, shall be expended in securing by dredging a deeper and wider low-water channel from Shilshole Bay through Salmon Bay to the wharves at Ballard. Nothing herein shall be construed as the adoption of any project for the construction of the waterway connecting Puget Sound with Lakes Union and Washington.

Project for the application of the above appropriation was approved June 20, 1905.

The present commerce benefited by the improvement of the channel to Ballard is the towing of logs to the mills at Ballard and the export of lumber and shingles from that place. Logs are brought in in rafts and lumber is loaded on sailing vessels and scows at the mills and then towed to the open Sound.

The maximum draft that could be carried to the city wharf, Ballard Harbor, June 30, 1905, was 10 feet at low water. The maximum tidal variation is about 17 feet.

Exports and imports.

Calendar year.	Tons.	Value.	Calendar year.	Tons.	Value.
1901	410,565	$2,002,950	1903	524,500	$2,219,000
1902	428,073	2,432,401	1904	584,079	2,520,785

NOTE.—The above includes only the present commerce of Ballard and Salmon Bay, Lake Union, and Lake Washington.

The loading of vessels with lumber has been largely facilitated by the work done in Ballard Harbor. Formerly the lumber was taken out by means of lighters to the vessels anchored in the Sound. Now all but the largest vessels are brought to the mills to receive their loads.

July 1, 1904, balance unexpended		$23,511.51
Amount appropriated by river and harbor act approved March 3, 1905		125,000.00
		148,511.51
June 30, 1905, amount expended during fiscal year, for maintenance of improvement		9,969.15
July 1, 1905, balance unexpended		138,542.36
July 1, 1905, outstanding liabilities		265.50
July 1, 1905, balance available		138,276.86

(See Appendix W W 7.)

8. Everett Harbor, Washington.—At this harbor the southern part of the water front has ample depth and is accessible for vessels of the deepest draft. The northern portion was inaccessible on account of the delta formation or tide flats off the mouth of the Snohomish River and the whole water front was exposed to westerly storms.

The original project was as follows:

First, to excavate a harbor basin in the shallows and tide lands adjoining deep water near the river's mouth; second, to dredge a channel from this through the tide flats and the Old River mouth to deep fresh water in the Snohomish River, this channel being designed

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to bring fresh water to the harbor basin and to afford facilities for navigation about the peninsula and into the deep water of the river bounding the peninsula on the east; and third, to protect and maintain this harbor and channel across the tide flats by a bulkhead interposed between them and the open waters of the Sound, the bulkhead to act as a retaining wall for the material dredged from the harbor.

By authority of joint resolution of Congress approved April 23, 1902, the work in Old River was discontinued, the project for a fresh-water basin was abandoned, and the further expenditure of the funds has been for deepening and widening the harbor basin and channel through the tide flats and repairing the bulkheads.

The estimated cost of the improvements was $422,000, all of which has been appropriated.

The amount expended on the project to June 30, 1905, was $413,581.18.

A dike for the purpose of retaining the dredged material has been built from the lower end of Smiths Island along the established bulkhead line for a distance of 19,336 feet. At the southern end of this work an outside bulkhead 200 feet from the other has been built for a distance of 2,600 feet. These dikes have been repaired, raised, and strengthened. The channel leading north from the basin had been partly dredged for a distance of 11,600 feet downstream before this part of the work was discontinued under the resolution of Congress above referred to.

The harbor basin has been dredged for a length of 5,500 feet and for a width of 400 feet and depth of 26 feet at mean lower low water.

No work was in progress during the year.

The maximum draft that could be carried through the dredged area June 30, 1905, at low water, was 26 feet. The tidal variation is approximately 15 feet.

The river and harbor act of March 3, 1905, provides for survey of Everett Harbor with a view to the extension of the dike and of the dredged area.

The harbor of Everett is freely accessible to vessels of deepest draft up to the entrance to the dredged harbor basin. The water traffic is varied in character and is carried on by seagoing vessels and the various types of sound and river boats. Lumber products, paper, and flour are the principal items of the export trade.

Exports and imports.

Calendar year.	Tons.	Value.	Calendar year.	Tons.	Value.
1898	55,460	$2,545,054	1902	85,263	$4,024,584
1899	42,713	1,477,120	1903	79,394	2,510,417
1900	55,094	1,820,561	1904	163,347	3,342,215
1901	71,881	2,712,260			

The effect of the completed dike as a breakwater and protection for the wharves and mills abreast of it has been very beneficial, but the channel and harbor basin dredged have not yet been utilized for commercial purposes.

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Description of the work and maps are published in Annual Report of the Chief of Engineers for 1895, pages 3430 to 3435, and for 1901, pages 3587 to 3589.

Reports on examinations, surveys, etc., are referred to in Annual Report of the Chief of Engineers for 1904, page 698.

July 1, 1904, balance unexpended	$9,372.22
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	953.40
July 1, 1905, balance unexpended	8,418.82
July 1, 1905, outstanding liabilities	3.30
July 1, 1905, balance available	8,415.52

(See Appendix W W 8.)

9. Snohomish River, Washington, at Stretchs riffle.—This is a new work. The first appropriation was made by the river and harbor act of March 3, 1905, which provides as follows:

Snohomish River at Stretchs riffle, Washington: Completing improvement in accordance with the approved project contained in House Document Numbered One hundred and sixty-three, Fifty-eighth Congress, second session, six thousand five hundred dollars.

In its original condition the Snohomish River at Stretchs riffle is impassable at low water, caused by deposits of coarse gravel and small bowlders.

The project adopted by the act contemplates construction of a single-pile brush and stone dike intended to rectify the channel at Stretchs riffle and maintain a navigable depth of 4 to 5 feet at low stages.

The estimated cost is $6,500.

No expenditures have been made on this work.

The commerce to be benefited by the proposed improvement is principally that represented by logging interests, and the improvement will also provide an outlet for farmers and fruit raisers along the Snohomish River.

Project for the application of the amount appropriated has been approved, and work will start as soon as the stage of the water permits.

Amount appropriated by river and harbor act approved March 3, 1905	$6,500.00
July 1, 1905, balance unexpended	6,500.00

(See Appendix W W 9.)

10. Swinomish Slough, Washington.—This slough affords an inland sheltered passage for small vessels from Puget Sound proper northward to Bellingham Bay and the Gulf of Georgia, and it is the only means of communication to the town of Laconner, located on the slough. The total distance by way of the slough from good water in Skagit Bay to navigable depths in Padilla Bay is about 11 miles.

At the northern end the slough opens out into the flats forming the southern portion of Padilla Bay, in the midst of diked land and marshes. At the southern end the best channel to deep water in Saratoga Passage crosses extensive flats, which are almost bare at low water.

The original and present project, adopted by Congress by act of July 13, 1892, contemplates dredging a channel 4 feet deep and 100

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feet wide from deep water in Saratoga Passage across Skagit flats through the shoals of the slough proper and across the flats of Padilla Bay to deep water, and to build dikes in Skagit and Padilla bays to direct the tidal currents through the dredged channels.

The original estimated cost was $122,000, which proved insufficient. The total appropriation to date is $130,000.

The amount expended to June 30, 1905, was $124,314.55, of which $25,548 was for maintenance.

The dike work completed to date is all between Laconner and deep water in Saratoga Passage, as follows: Single rows of piles to catch drift between Goat and Ika islands, 4,000 feet; wattled pile dike, 3,000 feet; pile, brush, and stone dike, 7,200 feet.

A considerable portion of this has been rebuilt and repaired. A channel of the depth and width contemplated by the project has been dredged from deep water at the southern end northward to about the middle point of the slough. The work of repairs to the dikes has been continued during the year. Depositing rock in the dike was continued until January 14, 1905, when work was suspended on account of exhaustion of funds. Work was again resumed after the new appropriation became available; 12,983.75 cubic yards of rock was placed during the year in the inner and outer dikes. The former was completed. Some local shoaling has occurred, and not over 2 feet can be carried through to Laconner from Saratoga Passage at low water.

The average tidal variation is about 8 feet.

Exports and imports.

Calendar year.	Tons.	Value.	Calendar year.	Tons.	Value.
1898	19,625	$382,345	1902	49,914	$1,472,847
1899	76,636	2,028,454	1903	51,399	1,473,197
1900	74,516	1,611,460	1904	56,262	1,539,094
1901	136,747	2,991,330			

The work has not yet progressed sufficiently to have any effect in lowering freight rates, so far as known, but the difficulties of navigating the slough in places have been reduced.

A greater depth than called for by the project, 4 feet at low water, is now desirable to meet the requirements of commerce.

A report on examination and survey of Swinomish Slough, upon which the plan of improvement is based, is referred to in Annual Report of the Chief of Engineers for 1904, page 699.

A map showing parts of the improvement is published in the Annual Report of the Chief of Engineers for 1900, opposite page 4488.

July 1, 1904, balance unexpended	$19,969.91
Amount appropriated by river and harbor act approved March 3, 1905	5,000.00
	24,969.91
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	19,284.46
July 1, 1905, balance unexpended	5,685.45
July 1, 1905, outstanding liabilities	1,266.05
July 1, 1905, balance available	4,419.40
Amount (estimated) required for completion of existing project	17,000.00

(See Appendix W W 10.)

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11. New Whatcom Harbor, Washington.—The local name of the town at this place is now Bellingham.

The mud flats in the harbor extend from the shore line to the 12-foot curve, a distance of 3,400 feet.

A system of harbor lines for this harbor, approved by the Secretary of War under date of June 3, 1892, provides for three waterways leading from deep water to the meander line.

The original and existing project, adopted by Congress by the act of June 13, 1902, contemplates dredging the Whatcom Creek waterway to a depth of 12 feet at mean lower low water and 200 feet wide from deep water as far as the railroad bridge and to its full width inside this bridge. The estimated cost is $80,000.

The amount expended to June 30, 1905, was $24,049.99, of which $733.32 was for maintenance.

A channel 50 feet wide and 12 feet deep at low water, with turning basin at inner end, has been dredged under contract. The channel extends the full length of the waterway, and the basin at the inner end has full width of the waterway, 330 feet, and is 383 feet long.

No work was done during this year, except general care of the improvement.

By the river and harbor act of March 3, 1905, $35,000 was appropriated for continuing the work.

Project for application of the appropriation was approved, the work was advertised, and the lowest bid was accepted before the close of the fiscal year.

The maximum draft that could be carried June 30, 1905, at low water over the full length of channel and turning basin was 12 feet. The range of the tide is about 12 feet.

Exports and imports.

Calendar year.	Tons.	Value.
1902	87,118	$2,872,789
1903	101,989	1,835,486
1904	236,669	4,225,490

The work has not yet produced any material effect on freight rates so far as known.

The commerce of this port is of a general nature, consisting largely of lumber, shingles, and fish. Vessels of the deepest draft can go as far as the entrance of the proposed dredged channel.

Description of proposed work is published in Annual Report of the Chief of Engineers for 1897, pages 3478 to 3481.

Reports on examination and survey are referred to in Annual Report of the Chief of Engineers for 1904, page 701.

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July 1, 1904, balance unexpended	$1,683.33
Amount appropriated by river and harbor act approved March 3, 1905	35,000.00
	36,683.33
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	733.32
July 1, 1905, balance unexpended	35,950.01
July 1, 1905, outstanding liabilities	144.89
July 1, 1905, balance available	35,805.12
Amount (estimated) required for completion of existing project	20,000.00

(See Appendix W W 11.)

12. Okanogan and Pend Oreille rivers, Washington.—(*a*) *Okanogan River.*—This river rises in Canadian territory, flows in a southerly direction, and empties into the Columbia. The lower portion, for a distance of 87 miles, lies in the northeastern part of Washington. The lower portion has sufficient depth and width for light-draft steamboat navigation throughout a good portion of the year, but it is obstructed in places by shoals and rocks, which interfere with navigation during low water.

The original and existing project, adopted by Congress by act of March 3, 1899, contemplates rock removal, the construction of wing dams, and snagging. By act of June 13, 1902, this work and that of the Pend Oreille were consolidated.

The estimated cost was $30,000 for the Okanogan. The amount expended to June 30, 1905, was $29,211.08, of which $1,638.29 was for maintenance.

Work of removing rocks and bowlders, wing-dam construction, and placing posts to assist vessels in hauling over rapids has been done at various points over about 40 miles of the lower portion of the river.

Cables to assist vessels in passing the rapids were placed at seven places on the Okanogan River.

The commerce of the river is carried on in small river steamers and consists of general traffic.

Exports and imports.

Calendar year.	Tons.	Value.	Calendar year.	Tons.	Value.
1899	1,738	$151,415	1902	1,571	$119,065
1900	(a)	(a)	1903	6,317	458,705
1901	983		1904	1,636	252,414

[a] Not obtainable.

The freight rates on this river are believed to have been materially reduced since the work started, but no definite information is available.

Descriptions of the river and the plan of improvement are given in the Annual Report of the Chief of Engineers for 1888, page 3121.

Report on examination of Okanogan River is published in Annual Report of the Chief of Engineers for 1895, page 3475; report of survey is referred to in Annual Report of the Chief of Engineers for 1904, page 702.

(*b*) *Pend Oreille River.*—This river forms the outlet of Pend Oreille Lake, in the northern part of Idaho.

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The obstructions to navigation consist of rocks and shoals in Box Canyon and in the section between this canyon and Albany Falls.

The original and existing project, adopted by Congress by act of March 3, 1899, contemplates the improvement of Box Canyon by the removal of submerged rocks, the blowing off of projecting rocky points, and the removal of submerged rocks between Box Canyon and Albany Falls.

The estimated cost was $30,000. The amount expended to June 30, 1905, was $17,109.19, $358.02 of which was for maintenance.

No construction work was done during the year.

The river is navigable throughout the year from Newport down to Box Canyon, a distance of 54 miles, except occasional interruption from ice. A channel depth of about 4 feet can be depended on.

The commerce consists of towing logs and general traffic carried on by a number of small vessels. Heavy freight is carried mainly on barges in tow.

Exports and imports.

Calendar year.	Tons.	Value.	Calendar year.	Tons.	Value.
1899	2,617	$129,677	1902	15,868	$500,200
1900	1,921	97,125	1903	27,100	753,000
1901	13,917	134,280	1904	39,974	358,453

No effect on freight rates directly attributable to the improvement has been reported.

Descriptions of the river and the plan of improvement are given in the Annual Report of the Chief of Engineers for 1898, page 3124.

Report of survey of the river is referred to in the Annual Report of the Chief of Engineers for 1904, page 702.

By the act of March 3, 1905, $15,000 was appropriated for maintenance of the Okanogan River and for continuing improvement and maintenance of the Pend Oreille River.

July 1, 1904, balance unexpended	[a] $3,176.04
Amount appropriated by river and harbor act approved March 3, 1905	15,000.00
	18,176.04
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	1,996.31
July 1, 1905, balance unexpended	16,179.73
July 1, 1905, outstanding liabilities	348.93
July 1, 1905, balance available	15,830.80
Amount (estimated) required for completion of existing project	[b] 2,500.00

(See Appendix W W 12.)

13. Inspection of fish traps, etc., Puget Sound, Washington.—The fishing industry on Puget Sound has rapidly developed during the past few years, and it has now reached very large proportions. Until two years ago the fish traps were placed with little or no regard to the established aids to navigation or to the laws relative to structures

[a] Increase over last year by $2 disallowed and deposited during the year on account of Pend Oreille River.

[b] For Pend Oreille River.

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in navigable waters, but during the year 1904 the fishing companies were brought to the adoption of a different policy. Under date of February 13, 1904, an allotment was made from the appropriation for "Examinations, surveys, and contingencies of rivers and harbors" for inspecting the locations of fish traps in the navigable waters of Puget Sound. Additional allotments for inspections, etc., were made as follows: August 4, 1904, $2,000; December 15, 1904, $2,000; April 7, 1905, $5,000. Under these allotments a tug was hired for the inspection of fish traps from time to time, as necessary. A tug was so engaged for seven and one-half months during the year.

As a general rule all the fish-trap owners and fishing companies now readily conform to the requirements that have been imposed for the safety of navigation, and the Federal supervision of the traps in the interests of navigation is recognized locally as most necessary and beneficial to the public interests.

The amount expended to June 30, 1905, was $8,990.

(See Appendix W W 13.)

14. Removing sunken vessels or craft obstructing or endangering navigation.—An allotment of $3,000 was made on February 24, 1905, from the indefinite appropriation made by section 20 of the river and harbor act of March 3, 1899, for the removal of the wreck of schooner *Challenger* from Willapa Harbor. An emergency contract was made, after inviting bids in the usual way.

The contractor had not succeeded in removing the wreck at the close of the year.

The amount expended during the year was $652.94.

(See Appendix W W 14.)

HAWAIIAN ISLANDS.

IMPROVEMENT OF HARBORS IN THE HAWAIIAN ISLANDS.

This district was in the charge of First Lieut. J. R. Slattery, Corps of Engineers. Division engineer, Col. W. H. Heuer, Corps of Engineers.

1. Pearl Harbor.—[This work was in the charge of Col. W. H. Heuer, Corps of Engineers, until April 14, 1905.] This harbor is 8 miles west of Honolulu. Before improvement there was a bar at its entrance with a low-water depth of 10 feet on its crest and a coral reef on either side. A full description of the harbor is found in Senate Executive Document No. 42, Fifty-third Congress, second session. The project for improvement contemplated dredging a channel 200 feet wide and 30 feet deep at mean low water, at an estimated cost of $100,000. Congress approved this project by appropriating $100,000 in the act of March 3, 1899.

Contract was made in 1901 for doing the work required. Dredging was begun in March, 1902, and completed in August, 1903, which resulted in a channel 200 feet wide and fully 30 feet (and generally 31 feet) in depth at low water entirely across the bar from deep water in the ocean to deep water in the harbor, at an expenditure of $99,323.62. The channel has maintained itself.

As yet there is no commercial activity in the harbor. Inside the bar the channel is so crooked and the turns so sharp that it is not safe for the navigation of large vessels. No estimate for remedying

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this defect has yet been authorized by Congress. The mean range of tides at the entrance is about 14 inches.

The work, so far as authorized and appropriated for, has been completed in accordance with the project. The head of navigation is at the head of each loch forming the harbor. No further funds under the existing project are required.

July 1, 1904, balance unexpended	$676.38
July 1, 1905, balance unexpended	676.38

(See Appendix X X 1.)

2. Honolulu Harbor, Hawaii.—This harbor is situated on the south coast of the island of Oahu. It is formed by a coral reef, a narrow channel through the reef affording access to the harbor. The entrance channel and harbor proper were dredged from time to time by the monarchical, republican, and Territorial governments of Hawaii prior to July 1, 1904. On this date there existed an entrance channel having a depth of about 35 feet and a minimum width of about 200 feet at mean low water. The harbor proper (that portion commencing at the light-house and extending to the mouth of the Nuuanu River) had a general width of 800 feet. The water for about 200 feet immediately along the wharves had a depth of from 30 to 32 feet. Elsewhere there was only about 27 feet at low water. The bend at the light-house point was so sharp as to be somewhat difficult for large vessels to get around. The shallow water in the harbor made it impossible for the largest vessels calling at the port to enter the harbor when at all heavily laden. The narrowness of the harbor made turning difficult for all ships.

The river and harbor act of March 3, 1905, provides as follows:

Improving harbor at Honolulu, Hawaii: In accordance with the report and surveys made by the land department of the government of the Sandwich Islands prior to annexation and the further report of Lieutenant Slattery, two hundred thousand dollars: *Provided*, That a contract or contracts may be entered into for such materials and work as may be necessary to prosecute said work, to be paid for as appropriations may from time to time be made by law, not to exceed in the aggregate two hundred thousand dollars in excess of the amount herein appropriated. The amounts herein appropriated and authorized may be expended upon sections one, two, and three, it being the intention to provide first for the completion of section one, and the Secretary of War is authorized and directed to cause a resurvey of said harbor to be made.

The project thus approved is printed herewith in Appendix X X 2. It provides for an entrance channel 35 feet deep and 400 feet wide at mean low water from deep water at the entrance to the light-house point; for easing the curve at the junction of the entrance channel and the inner harbor by cutting off the light-house point, and for enlarging the harbor proper so that it will have a depth of 35 feet and a general width of 1,200 feet at mean low water, at an estimated cost of $1,582,840.67, exclusive of a new front range light, estimated to cost $30,000.

On June 30, 1905, the sum of $1,404.75 had been expended on this improvement, in making a resurvey of the harbor, called for by the river and harbor act.

The maximum draft that could be carried on June 30, 1905, at mean low water over the shoalest part of the harbor was 26 feet. The mean range of the tide is about 24 inches, as determined from observations made during the progress of the survey.

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During the calendar year 1904 the commerce between Honolulu and the United States and foreign ports amounted to more than 300,228 tons, valued at $18,551,111. Three hundred and sixteen passengers, not immigrants, arrived in the islands; 6,636 passengers departed.

The local commerce between Honolulu and island ports for the same period amounted to 237,727 tons of freight and 55,441 passengers. The through commerce passing through the port between San Francisco and the Orient and Australia for the same period was valued at $45,897,753.

All of this commerce will be directly benefited by the improvement, through the greater safety of the harbor and the greater facility in entering and leaving it. With the harbor in its present condition, the largest vessels are unable to enter the harbor when at all heavily laden. The improvement will remedy this and may result in some of the larger ships, which do not now call at this port, calling here. The present freight rates to and from this port are exceedingly high. If additional steamship lines could be induced to have their ships call here a considerable reduction might result.

Although the completion of the work which it is contemplated to accomplish under the available appropriations will greatly improve the harbor, it will still be difficult for steamers to turn, and the completion of the project by the cutting off of the light-house point and widening of the harbor to the full project width will be necessary before proper facilities for the shipping of the harbor can be provided.

Due to the remoteness of this point, it is important that contracts for large amounts should always be made. A continuing contract for the entire work would probably enable the work to be done at a much lower figure than will be possible if done under several different contracts.

Amount appropriated by river and harbor act approved March 3, 1905	$200,000.00
June 30, 1905, amount expended during fiscal year, for works of improvement	1,202.75
July 1, 1905 balance unexpended	198,797.25
July 1, 1905, outstanding liabilities	82.64
July 1, 1905, balance available	198,714.61
Amount (estimated) required for completion of existing project	1,382,840.67
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	200,000.00

(See Appendix X X 2.)

THE BOARD OF ENGINEERS FOR RIVERS AND HARBORS.

Section 3 of the river and harbor act of June 13, 1902, provided for the organization, in the Office of the Chief of Engineers, by detail from time to time from the Corps of Engineers, of a Board of five engineer officers, whose duties shall be fixed by the Chief of Engineers,

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and to whom shall be referred for consideration and recommendation, in addition to any other duties assigned, so far as in the opinion of the Chief of Engineers may be necessary, all reports upon examinations and surveys provided for by Congress, and all projects or changes in projects for works of river and harbor improvement heretofore or hereafter provided for. It is further the duty of the Board, upon request to the Chief of Engineers by the Committee on Commerce of the Senate, or the Committee on Rivers and Harbors of the House of Representatives, in the same manner to examine and report through the Chief of Engineers upon any projects heretofore adopted by the Government, or upon which appropriations have been made, and to report upon the desirability of continuing the same or upon any modifications thereof which may be deemed desirable. This provision of the law was extended by act of March 3, 1905, to require the Board, upon request of the committees of Congress specified above, to examine and review surveys, as well as projects, provided for by acts or resolutions prior to the river and harbor act of June 13, 1902.

During the past fiscal year the Board was composed of the following officers of the Corps of Enginers: Col. A. M. Miller, senior member, to September 14, 1904; Lieut. Col. D. W. Lockwood, since September 2, 1904; Lieut. Col. R. L. Hoxie; Maj. S. W. Roessler, since August 13, 1904; Maj. Edward Burr; Maj. H. C. Newcomer, to August 13, 1904; Capt. W. V. Judson, to September 2, 1904, and Capt. Charles W. Kutz, since October 31, 1904.

Under the provisions of the river and harbor act of March 3, 1905, all reports on preliminary examinations and surveys required by that act received up to the close of the fiscal year have been referred to the Board for consideration and recommendation; in addition, a number of subjects have been presented to it for report in accordance with resolutions of the Committee on Rivers and Harbors of the House of Representatives. The reports rendered by the Board from time to time have been duly presented to Congress, and reference is made to Appendix Y Y for details of the operations of the Board during the past fiscal year.

SUPERVISION OF THE HARBOR OF NEW YORK.

The supervisor of the harbor during the past year was Commander Danl. D. V. Stuart, U. S. Navy, until July 13, 1904, and Commander H. H. Hosley, U. S. Navy, since that date.

The office of supervisor of the harbor of New York was created by act of Congress approved June 29, 1888, entitled "An act to prevent obstructive and injurious deposits within the harbor and adjacent waters of New York City, by dumping or otherwise, and to punish and prevent such offenses." This act has been amended by section 3 of the act of August 18, 1894, entitled "An Act Making appropriations for the construction, repair, and preservation of certain public works on rivers and harbors, and for other purposes," by which amendment the functions and powers of the officer have been greatly enlarged. Additional duties are also conferred on the supervisor by section 2 of the last-named act.

Under the provisions of section 5 of the act of June 29, 1888, a line officer of the Navy is designated to discharge the duties created by the

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act under the direction of the Secretary of War. On May 23, 1889, the Secretary of War directed that all communications in connection with these duties should be addressed to him through this office, and on February 1, 1890, he further directed that the powers conferred upon him by the act should be exercised through the Chief of Engineers.

The report of Commander Hosley for the fiscal year ending June 30, 1905, is submitted as Appendix Z Z.

Estimates for the fiscal year ending June 30, 1907.—The estimates of funds required for this service for the fiscal year ending June 30, 1907, are given in the above-mentioned report, as follows:

For pay of inspectors, deputy inspectors, office force, and expenses of office	$10,260
For pay of crews and maintenance of patrol fleet	75,000
Total	85,260

CALIFORNIA DÉBRIS COMMISSION.

Unrestricted mining by the hydraulic process in California resulted in enormous quantities of débris being washed into the rivers and natural water courses draining the western slopes of the Sierras. Later on hydraulic mining was practically prohibited by the decisions of the courts on account of injury to streams and the adjacent private land.

The act of Congress approved March 1, 1893, created the California Débris Commission, stipulating that the Commission should consist of three officers of the Corps of Engineers, appointed by the President, with the concurrence of the Senate. The same act prescribed the duties of the Commission, which are, first, the regulation of hydraulic mining in the territory drained by the Sacramento and San Joaquin river systems so that mining by that method may be resumed and carried on without injury to other interests in the State, and, second, to mature and adopt plans to improve and protect the navigability of the rivers in the systems above mentioned. The following statement shows the present condition for purposes of navigation of the three principal streams comprising the Sacramento and San Joaquin river systems:

	Sacramento River.	Feather River.	San Joaquin River.
Maximum draft that can be carried at low water.	San Francisco to Sacramento, 7 feet; Sacramento to Colusa, 4 to 5 feet; Colusa to Redbluff, 26 inches.	Mouth of river to Marysville, 1 to 2 feet.	Mouth of river to Stockton, 9 feet; Stockton to Firebaugh, a few inches.
Head of navigation	Redbluff	Marysville	Stockton (Firebaugh 4 months in year).
Length, in miles, of navigable portions.	Mouth to Sacramento, 64 miles; mouth to Colusa, 155 miles; mouth to Redbluff, 255 miles.	Mouth to Marysville, 30 miles.	Mouth to Stockton, 50 miles; mouth to Firebaugh, 200 miles.

Regulation of hydraulic mining.—Up to June 30, 1905, the Commission received 699 applications to mine by the hydraulic process and granted 532 permits, the applicants in these cases having, in accordance with the law, either built dams to properly impound

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near the mines the débris resulting from their operations, or shown that other satisfactory facilities existed which would accomplish the same result. During the same period 397 permits have been revoked, principally for the reason that the mines have been worked out or abandoned.

In its last annual report (printed in the Annual Report of the Chief of Engineers for 1904, pp. 3693–3708) the Commission called attention to an apparent defect in the law of March 1, 1893, in that it does not protect the miner from interference by injunctions of local courts after he has complied with all the terms of the United States law and the requirements of the Commission.

Improvement and protection of rivers.—The Yuba River, a tributary of the Feather, which in turn is a tributary of the Sacramento River, was the first selected for treatment, this stream being more filled with débris and perhaps carrying more detritus than all the other tributaries of the Sacramento combined. The general project for the treatment of the Yuba was printed in the Annual Report of the Chief of Engineers for 1900, Part 8, page 5030. The estimated total cost of this project was placed at $800,000. It was adopted by act of Congress approved June 13, 1902. The estimated total cost of the project has been appropriated—$400,000 by Congress and $400,000 by the legislature of California, the appropriations by Congress stipulating that one-half the cost of the work should be paid by the State of California. The Yuba River project contemplates holding the great quantities of mining débris now in that stream and tributaries, to prevent it from being carried down into the Feather and Sacramento rivers. This is to be accomplished by four restraining barriers, or dams, across the bed of the Yuba, and by a settling basin adjoining the river on the south.

The amount expended by the United States on the existing project for the treatment of Yuba River up to June 30, 1905, was $135,898.84. These expenditures were principally in payment of one-half the purchase price of upward of 10,000 acres of land required, in payment of one-half the cost of the construction of portions of barriers, or dams, in Yuba River, known as Nos. 1 and 2, and of one-half the cost of excavating a portion of a flood overflow channel through the promontory on Yuba River known as Daguerre Point. The work under this project has now reached the point where permanent advantages are being derived, especially at Barrier No. 1. The first step of this barrier was completed in December, 1904, and since then it has impounded and prevented from reaching the navigable streams below upward of a quarter of a million cubic yards of débris brought down by the Yuba.

The members of the Commission during the past fiscal year were Col. W. H. Heuer, Col. Thos. H. Handbury, and Capt. Wm. W. Harts.

The appended money statement for appropriation for restraining mining débris in California includes only funds appropriated by Congress, and does not include funds appropriated by the legislature of California.

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APPROPRIATION FOR EXPENSES OF CALIFORNIA DÉBRIS COMMISSION, 1905.

Amount appropriated by sundry civil act approved April 28, 1904	$15,000.00
June 30, 1905, amount expended during fiscal year	[a] 14,662.73
July 1, 1905, balance unexpended	337.27
July 1, 1905, outstanding liabilities	85.46
July 1, 1905, balance reverting to Treasury	251.81
Amount (estimated) required for expenses of the California Débris Commission during the fiscal year ending June 30, 1907	15,000.00

APPROPRIATION FOR RESTRAINING MINING DÉBRIS IN CALIFORNIA.

July 1, 1904, balance unexpended	$353,462.84
June 30, 1905, amount expended during fiscal year, for works of improvement	89,361.68
July 1, 1905, balance unexpended	264,101.16
July 1, 1905, outstanding liabilities payable by United States	14,674.97
July 1, 1905, balance available	249,426.19
July 1, 1905, amount of United States funds covered by uncompleted contracts	44,172.69

(See Appendix A A A.)

MISSISSIPPI RIVER COMMISSION.

The Mississippi River Commission, constituted by act of Congress of June 28, 1879, is in charge of the improvement of the Mississippi River from Head of Passes to the mouth of the Ohio River, including the rectification of Red and Atchafalaya rivers at their junction with the Mississippi, the building of levees, and the improvement of the several harbors for which specific appropriations have been made, with the exception of the harbor of Vicksburg and the mouth of Yazoo River. It is also charged with the survey of the Mississippi River from Head of Passes to its headwaters, and with gauging the river and its tributaries.

The commissioners during the past fiscal year were: Col. O. H. Ernst, Corps of Engineers, president; Lieut. Col. H. M. Adams, Corps of Engineers, to September 27, 1904; Lieut. Col. Clinton B. Sears, Corps of Engineers, since September 27, 1904; Maj. Thos. L. Casey, Corps of Engineers; Homer P. Ritter, assistant, United States Coast and Geodetic Survey; Robert S. Taylor, J. A. Ockerson, and Henry B. Richardson.

Capt. W. B. Ladue, Corps of Engineers, has been on duty as secretary of the Commission during the year.

The river and harbor act of March 3, 1905, prescribed that the money therein appropriated and authorized to be expended should be applied to the construction of suitable and necessary dredge boats and other devices and appliances and in the maintenance and operation of the same, with the view of ultimately obtaining and maintaining a navigable channel from Cairo down not less than 250 feet in width and 9 feet in depth at all periods of the year, except when

[a] In addition there was expended during the year $886.26 from appropriation for fiscal year 1904.

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navigation is closed by ice. It also authorized allotments from such funds, in the discretion of the Commission and upon approval by the Chief of Engineers, to be applied to the water courses connected with the river and the harbors upon it now under the control of the Mississippi River Commission.

The report of the Commission upon the operations under its charge during the fiscal year ending June 30, 1905, was submitted to the Secretary of War September 11, 1905, and is printed in a supplement to this report.

Estimates for the fiscal year ending June 30, 1907.—The following estimates of funds required for carrying on the works under its charge for the year ending June 30, 1907, are submitted by the Commission:

For continuing the improvement of the Mississippi River from Head of Passes to the mouth of the Ohio River, including salaries and clerical, office, traveling, and miscellaneous expenses of the Mississippi River Commission	$3,000,000
For protection of banks at or near Caruthersville, Mo	25,000
Improving harbor at or near Memphis, Tenn. (including Wolf River)	25,000
Improving harbor at Helena, Ark	25,000
Improving harbor at Natchez, Miss., and Vidalia, La	200,000
Rectification of Red and Atchafalaya rivers, Louisiana	50,000
Improving harbor at New Orleans, La	300,000
Total	3,625,000

PERMANENT INTERNATIONAL COMMISSION OF CONGRESSES OF NAVIGATION.

By act approved June 28, 1902, Congress appropriated the sum of $3,000 per year for the support and maintenance of the Permanent International Commission of Congresses of Navigation, and for the payment of the actual expense of the properly accredited national delegates of the United States to the meeting of the congresses and of the Commission.

The ninth international congress of navigation was held at Düsseldorf, Germany, in June, 1902. Three delegates were appointed to represent the United States, namely, Col. C. W. Raymond, Corps of Engineers (now brigadier-general, United States Army, retired), and Messrs. B. M. Harrod and John Bogart, civil engineers. General Raymond and Mr. Bogart attended the congress.

At the beginning of the fiscal year the United States was represented on the Permanent International Commission of Congresses of Navigation and on the permanent executive committee of that Commission by General Raymond as the principal representative and Mr. E. L. Corthell, civil engineer, as the substitute. The other members representing the United States on the Commission are Maj. H. F. Hodges, Corps of Engineers; Maj. J. C. Sanford, Corps of Engineers, and Mr. John Bogart, civil engineer. The representation on the executive committee remains unchanged. Mr. Corthell attended a meeting of the Commission held at Brussels, Belgium, on May 2, 1904.

The tenth international congress of navigation will be held at Milan, Italy, in September, 1905, and the following-named delegates have been appointed to represent the United States at this meeting: Maj. H. F. Hodges, Corps of Engineers; Maj. J. C. Sanford, Corps of Engineers; Mr. J. A. Ockerson, civil engineer, member Mississippi River Commission; Brig. Gen. C. W. Raymond, U. S. Army,

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retired; Mr. John Bogart; Mr. E. L. Corthell; Maj. Gen. G. L. Gillespie, U. S. Army, retired, and Messrs. William W. Bates, H. W. Aisley, and John A. Sullivan.

The expenditures during the year from the appropriation made by Congress have been for the expenses of the properly accredited national delegates to the meeting of the congress and of the Permanent International Commission, and for the support and maintenance of the Commission, to which the United States contributes $1,000 per annum.

ESTABLISHMENT OF HARBOR LINES.

Under authority given to the Secretary of War in section 11 of the river and harbor act approved March 3, 1899, harbor lines have been established during the past fiscal year at the following localities, details of which will be found in the reports of the local officers:

Charles River at Boston, Mass.; Greenport Harbor, New York; East River, New York, between East Thirty-second street and East Thirty-seventh street, New York City; Ellis Island, New York Harbor, New York; Arthur Kill and Newark Bay, at Elizabethport, N. J.; (2) Arthur Kill, at Smoking Point, Rossville, Staten Island, New York; Carters Creek, at Weems, Va.; Matagorda Bay, at Port Lavaca, Tex.; Mississippi River, at Hannibal, Mo.; Missouri River and Kansas River, at Kansas City, Mo. and Kans.; Monongahela River, at Lock No. 2, Pittsburg Harbor, Pennsylvania; Monongahela River from McKeesport to Wilson, Pittsburg Harbor, Pennsylvania; Duluth Harbor, Minnesota; Grand River, at Grand Rapids, Mich.; Saginaw River, at Saginaw, Mich.; Detroit River, at mouth of Rouge River, Michigan.

RULES AND REGULATIONS GOVERNING THE NAVIGATION OF CANALS, ETC., THE OPENING OF DRAWBRIDGES, AND THE FLOATING OF LOOSE LOGS, ETC.

Rules and regulations for the navigation of canals and similar works of navigation.—Section 4 of the river and harbor act of August 18, 1894, as amended by section 11 of the river and harbor act of June 13, 1902, delegates to the Secretary of War the duty of prescribing such rules and regulations for the use, administration, and navigation of any or all canals and similar works of navigation that now are or that hereafter may be owned, operated, or maintained by the United States as in his judgment the public necessity may require; and he is also authorized to prescribe regulations to govern the speed and movement of vessels and other water craft in any public navigable channel which has been improved under authority of Congress, whenever in his judgment such regulations are necessary to protect such improved channels from injury or to prevent interference with the operations of the United States in improving navigable waters or injury to any plan that may be employed in such operations. Such rules and regulations have been established during the past year for the following-named localities:

Ambrose channel, New York Harbor, New York; Delaware River, at Schooner ledge; Hillsboro Bay, Florida; Bayou Plaquemine, Louisiana; Yazoo River diversion canal, Vicksburg Harbor, Mississippi; White River, Arkansas; Cumberland River, Tennessee and

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Kentucky; harbors on the east coast of Lake Michigan, at St. Joseph, South Haven, Saugatuck, Holland (Black Lake), Grand Haven, Muskegon, White Lake, Pentwater, Ludington, Manistee, Portage Lake (Manistee County), Frankfort, Charlevoix, and Petoskey, Mich., and San Diego Harbor, California.

Rules and regulations governing the opening of drawbridges.—Section 5 of the river and harbor act of August 18, 1894, provides that it shall be the duty of all persons owning, operating, and tending the drawbridges then built or which might thereafter be built across the navigable rivers and other waters of the United States, to open or cause to be opened the draws of such bridges, under such rules and regulations as in the opinion of the Secretary of War the public interests require, for the passage of vessels and other water craft. Such rules and regulations have been established during the past year by the Secretary of War for certain drawbridges over the following-named waterways:

Hudson River, at Albany, N. Y.; Sinepuxent Bay, at Ocean City, Md.; Hillsboro River, at Tampa, Fla.; Lake Pontchartrain, Louisiana; Arkansas River; Calumet River, Illinois and Indiana.

Rules and regulations for the navigation of streams on which the floating of loose timber and sack rafts of timber and logs is the principal method of navigation.—Under the provisions of act of Congress approved May 9, 1900, "An Act Authorizing the Secretary of War to make regulations governing the running of loose logs, steamboats, and rafts on certain rivers and streams," the Secretary of War has prescribed rules and regulations for the navigation of Little River, Arkansas and Missouri; Red Lake River, Big Fork River, and Rainy River, Minnesota.

IMPROVEMENT OF MOUTH OF SNAKE RIVER, ALASKA, BY THE NOME IMPROVEMENT COMPANY.

The river and harbor act of March 3, 1905, granted to the Nome Improvement Company, under certain specified conditions, the right to dredge Snake River, which enters Bering Sea at or near Nome, Alaska, for a distance not exceeding 5,000 feet from the mouth thereof, to extend the channel seaward to a depth of water not exceeding 12 feet, and to construct jetties and bulkheads along both sides of the channel so dredged, in accordance with plans to be approved by the Secretary of War, with a view to making said river available for harbor purposes for vessels drawing not less than 6 feet of water and providing an entrance thereto.

Plans for prosecuting the work thus authorized were approved by the Secretary of War June 5, 1905.

BRIDGING NAVIGABLE WATERS OF THE UNITED STATES.

Plans and maps of locations of the following bridges, proposed to be erected under the authority of special acts of Congress, have been examined with a view to protection of the interests of navigation, and have been approved by the Secretary of War as provided by the acts, and the local engineer officers have been furnished copies of the instruments of approval and drawings showing plans and locations,

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and charged with the supervision of the construction of the bridges so far as necessary to see that they are built in accordance with the approved plans:

1. Bridge of the Mercantile Bridge Company over Monongahela River above Dam No. 4, Pittsburg Harbor, Pennsylvania.—Plans and map of location of a bridge proposed to be built at this place under authority of act of Congress approved March 14, 1904, were approved by the Secretary of War August 8, 1904.

2. Bridge of the Lexington and Suburban Railway Company over Missouri River at Lexington, Mo.—Construction of a bridge at this place was authorized by act of Congress approved April 28, 1904. Plans and map of location were approved by the Secretary of War August 18, 1904.

3. Bridge of Itasca County, Minn., over Mississippi River.—Construction of a bridge at this place was authorized by act of Congress approved April 21, 1904. Plans and map of location were approved by the Secretary of War August 19, 1904.

4. Bridge of the Yankton, Norfolk and Southern Railway Company over Missouri River at Yankton, S. Dak.—Construction of this bridge was authorized by act of Congress approved March 9, 1904. Plans and map of location were approved by the Secretary of War August 23, 1904.

5. Bridge of the Minneapolis, St. Paul and Sault Ste. Marie Railway Company over Red Lake River at Thief River Falls, Minnesota.—Construction of a bridge at this place was authorized by act of Congress approved April 11, 1904. Plans and map of location were approved by the Secretary of War September 2, 1904.

6. Bridge of Frank P. Harman over Tug Fork of Big Sandy River, near Delorme, W. Va.—Construction of a bridge at this place was authorized by act of Congress approved April 18, 1904. Plans and map of location were approved by the Secretary of War October 8, 1904.

7. Bridge of the Southern Indiana Railway Company over Wabash River in Vigo County, Ind.—Plans and map of location of a bridge proposed to be built at this locality under authority of act of Congress approved April 7, 1904, were approved by the Secretary of War October 28, 1904.

8. Bridge of Hampden County, Mass., over Connecticut River at Chicopee and West Springfield.—Construction of this bridge was authorized by act of Congress approved April 28, 1904. Plans and map of location were approved by the Secretary of War October 29, 1904.

9. Bridge of the village of Elk River, the county of Wright, and the town of Otsego, Minn., over Mississippi River near Elk River.—Construction of this bridge was authorized by act of Congress approved April 28, 1904. Plans and map of location were approved by the Secretary of War November 4, 1904.

10. Bridge of the Shreveport Bridge and Terminal Company over Red River at Shreveport, La.—Plans and map of location of a bridge proposed to be built at this place under authority of act of Congress approved April 30, 1902, were approved by the Secretary of War November 19, 1902 (see Annual Report of the Chief of Engineers for 1903, p. 643). Modified plans, to be in lieu of those heretofore approved, were approved by the Secretary of War January 11, 1905.

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11. Bridge of the Ashland and Ironton Bridge Company over Ohio River at Ironton, Ohio, and Ashland, Ky.—Plans for construction of this bridge under authority of act of Congress approved December 17, 1872, as amended by act of February 14, 1883, were approved by the Secretary of War April 22, 1901 (see Annual Report of the Chief of Engineers for 1901, p. 660). The statutory time for completion having expired, the plans were reapproved by the Secretary of War February 15, 1905.

12. Bridge of the city of Minneapolis, Minn., over Mississippi River at Thirty-second avenue.—Construction of a bridge at this place was authorized by act of Congress approved January 19, 1905. Plans and map of location were approved by the Secretary of War February 18, 1905.

13. Bridge of the Minneapolis, St. Paul and Sault Ste. Marie Railway Company over Mississippi River at Minneapolis, Minn.—Plans and map of location of this bridge proposed to be built under authority of act of Congress approved January 19, 1905, were approved by the Secretary of War March 10, 1905.

14. Bridge of the Minneapolis, St. Paul and Sault Ste. Marie Railway Company over Red River of the North, in Marshall County, Minn., and Walsh County, N. Dak.—Construction of this bridge was authorized by act of Congress approved January 24, 1905. Plans and map of location were approved by the Secretary of War March 14, 1905.

15. Bridge of Berrien County, Mich., over St. Joseph River near its mouth.—Construction of this bridge was authorized by act of Congress approved March 2, 1905. Plans and map of location were approved by the Secretary of War March 23, 1905.

16. Bridge of the New York, New Haven and Hartford Railroad Company over Connecticut River at Old Saybrook and Old Lyme, Conn.—Plans and map of location of a bridge proposed to be built at this place under authority of act of Congress of April 7, 1904, were approved by the Secretary of War March 29, 1905.

17. Bridge of the Memphis-Chattanooga Railroad (Southern Railway system) over Tennessee River at Oates Island and Mullens Cove, in Marion County, Tenn.—Construction of this bridge was authorized by act of Congress approved February 1, 1905. Plans and map of location were approved by the Secretary of War April 13, 1905.

18. Bridge of the Borderland Coal Company over Tug Fork of Big Sandy River at Nolan, W. Va.—Construction of this bridge was authorized by act of Congress approved March 3, 1905. Plans and map of location were approved by the Secretary of War April 27, 1905.

19. Bridge of Caldwell Parish, La., over Ouachita River at Columbia.—Construction of this bridge was authorized by act of Congress approved January 18, 1905. Plans and map of location were approved by the Secretary of War April 27, 1905.

20. Bridge of the White River Valley Railway Company over Missouri River in Lyman and Brule counties at American Island and the town of Chamberlain, S. Dak.—Plans and map of location of this bridge proposed to be built under authority of act of Congress ap-

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proved February 9, 1905, were approved by the Secretary of War May 10, 1905.

21. Bridge of the Louisa and Fort Gay Bridge Company over Tug and Levisa forks of Big Sandy River at Louisa, Ky., and Cassville, W. Va.—Construction of this bridge was authorized by act of Congress approved March 3, 1905. Plans and map of location were approved by the Secretary of War May 12, 1905.

22. Bridge of the Lindsey Lumber Company over Conecuh River near Pollard, Ala.—Construction of this bridge was authorized by act of Congress approved January 27, 1905. Plans and map of location were approved by the Secretary of War May 15, 1905.

23. Bridges of the Norfolk and Western Railway Company over Tug Fork of Big Sandy River in Mingo County, W. Va., and Buchanan County, Va.—Construction of these bridges was authorized by act of Congress approved April 12, 1904. Plans and maps of location were approved by the Secretary of War June 6, 1905.

24. Bridge of the Leckrone and Little Whiteley Railroad Company over Monongahela River at McCanns Ferry, Pa.—Authority for construction of this bridge was granted by act of Congress approved February 16, 1905. Plans and map of location were approved by the Secretary of War June 12, 1905.

Under the provisions of section 9 of the river and harbor act approved March 3, 1899, bridges may be built over navigable waters entirely within the limits of any State, under authority of legislative enactment of such State, when the plans and locations of the structures are approved by the Secretary of War. Plans and maps of locations of the following bridges proposed to be erected under these provisions have been examined with a view to protection of the interests of navigation, and have been approved by the Secretary of War; and the local engineer officers have been furnished copies of the drawings and instruments of approval, and charged with the supervision of construction of the bridges so far as necessary to see that they are built in accordance with the approved plans:

1. Bridge of King County, Wash., over White River near the town of Kent.—Plans and map of location were approved by the Secretary of War July 5, 1904.

2. Bridge of the city of Oshkosh, Wis., over Fox River at Main street.—Plans for rebuilding an existing structure were approved by the Secretary of War July 7, 1904.

3. Bridge of Burlington County, N. J., over Assiscunk Creek at Mitchell avenue, Burlington.—Plans and map of location were approved by the Secretary of War July 7, 1904.

4. Bridge of the city of Buffalo, N. Y., over Buffalo Creek, River, at Ohio street.—Plans for rebuilding an existing structure were approved by the Secretary of War July 13, 1904.

5. Bridge of the Hampton Roads Railway and Electrical Company over Mill Creek at Fort Monroe, Old Point Comfort, Va.—Plans and map of location were approved by the Secretary of War July 15, 1904.

6. Bridge of the Caney Fork Bridge Company over Caney Fork River near Trousdale Ferry, Tennessee.—Plans and map of location were approved by the Secretary of War July 26, 1904.

7. Bridge of the Great Northern Railway Company over Stilaguamish River near Silvana, Wash.—Plans for reconstruction of an existing bridge were approved by the Secretary of War July 27, 1904.

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8. Bridge of Burlington County, N. J., over Rancocas River at Washington street, Mount Holly, N. J.—Plans and map of location were approved by the Secretary of War July 27, 1904.

9. Bridge of the Pennsylvania Railroad Company over Rancocas River at Delanco, N. J.—Plans for rebuilding an existing structure were approved by the Secretary of War July 28, 1904.

10. Bridge of the Coal and Coke Railway Company over Little Kanawha River in Braxton County, W. Va.—Plans and map of location were approved by the Secretary of War July 29, 1904, to be in lieu of those approved May 1, 1903, for a bridge proposed to be built at this place by the Little Kanawha Railroad Company. (See Annual Report of the Chief of Engineers for 1903, p. 650.)

11. Bridge of Okanogan County, Wash., over Okanogan River near Riverside.—Plans and map of location were approved by the Secretary of War July 30, 1904.

12. Bridge of Leon County, Fla., over Ocklockonee River.—Plans and map of location were approved by the Secretary of War August 3, 1904.

13. Bridge of the Michigan Central Railroad Company over Saginaw River near Bay City, Mich.—Plans and map of location were approved by the Secretary of War August 3, 1904.

14. Bridge of the Florida East Coast Railway Company over Halifax River at Ormond, Fla.—Plans and map of location were approved by the Secretary of War August 3, 1904.

15. Bridge of the city of Peoria, Ill., over Illinois River (lower free wagon bridge).—The existing bridge being considered obstructive to navigation, notice to alter it was duly served on the owners (see Annual Report of the Chief of Engineers for 1904, p. 721). Plans for replacing the bridge by an entirely new structure were approved by the Secretary of War August 3, 1904.

16. Bridge of the Tuscumbia Bridge Company over Osage River at Tuscumbia, Mo.—Plans and map of location were approved by the Secretary of War August 8, 1904.

17. Bridge of the city of Saginaw, Mich., over Saginaw River at Center street.—Plans and map of location approved by the Secretary of War August 23, 1904.

18. Bridge of the city of Saginaw, Mich., over Saginaw River at Sixth street.—Plans and map of location were approved by the Secretary of War August 23, 1904.

19. Bridge of Anne Arundel County, Md., over Severn River near Annapolis.—Plans for rebuilding an existing structure were approved by the Secretary of War August 24, 1904.

20. Bridge of the State of Massachusetts over Charles River at Boston, Mass.—Plans for a temporary bridge to be built on the present site of the Boston and Maine Railroad bridge were approved by the Secretary of War September 1, 1904.

21. Bridge of Pacific County, Wash., over South Fork of Willapa River.—Plans and map of location were approved by the Secretary of War September 1, 1904.

22. Bridge of Stearns & Culver Lumber Company over Blackwater River at Bagdad, Fla.—Plans and map of location were approved by the Secretary of War September 2, 1904.

23. Bridge of the Florida East Coast Railway Company over San

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Sebastian River at St. Augustine, Fla.—Plans and map of location approved by the Secretary of War September 3, 1904.

24. Bridge of Whatcom County, Wash., over Nooksak River.—Plans and map of location were approved by the Secretary of War September 6, 1904.

25. Bridge of Glenn County, Cal., over Sacramento River at Butte City.—Plans for reconstruction of an existing bridge were approved by the Secretary of War September 6, 1904.

26. Bridge of the New York Central and Hudson River Railroad Company over Bellmans Creek near Granton, N. J.—Plans for reconstructing an existing bridge were approved by the Secretary of War September 6, 1904.

27. Bridge of the Washington and Vandemere Railroad Company over Tar River near Washington, N. C.—Plans and map of location were approved by the Secretary of War September 7, 1904.

28. Bridges of the Southern Pacific Company over Warm Spring Creek and Coyote Creek near Alviso, Cal.—Plans for reconstruction of existing bridges at these points were approved by the Secretary of War August 17, 1903 (see Annual Report of the Chief of Engineers for 1904, p. 714). Substitute plans were approved by the Secretary of War September 8, 1904.

29. Bridge of the Mobile and Ohio Railroad Company over Tombigbee River at Columbus, Miss.—Plans for rebuilding an existing structure were approved by the Secretary of War September 12, 1904.

30. Bridge of the city of Chicago, Ill., over South Branch of Chicago River at Harrison street.—Plans for a bridge at this place were approved by the Secretary of War September 14, 1900 (see Annual Report of the Chief of Engineers for 1901, p. 662). Modified plans to replace the original plans were approved by the Secretary of War September 13, 1904.

31. Bridge of the Boston and Maine Railroad Company over Charles River at Boston and Cambridge, Mass.—Plans for reconstruction of an existing structure were approved by the Secretary of War September 15, 1904.

32. Bridge of Essex County, Mass., over Bass River at Beverly.—Plans for reconstruction of an existing bridge were approved by the Secretary of War October 6, 1904.

33. Bridge of the Louisville and Nashville Railroad Company over Little Tennessee River at Niles Ferry, Tennessee.—Plans and map of location of a bridge proposed to be built at this place to replace an existing structure were approved by the Secretary of War October 21, 1904.

34. Bridge of J. H. Tatum over Miami River at Miami, Fla.—Plans and map of location were approved by the Secretary of War October 24, 1904.

35. Bridge of Lauderdale and Crockett counties, Tenn., over South Fork of Forked Deer River, at Chestnut Bluff.—Plans and map of location were approved by the Secretary of War October 25, 1904.

36. Bridge of Pierce County, Wash., over an arm of Henderson Bay at Purdy, Wash.—Plans and map of location were approved by the Secretary of War October 28, 1904.

37. Bridge of the Topeka Railway Company over Kansas River at Topeka, Kans.—Plans for rebuilding an existing structure were approved by the Secretary of War November 4, 1904.

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38. Bridges of Gordon County, Ga., over Oostenaula River at Gordons Ferry, Millers Ferry, and Printups Ferry.—Plans and maps of location were approved by the Secretary of War November 18, 1904.

39. Bridge of the Riverside Railway Company over Grand River near Bassriver, Mich.—Plans and map of location were approved by the Secretary of War November 19, 1904.

40. Temporary bridge of the city of Chicago, Ill., over North Branch Canal at Weed street.—Plans and map of location were approved by the Secretary of War December 7, 1904.

41. Bridge of the city of Cambridge, Mass., over Charles River at Brookline street, Cambridge, and Essex street, Boston.—Plans for rebuilding an existing structure were approved by the Secretary of War December 10, 1904.

42. Bridge of the New York Central and Hudson River Railroad Company, lessee of the Boston and Albany Railroad, over Charles River at Boston and Cambridge, Mass.—Plans for rebuilding an existing structure were approved by the Secretary of War December 10, 1904.

43. Bridge of the Kelso Bridge Company over Cowlitz River at Kelso and Catlin, Wash.—Plans and map of location were approved by the Secretary of War December 20, 1904.

44. Bridges of the Baltimore, Sparrows Point and Chesapeake Railway Company over Jones, or Welshmans, Creek, North Point Creek, and Shallow Creek, Maryland.—Plans and maps of location were approved by the Secretary of War December 20, 1904.

45. Bridge of the Louisville and Nashville Railroad Company over Hiwassee River near the mouth of Ocoee River, Tennessee.—Plans and map of location were approved by the Secretary of War December 30, 1904.

46. Bridge of the city of New York, N. Y., over East River (Bridge No. 3, Manhattan Bridge).—Plans for this bridge were approved by the Secretary of War January 29, 1900 (see Annual Report of the Chief of Engineers for 1900, p. 700). Modified plans to be in lieu of the original plans were approved by the Secretary of War January 5, 1905.

47. Bridges of the Howland Improvement Company, lessee of the Atlantic and North Carolina Railroad, over Neuse River near Kinston, N. C., and Newport River near Newport, N. C.—Plans for reconstruction of existing bridges were approved by the Secretary of War January 23, 1905.

48. Bridge of the Chicago, Milwaukee and St. Paul Railway Company over the Government canal along Fox River at Menasha, Wis.—Plans for reconstruction of an existing bridge were approved by the Secretary of War January 25, 1905.

49. Bridge of the Cleveland Terminal and Valley Railroad Company, of the Baltimore and Ohio Railroad system, over Cuyahoga River at Cleveland, Ohio.—Plans for rebuilding an existing bridge were approved by the Secretary of War January 25, 1905.

50. Bridge of the village of Montello, Wis., over the Fox River Canal.—Plans and map of location were approved by the Secretary of War January 27, 1905.

51. Bridge of the city of Manistee, Mich., over Manistee River at Maple street.—Plans for rebuilding an existing structure were approved by the Secretary of War February 11, 1905.

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52. Bridge of Sacramento County, Cal., over Sacramento River at Grand Island.—Plans and map of location were approved by the Secretary of War February 20, 1905.

53. Bridge of the St. Louis, Brownsville and Mexico Railway Company over Nueces River, Texas.—Plans and map of location were approved by the Secretary of War February 27, 1904.

54. Bridge of the State of Rhode Island (Stone Bridge) over Sakonnet River at Tiverton and Portsmouth, R. I.—Plans for reconstruction of an existing bridge were approved by the Secretary of War February 28, 1905.

55. Bridge of the Manitowoc, Green Bay and Northwestern Railway Company over Manitowoc River near Manitowoc, Wis.—Plans and map of location were approved by the Secretary of War March 14, 1905.

56. Bridge of Cabell County, W. Va., over Guyandot River at Guyandot and Huntington.—Plans and map of location were approved by the Secretary of War March 15, 1905.

57. Bridge of the Manitowoc, Green Bay and Northwestern Railway Company (Chicago and Northwestern Railway Company) over East River near Green Bay, Wis.—Plans and map of location were approved by the Secretary of War March 22, 1905.

58. Bridge of the Manitowoc, Green Bay and Northwestern Railway Company (Chicago and Northwestern Railway Company) over Fox River at Green Bay, Wis.—Plans and map of location were approved by the Secretary of War March 27, 1905.

59. Bridge of the Louisville and Nashville Railroad Company over Coosawattee River at Carters, Ga.—Plans and map of location were approved by the Secretary of War March 30, 1905.

60. Temporary bridge of the city of Chicago, Ill., over West Fork of South Branch of Chicago River at South Western avenue.—Plans and map of location were approved by the Secretary of War March 31, 1905.

61. Bridge of the city of Toledo, Ohio, over Swan Creek at Green street.—Plans and map of location were approved by the Secretary of War March 31, 1905.

62. Bridge of Itawamba County, Miss., over Tombigbee River near the town of Fulton.—Plans and map of location were approved by the Secretary of War March 31, 1905.

63. Bridge of the Chicago and Northwestern Railway Company over Sheboygan River at Sheboygan, Wis.—Plans and map of location were approved by the Secretary of War April 7, 1905.

64. Bridge of the Northern Pacific Railway Company over Spokane River near Cœur d'Alene, Idaho.—Plans and map of location were approved by the Secretary of War April 7, 1905.

65. Bridge of the city of Boston, Mass., over Fort Point channel at Northern avenue and Oliver street.—Plans and map of location were approved by the Secretary of War April 11, 1905.

66. Bridge of the Chicago, Rock Island and Pacific Railway Company over Kansas River at Kansas City, Kans.—Plans for rebuilding a bridge at this place were approved by the Secretary of War April 14, 1905.

67. Bridge of the Atlantic Coast Line Railroad Company over Suwanee River, Florida.—Plans and map of location were approved by the Secretary of War April 15, 1905.

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68. Bridge of the St. Louis, Brownsville and Mexico Railway Company over Lavaca River near Texana and the mouth of Navadad River, Texas.—Plans and map of location were approved by the Secretary of War April 15, 1905.

69. Bridge of the city of New York, N. Y., over Harlem River Ship Canal at Broadway crossing.—Plans and map of location were approved by the Secretary of War February 11, 1893. (See Annual Report of the Chief of Engineers for 1893, p. 467.) Plans for reconstructing the bridge were approved by the Secretary of War April 20, 1905.

70. Bridge of the city of Chicago over South Branch of Chicago River at Twenty-second street.—Plans for a permanent bridge to replace an existing structure were approved by the Secretary of War July 14, 1904. Plans and map of location for a temporary bridge for use during the construction of the permanent structure were approved by the Secretary of War May 2, 1905; revised plans and map of location therefor were approved by the Secretary of War May 22, 1905.

71. Bridge of the St. Louis, Brownsville and Mexico Railway Company over Guadalupe River near Kemper City, Tex.—Plans and map of location were approved by the Secretary of War May 3, 1905.

72. Bridge of W. C. Baker over Hook Creek at Meadowmere, N. Y.—Plans and map of location of a bridge at this place to replace an existing structure were approved by the Secretary of War May 10, 1905.

73. Bridge of the Lemann Company (Limited) over Bayou Lafourche, near Donaldsonville, La.—Plans and map of location were approved by the Secretary of War May 10, 1905.

74. Bridge of the Florida East Coast Railway Company over St. Lucie River at Kitchens and Fosters points, Florida.—Plans for reconstruction of an existing bridge were approved by the Secretary of War May 13, 1905.

75. Bridge of the Humboldt Northern Railway Company over Mad River Slough, near Eureka, Cal.—Plans and map of location were approved by the Secretary of War May 13, 1905.

76. Bridge of Westmorland County, Pa., over Youghiogheny River at West Newton.—Plans for rebuilding an existing structure were approved by the Secretary of War May 18, 1905.

77. Bridge of the city of Providence, R. I., over Providence River at Point street.—Plans for rebuilding an existing structure were approved by the Secretary of War May 18, 1905.

78. Bridge of the city of Kewaunee, Wis., over Kewaunee River at Park street.—Plans and map of location were approved by the Secretary of War May 19, 1905.

79. Bridge of the Maine Central Railway Company, lessee of the European and North American Railway, over Kenduskeag River at Bangor, Me.—Plans for reconstruction of an existing bridge were approved by the Secretary of War May 25, 1905.

80. Bridge of the city of Cambridge, Mass. (Brookline Street Bridge), over Charles River at Cambridge and Boston.—Plans and map of location were approved by the Secretary of War May 27, 1905.

81. Bridge of the Kansas City Viaduct and Terminal Railway Company over Kansas River at Kansas City, Kans.—Plans and map of location were approved by the Secretary of War June 1, 1905.

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82. Bridge of the Seaboard Traction Company over Bennetts Creek, Virginia.—Plans and map of location were approved by the Secretary of War June 23, 1905.

83. Bridge of the Southern Pacific Company over Willamette River near Harrisburg, Oreg.—Plans for rebuilding an existing bridge were approved by the Secretary of War June 14, 1905.

84. Bridge of Middlesex County, N. J., over Raritan River at Perth Amboy and South Amboy.—Plans for rebuilding a portion of an existing structure were approved by the Secretary of War June 20, 1905.

85. Bridge of the Wisconsin Central Railway Company over east channel of Mississippi River at Boom Island and Minneapolis, Minn.—Plans and map of location were approved by the Secretary of War June 22, 1905.

86. Bridge of Cape May County, N. J., over Ludlams Thoroughfare at Sea Isle City.—Plans and map of location were approved by the Secretary of War June 22, 1905.

87. Bridge of Essex County, Mass., over Merrimac River at Haverhill, Mass.—Plans and map of location were approved by the Secretary of War June 23, 1905.

88. Bridge of the city of Chicago, Ill., over the North Branch Canal of Chicago River at North Halsted street.—Plans and map of location were approved by the Secretary of War June 23, 1905.

89. Bridge of the Northern Maine Seaport Railway Company over Cape Jellison Harbor at Stockton Springs, Me.—Plans and map of location were approved by the Secretary of War June 27, 1905.

90. Bridge of the Northern Maine Senport Railway Company over Passagassawaukeag River at Belfast, Me.—Plans and map of location were approved by the Secretary of War June 27, 1905.

91. Bridge of the Pennsylvania, New Jersey and New York Railroad Company over Hackensack River near Marion, N. J.—Plans and map of location were approved by the Secretary of War June 29, 1905.

Under the provisions of section 18 of the river and harbor act approved March 3, 1899, relating to bridges obstructing navigation, plans for alteration of the following bridges, so as to render navigation through or under them reasonably free, easy, and unobstructed, have been examined and approved by the Secretary of War, and the local engineer officers have been furnished copies of the plans and instruments of approval and charged with supervision of the work of alteration so far as necessary to see that the approved plans are complied with:

1. Bridge of the Wheeling and Lake Erie Railroad Company over Cuyahoga River at Cleveland, Ohio.—The existing bridge at this place being considered an obstruction to navigation, notice to alter it was duly served on the owners. Plans for reconstruction of the bridge were approved by the Secretary of War October 25, 1904.

2. Bridge of the Southern Railway Company over Tennessee River at Loudon, Tenn.—The existing structure being unsatisfactory to navigation interests, and plans for its reconstruction having been submitted by the company, they were approved by the Secretary of War March 13, 1905.

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3. Bridge of the Baltimore and Ohio Railroad Company and the Fairmont, Morgantown and Pittsburgh Railroad Company over Monongahela River 1½ miles below Fairmont, W. Va.—An existing bridge at this locality being considered an obstruction to navigation, notice to alter it was duly served on the owners (*infra*). Plans for a new bridge at a different location to replace the existing structure were approved by the Secretary of War March 15, 1905.

4. Bridge of the District of Columbia over Anacostia River at Washington, D. C.—Provision for reconstructing the existing bridge was made by the District of Columbia appropriation act approved April 27, 1904, as amended by act of March 3, 1905. Plans were approved by the Secretary of War April 7, 1905.

5. Bridge of Crow Wing County, Minn., over Mississippi River between the mouths of Pine River and Dean Brook.—The existing bridge at this place being considered obstructive to navigation, and plans for replacing it with a new structure having been submitted by the county, they were approved by the Secretary of War June 2, 1905.

BRIDGES OBSTRUCTING NAVIGATION.

Under the requirements of section 18 of the river and harbor act approved March 3, 1899, the Secretary of War notified the persons, corporations, or associations owning or controlling certain bridges obstructing navigation, after giving them a reasonable opportunity to be heard, to so alter said bridges as to render navigation through or under them reasonably free, easy, and unobstructed, specifying in the notice the alterations required to be made and prescribing a reasonable time in which to make them, as follows:

1. Bridge of the Cleveland Terminal and Valley Railroad of the Baltimore and Ohio System, over old bed of Cuyahoga River at Cleveland, Ohio.—Notices dated April 27, 1905, served on officials of the respective companies May 4 and 16, 1905. Specified alterations to be completed on or before April 1, 1906.

2. Bridge of the Fairmont, Morgantown and Pittsburgh Railroad Company and the Baltimore and Ohio Railroad Company over Monongahela River, 1½ miles below Fairmont, W. Va.—Notices dated September 1, 1904, served on the companies September 13, 1904. Specified alterations to be completed on or before August 1, 1905.

3. Bridge of the Michigan Central Railroad Company over Detroit River between Grosse Isle and Stony Island, Michigan.—Notice dated October 3, 1904, served on the company October 13, 1904. Specified alterations to be completed on or before May 1, 1905.

4. Bridge of the Monongahela Bridge Company (Brownsville bridge) over Monongahela River at Bridge street, Bridgeport, Pa.—Notice dated August 10, 1904, served on the company August 15, 1904. Specified alterations to be completed on or before August 1, 1905.

5. Bridge of the New York, New Haven and Hartford Railroad Company, lessee of the Old Colony Railroad Company, over Neponset River at Quincy and Neponset, city of Boston, Mass.—Notice dated August 10, 1905, served on the New York, New Haven and Hartford Railroad Company August 18, 1904. Specified alterations to be completed on or before December 31, 1904.

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6. Bridge of the Jamaica and Rockaway Turnpike Company over Hook Canal at mouth of Hook Creek, New York.—Notice dated October 10, 1904, served on the company October 18, 1904. Specified alterations to be completed on or before December 1, 1904.

7. Bridge of Beaufort County, N. C., over Durhams Creek at Bonnerton, N. C.—Notice dated September 13, 1904, served on the board of county commissioners September 24, 1904. Specified alterations to be completed on or before February 1, 1905.

8. Bridge of the city of Boston, Mass., over Fort Point channel at Dover street.—Notice dated December 30, 1904, was served on the mayor January 5, 1905. Specified alterations to be completed on or before November 30, 1905.

STRUCTURES, OTHER THAN BRIDGES, IN THE NAVIGABLE WATERS OF THE UNITED STATES.

Pursuant to the provisions of sections 9 and 10 of the river and harbor act of March 3, 1899, and of certain special acts of Congress, numerous applications for permission to build structures of various kinds, other than bridges (such as dams, wharves, dolphins, booms, weirs, etc.), in the navigable waters of the United States have been examined with a view to the protection of navigation interests.

Upon the recommendation of the Chief of Engineers, permits have been granted by the Secretary of War for the erection of a number of such structures, but specific reference is not deemed necessary except in the following cases:

1. Dam of the St. Croix Falls Wisconsin Improvement Company and the St. Croix Falls Minnesota Improvement Company across St. Croix River at St. Croix, Wis.—Construction of this dam was authorized by act of Congress approved February 7, 1903. Plans and map of location were approved by the Secretary of War September 16, 1904.

2. Lock and dam of the State of Massachusetts across Charles River at Boston, Mass.—In pursuance of section 9 of the river and harbor act of March 3, 1899, general plans for a lock and dam at this place, to be built under authority of State law, were approved by the Secretary of War May 18, 1904, and detailed plans October 5, 1904.

3. Dam of the Dominion of Canada in St. Lawrence River, between Adams and Les Galops islands.—The construction of this dam was authorized by act of Congress approved June 18, 1902. Plans for construction of the dam were approved by the Secretary of War August 18, 1903. Modified plans, providing for an increase in height of the dam, were approved by the Secretary of War October 10, 1904.

4. Dam of the Watab Rapids Power Company across Mississippi River in Stearns and Benton counties, Minn., above the mouth of Watab River.—Plans and map of location were approved by the Secretary of War April 6, 1905. Construction was authorized by act of Congress approved April 23, 1904.

5. Dam of the Ox Bow Power Company across Missouri River at Ox Bow bend, Mont.—Construction of this dam was authorized by act of Congress approved April 28, 1904. Plans and map of location were approved by the Secretary of War April 15, 1905.

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MISCELLANEOUS.

[Public works not provided for in acts making appropriations for the construction, repair, and preservation of works on rivers and harbors.]

BRIDGES AT WASHINGTON, D. C.

Operations under this head were in the charge of Col. A. M. Miller, Corps of Engineers, until September 14, 1904; in the temporary charge of Capt. W. P. Wooten, Corps of Engineers, from September 14, 1904, until November 14, 1904, and in the charge of Lieut. Col. Smith S. Leach, Corps of Engineers, since November 14, 1904.

1. Repair of the Aqueduct Bridge across Potomac River.—(a) Pier No. 5.—The District of Columbia appropriation act approved July 1, 1902, contained the following item:

Repairs to Aqueduct Bridge: For construction of pier numbered five of the Aqueduct Bridge across the Potomac River at Georgetown, District of Columbia, to be expended under the direction of the Secretary of War, sixty-five thousand dollars.

Under the above authority a contract was made on April 22, 1903, for the complete reconstruction of Pier No. 5, the work to be completed by December 1, 1903.

Work was started in the summer of 1903, and considerable progress on the cutting of stone and the construction of the cofferdam was made by December, when weather conditions necessitated the suspension of the work. Previously it was seen that the completion of the contract within the time set would be impossible, owing somewhat to the difficulty of obtaining construction material of the kind needed, and an extension of contract time was applied for and granted.

Work was resumed in March, 1904, as soon as weather conditions warranted, and prosecuted continuously until the completion of the contract in December, 1904. Some difficulties were encountered during the pumping out and making water-tight of the cofferdam, but no very serious delays occurred, and, considering the natural and artificial obstacles to rapid construction, the work was completed in fair time.

The scheme of repair was radical, consisting of the entire removal of the old rubble masonry pier within a cofferdam built around it, and its reconstruction with first-class ashlar masonry.

The cofferdam was of an ordinary crib type of dam sheathed with tongue-and-groove sheet piling and banked around the exterion with earth puddle. The two bridge spans resting on the old pier were carried during the period of reconstruction by wooden "A" frames spanning the interval between the inner walls of the cofferdam inclosure and supported in turn on trestle towers resting on the crib framing. From the tops of the "A" frames the steel trusses were subtended by long iron rods or stirrups around their end pins.

No interruption to bridge traffic was caused by the rebuilding operations.

July 1, 1904, balance unexpended	$61,511.09
June 30, 1905, amount expended during fiscal year, for works of improvement	59,899.00
July 1, 1905, balance unexpended, deposited in Treasury	1,612.09

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(*b*) *Repair of piers.*—Congress, by joint resolution approved July 1, 1902, enacted as follows:

That the Secretary of War be, and he is hereby, authorized to spend an amount not exceeding three thousand dollars from the balance of appropriations made for the reconstruction of pier number four of the Aqueduct Bridge, District of Columbia, for the purpose of the examination of, and immediate temporary repairs to, the remaining piers of said bridge in cases of need arising from flood or ice.

In accordance with the above authority a thorough examination was made by diver in the late spring of 1904, and such minor repairs made as were necessary.

The piers were at that time left in as good condition as it was practicable to put them, and as there has been no freshet, or unusual current disturbance in the river since then, it was thought unnecessary to undertake any further examination or repair of them this season.

July 1, 1905, balance unexpended	$2,317.77
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	104.40
July 1, 1905, balance unexpended	2,213.37

(See Appendix B B B 1.)

2. Highway bridge across Potomac River at Washington, D. C.—Section 12 of an act of Congress approved February 12, 1901, provided for the construction of a highway bridge to replace the existing Long Bridge, and appropriated the sum of $568,000 for the purpose.

By authority of the Secretary of War a Board of Engineers was constituted to select a site and to formulate plans, specifications, and estimates for the bridge. The Board submitted a report, dated October 25, 1901, which was transmitted to Congress for its information. It is printed at page 2652 of the Annual Report of the Chief of Engineers for 1902.

The Board presented two plans, one for $575,000 and one for $996,000.

Congress, by act of July 1, 1902 (Public, No. 218), authorized the increase of the limit of cost of the structure to $996,000, but no actual additional appropriation was made thereby.

Bids for the construction of the bridge across the main river were opened first on March 27, 1903, and, all being in excess of the amount available, were rejected.

As a result of the second bidding of July 25, 1903, on slightly revised plans and specifications, an agreement was entered into on August 29, 1903, for the erection of the bridge, the contract calling for its completion by February 12, 1905, in accordance with the requirements of the act of July 1, 1902.

By authority of the Secretary of War a Board of Engineer officers was constituted, consisting of the officer in charge of public buildings and grounds, the district engineer, and the Engineer Commissioner of the District of Columbia, for the consideration of plans for the approaches to the bridge, and a report upon the subject was submitted in January, 1904.

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Upon the Board's recommendation and estimate, the appropriation was further increased by the act of Congress of April 27, 1904 (Public, No. 187), as follows:

> For continuing construction, including approaches, of the highway bridge across the Potomac River at Washington, District of Columbia, and for any and all purposes connected therewith, four hundred and twenty-eight thousand dollars; and the total cost of said bridge and approaches shall not exceed one million one hundred and ninety-six thousand dollars.

By this act the appropriation was brought up to $996,000, and the expenditure of $200,000 additional, to cover the cost of approaches, etc., authorized. This additional $200,000 was finally appropriated by act of Congress of March 3, 1905, thus bringing the total appropriations up to $1,196,000 for completing construction of the bridge and approaches and all purposes connected therewith.

On account of the time lost in preparation of plans and specifications and the obtaining of bids after the passage of the original act, it was early seen that the above-mentioned time limit was unreasonable, and its extension for one year was recommended by the Department to Congress. This was done by joint resolution of Congress approved February 18, 1905, extending the time for completion to February 12, 1906.

Construction work was commenced on the bridge substructure in October, 1903, and suspended in December, because of prohibitive weather conditions. Not much beyond a little preliminary work, assembling of plant, materials, etc., was done during this period. Work on the substructure was resumed in March, 1904, and continued steadily until January, 1905, when severe weather conditions again necessitated its suspension. Fair progress was made during this season, though owing to slow deliveries of material not as much was accomplished as had been anticipated. The two abutments and seven of the twelve piers were complete at the time of the suspension.

The erection of the superstructure was not commenced until September, 1904, and when operations were temporarily stopped in January, 1905, six spans had been assembled in place, swung clear of the false work, and partially riveted up.

Work was resumed on the substructure in March and on the superstructure in May, 1905, since which time the former has been practically completed and the latter advanced to such a point that three spans of steel only remain to be assembled.

After assembling and riveting up the remaining steel work, the sidewalk railing and lamps will be placed and sidewalk and roadway paving laid.

The embankment for the Washington approach is now completed, and work has been started on the Virginia approach embankment, and, it is expected, will be completed by September 1.

The bridge will probably be open for travel in the fall of 1905.

An estimate of $11,600 for the payment of expenses incident to operation of the bridge during the fiscal year ending June 30, 1907, is submitted.

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July 1, 1904, balance unexpended	$968,235.44
Amount appropriated by District of Columbia appropriation act of March 3, 1905	200,000.00
Refund August 11, 1904	1.00
	1,168,236.44
June 30, 1905, amount expended during fiscal year, for works of improvement	625,032.12
July 1, 1905, balance unexpended	543,204.32
July 1, 1905, outstanding liabilities	1,845.00
July 1, 1905, balance available	541,359.32
July 1, 1905, amount covered by uncompleted contracts	361,640.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	11,600.00

(See Appendix B B B 2.)

MAINTENANCE AND REPAIR OF THE WASHINGTON AQUEDUCT, DISTRICT OF COLUMBIA, AND WASHINGTON AQUEDUCT, DISTRICT OF COLUMBIA, FILTRATION PLANT.

Operations under this head were in the charge of Col. A. M. Miller, Corps of Engineers, until September 14, 1904; in the charge of Capt. W. P. Wooten, Corps of Engineers, from September 14, 1904, until November 14, 1904; and since the latter date in the charge of Lieut. Col. Smith S. Leach, Corps of Engineers, having under his immediate orders Capt. William P. Wooten and First Lieut. E. J. Dent, Corps of Engineers.

1. Washington Aqueduct, District of Columbia.—Small repairs were made to the riprap backing of the dam at Great Falls. The deposit of mud at the mouth of the conduit was removed. The feeder between the river and the gatehouse was cleaned. A new fence was built around the Government reservation at Great Falls.

Gatehouses and buildings were repaired, painted, and whitewashed. Steel gratings were placed in all floor openings of the east shaft gatehouse, a wood ceiling was placed in the Rock Creek pumphouse, new screens were made for the Georgetown distributing reservoir gatehouse, and all machinery was kept in good condition.

The grounds at the reservoirs were kept in good order, gutters, ditches, roads, and embankments were cleaned and repaired, and fences were repaired and whitewashed. During the year a small dredge was built at the Dalecarlia reservoir and 3,763 cubic yards of mud removed from the channel leading from the conduit outlet to deep water. The flume at the north end of the dredged channel was repaired.

On the Conduit road gutters, ditches, culverts, and drains were cleaned, and repairs made. Grass and weeds were cut and fences repaired and whitewashed. Between the clubhouse and Great Falls 1,850 linear feet of macadam road was built.

Small repairs were made to the bridges along the line of the Aqueduct. The timber work on the Pennsylvania Avenue Bridge across Rock Creek was entirely renewed.

Repairs were made to water mains, the vaults cleaned, and the valves worked and oiled.

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Measurement of the quantity of water flowing into the distribution system, made in the month of June, showed a daily average of 68,000,000 gallons. This is the largest measurement yet made. The quantity of water used by the United States in the Federal buildings and reservations may now be closely estimated at 10,000,000 gallons per day, based on actual meterings by the District authorities at a majority of the points of consumption. Excluding this 10,000,000 gallons from the total consumption and taking the population of 1905 from the police census, a per capita consumption of 170 gallons results. The measured supply to a purely residential district is nearly as great from midnight to 4 a. m. as from noon to 4 p. m. During the cold weather in February the quantity passing into the mains varied from 90,000,000 to 103,000,000 gallons; the reservoirs were depleted until the total reserve capacity was but one-third of the normal and less than two days' supply, notwithstanding the fact the conduit discharged the unprecedented quantity of 97,000,000 gallons. The filtration plant which will be put in operation before the next winter has a maximum capacity of 75,000,000 gallons per diem. Any excess of this amount must be supplied by the introduction of unfiltered water into the mains.

The conduit from Great Falls to Georgetown was built nearly fifty years ago.

Attention is invited to the danger of an interruption of the supply by an accident to the conduit. This structure has stood for nearly half a century, and without interruption in its use other than to empty it periodically for cleaning. This fact is no guaranty that it will not be interrupted in the future.

It includes 6 tunnels, aggregating 3,700 linear feet, in seamy rock, and unlined. They can not be lined until a new conduit is built. At every cleaning fragments of rock are found to have been dislodged from the roof. There is an appreciable risk of more or larger pieces falling in, sufficient to block the tunnel for a considerable time.

There are 26 culverts, nearly all in made ground, the failure of any one of which would break the conduit. They are of massive construction, but equally strong ones have been washed out, and these may be.

The Dalecarlia reservoir is formed by an earthen dam across a valley. In this dam is the by-conduit. If this dam should break, the by-conduit would be destroyed and the supply of the District completely cut off.

The statement is justifiable that, notwithstanding its fifty years of uninterrupted use, the Washington Aqueduct is more vulnerable than the average of similar structures and that there is risk of an accident to it which would cut off the supply for a period long enough to cause a water famine, which would involve a cancellation of all fire insurance and a partial depopulation of the city, besides other and more calamitous consequences. This risk can be underwritten by the construction of another conduit, and in no other way.

The construction of a second conduit presents some important incidental advantages. It will settle the question of supply until the District contains more than twice its present population.

The project for the second conduit should include adequate reservoirs, and may be made to more than double the present reserve supply. This will remove the single defect in the filtration scheme.

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It is conceded, and has been officially stated, that the filtration plant will probably not produce an effluent entirely satisfactory as to color at periods of maximum turbidity in the river. To double the reserve reservoir capacity will permit the headgates to be closed during periods of maximum turbidity and insure a clear effluent at all times. The increased sedimentation will slightly increase the capacity of the beds for a given cost of operation, or will reduce the cost for a given capacity.

With the idea of insurance paramount, the new conduit should not be built alongside the present one, but should follow a radically different course, to reduce to a minimum the chance of a single cause disabling both. For this reason all possible alternative routes should be examined and the preliminary surveys become more important and more extensive and will require more time.

An estimate of $10,000 for these surveys is submitted and its favorable consideration is urged. The cost of these surveys and any probable cost of a second conduit will be a very cheap insurance against the interruption of the water supply, which will remain a constant menace to the District until such insurance is effected.

The estimates for the fiscal year ending June 30, 1907, are as follows:

For building combined storehouse and stable at Great Falls	$3,000
For preliminary surveys for additional conduit from Great Falls	10,000
For operation, maintenance, and repair of the aqueduct and its accessories, including the Conduit road, the Washington city reservoir, and the Washington Aqueduct tunnel	33,000
Total	46,000

Appropriated by act of April 27, 1904	$33,000.00
June 30, 1905, amount expended during fiscal year	30,051.61
July 1, 1905, balance unexpended	2,948.39
July 1, 1905, outstanding liabilities	2,948.39

(See Appendix C C C 1.)

2. Washington Aqueduct, District of Columbia, Filtration Plant.—By various acts of Congress there has been appropriated for the work the sum of $3,468,405. At the beginning of the fiscal year the work was about 15 per cent completed and was in full progress.

During the year the following progress has been made:

Pumping station.—The station is complete, except for the installation of the electric generator and engines, the tiling and finishing.

Office and laboratory.—The foundations, walls, roof, floors, and partitions are complete.

Regulator houses.—The foundation of No. 7 was built; Nos. 2 and 5 were completed; the superstructures of Nos. 1, 3, and 4 were built, and the foundation and walls of No. 6.

Controller house.—This building was completed, except the plastering and painting.

Shelter house.—The foundation, walls, and roof were completed.

Contract work.—The following work has been done:

The Babcock & Wilcox Company has completed the installation of boilers, mechanical stokers, and economizers.

Henry R. Worthington has completed the installation of main pumps and engines, sand-washing pumps and engines, and steam piping.

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The Builders' Iron Foundry has delivered and installed the registers for the 72-inch and 54-inch meters, and has delivered the remaining register and 29 indicators.

The Coffin Valve Company has completed its contract.

The Virginia Portland Cement Company delivered during the year 120,607.75 barrels of Old Dominion cement. Of this quantity 118,312.50 barrels were accepted.

In January, 1905, schedules of operations for the ensuing season were prepared by the engineer officer in charge and submitted to the contractors. These schedules indicated to each contractor the quantity and location of work to be done during each month from March to October. At the close of the fiscal year all work was up to schedule, except as hereinafter noted.

The Brennan Construction Company has continued work as fast as the ground was available. The progress made by this contractor has equaled that required by the schedule, with a few trifling exceptions.

Cowardin, Bradley, Clay & Co. have completed the embankment under the filters during the year. The remaining embankment consists of filling around and over filters and trimming various slopes. The remaining excavation consists of about 14,900 cubic yards in bed No. 10 and about 7,000 cubic yards in the courts. During the year the progress of the concrete work has been satisfactory and the quality of the concrete has been good. This contractor has fallen behind his schedule in beds Nos. 6, 7, 10, and 11, but has run ahead of the schedule in beds Nos. 25 to 29.

L. E. Smoot has placed during the year 95,008 cubic yards of filter sand and 23,011 cubic yards of gravel. Fifteen beds have been completed, 4 partially completed, and the work is practically up to schedule.

The following estimate of the cost of maintenance and operation of the Washington Aqueduct filtration plant for the fiscal year ending June 30, 1907, is submitted:

1 superintendent	$3,000
1 chief chemist and assistant superintendent	2,100
1 first assistant chemist	1,500
1 second assistant chemist	1,000
1 stenographer and clerk	1,200
2 janitors, at $600 each	1,200
1 chief steam engineer	1,800
1 first assistant steam engineer	1,440
1 second assistant steam engineer	1,080
3 oilers, at $900 each	2,700
3 firemen, at $900 each	2,700
3 coal passers, at $720 each	2,160
1 filter foreman	1,500
1 assistant filter foreman	1,080
3 foremen, at $900 each	2,700
3 watchmen and gauge tenders, at $900 each	2,700
80 laborers, at $1.50 per day, for 300 days	36,000
6 teams with drivers, 300 days, at $2 per day each	3,600
Laboratory and office supplies	1,500
5,600 tons of coal, at $4.25	23,800
Pumping station supplies, oil, waste, repairs, etc	2,400
Filter supplies, tools, hose, repairs, and contingencies	8,000
Total	105,160

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July 1, 1904, balance unexpended		$2,302,129.17
June 30, 1905, amount expended during fiscal year		1,325,445.11
July 1, 1905, balance unexpended		976,684.06
July 1, 1905, outstanding liabilities	$12,761.20	
July 1, 1905, amount covered by uncompleted contracts	558,677.01	
		571,438.21
July 1, 1905, balance available		405,245.85

(See Appendix C C C 2.)

IMPROVEMENT AND CARE OF PUBLIC BUILDINGS AND GROUNDS, AND CARE AND MAINTENANCE OF THE WASHINGTON MONUMENT, IN THE DISTRICT OF COLUMBIA.

Officer in charge, Col. Charles S. Bromwell, U. S. Army.

Considerable miscellaneous painting was done about the Executive Mansion, necessary minor repairs made, and improvements made in some of the plumbing. Three additional greenhouses were built.

At the Washington Monument new hoisting cables and new counterweight cables and a new controller cable installed for the use of the elevator. Two new 80-horsepower boilers purchased and placed in position in the power house. A reception room constructed on the lower floor for the accommodation of visitors waiting for the elevator. A pair of iron folding gates and a revolving door placed at the entrance to the Monument.

Inspections were made every month of the various buildings occupied as offices by the War Department, except the State, War, and Navy Department building, in connection with their preservation, care, and safety.

The care required to maintain them in good condition was extended to the improved parks and park places. Eight of the unimproved reservations were partially improved, and one that had been partially improved was still further improved. Cement coping was constructed around 5 reservations, a total length of 6,255 feet of coping, with 54 corner posts at entrances to walks. Seventeen thousand eight hundred and thirty square yards of sod laid. Two new cement fountain basins constructed. The work of improving the part of Potomac Park lying between the tidal reservoir and the Monument grounds completed by the improvement of the part west and south of the propagating gardens and a small section west of the Seventeenth street roadway, a total area of 23 acres. Six hundred trees and 2,500 shrubs planted. Extensive repairs made to gravel roads and walks. A bridle path staked out in the Smithsonian grounds. Four hundred and forty-nine trees and shrubs planted in the Congressional Library grounds, and a large number of trees, shrubs, vines, and bulbs planted in the Capitol grounds. One hundred and ninety-one park settees repaired and 1,829 painted. Post-and-chain fences erected around four reservations. Eight park lodges and the post-and-chain fences and post-and-bar fences around 59 reservations painted. Five thousand four hundred and fifty-six feet of water pipe and 3,070 feet of drainpipe laid. Three hundred and fifty-seven square yards of asphalt roadway and 2,635 square yards of asphalt foot walks resurfaced. Improvements and betterments made in the line of telegraph that connects the Capitol with the Departments, etc. Six hundred and sixty-seven applications for projections beyond the building line investigated and reported upon.

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At the propagating gardens two additional greenhouse structures, commenced the previous year, completed. Considerable progress was made in improving the addition to the nursery grounds. Over 1,000,000 plants propagated. Additional machinery and electric motors installed in the shops building.

Work for the improvement of "Sherman Plaza," the grounds around the statue of General Sherman, completed.

The working model for the statue of Gen. George B. McClellan approved.

A contract entered into for the erection of the statue of Gen. Hugh Mercer at Fredricksburg, Va., and the full-size clay model of the statue submitted and approved.

The model for the statue of General Pulaski submitted by the artist selected to make it and rejected.

Additional damage was done by ice in February, 1905, to the wharf at Wakefield, Va., the birthplace of Washington.

Attention is invited to the detailed report of the officer in charge and to his estimates and recommendations for the fiscal year ending June 30, 1907.

The estimates are as follows:

For the improvement and care of public buildings and grounds in charge of the Chief of Engineers		$261,775
For compensation of persons employed by office of public buildings and grounds		84,780
Telegraph lines connecting Capitol with Departments: Care and repair of existing lines		1,500
For contingent and incidental expenses of public buildings and grounds		700
For care of Washington Monument and maintenance of elevator:		
Salaries of employees	$8,820	
Fuel, lights, contingencies, etc	3,000	
		11,820
For monument and wharf at Wakefield, Va., the birthplace of Washington:		
Repairs to wharf	$7,000	
Repairs to fences, etc	500	
		7,500
For rebuilding sea wall on Potomac River front between Arsenal wall and N street south		7,500
Total		375,575

(See Appendix D D D.)

NORTHERN AND NORTHWESTERN LAKES—CORRECTING AND ISSUING CHARTS—SURVEYS—WATER LEVELS.

As early as 1816 local surveys of the Great Lakes for special purposes were made by engineer officers, but the "lake survey" as a systematic work was commenced in 1841. It was diligently prosecuted thereafter until 1882, when for a time extended field operations were suspended. The correction, printing, sale, and issue of charts continued without cessation, however, the additions and corrections being largely based upon local surveys and reports by engineer officers in charge of the river and harbor improvements on the lakes.

Systematic field work was resumed in 1889, and has since been prosecuted with increased vigor. In 1898 operations were extended to include cognate work of observing and investigating the levels of the

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Great Lakes and their connecting waters, with a view to their regulation in the interest of commerce. The survey proper has from the beginning been carried on under the War Department, being at first conducted by the Chief of Topographical Engineers, and by the Chief of Engineers after the consolidation of the Topographical Engineers with the Corps of Engineers.

The first regular appropriation for the survey was made in 1841, and annual appropriations followed, with the single exception of 1847. The appropriations to date for all purposes of the survey during the sixty-four years of its existence have aggregated $3,911,879, of which $2,411.81 has reverted to the Treasury.

The following extract from Professional Papers of the Corps of Engineers, United States Army, No. 24, describes the conditions governing the navigation of the Great Lakes in 1841:

1. The lake survey was begun in 1841 under an appropriation of $15,000 made in May of that year. At this time the country bordering on the lower lakes was already pretty well settled, and works for the improvement or formation of harbors had been commenced at most of the important points on Lakes Erie and Ontario. The upper lake region was but thinly settled, and there were no good harbors on Lake Huron and but one (the harbor of Chicago) on Lake Michigan. Settlers were, however, pouring in rapidly, and there was even then a large and constantly increasing commerce between the lake ports, especially from Buffalo to Detroit and Chicago. Communication with Lake Superior could only be had by portage around the Sault Ste. Marie, but the great mineral wealth of the country was attracting attention, and a survey for a ship canal had been made in 1840 by officers of the Topographical Engineers. The lake commerce was carried on under many difficulties, which caused much loss of life and property each year.

There were no charts of the lakes except the admiralty charts, compiled from the surveys of Capt. H. W. Bayfield, of the royal navy (English), and these were not in general use by the masters of American vessels. These charts were the results of rapid reconnaissances, and although they showed the coast lines with an accuracy which is remarkable considering the rough methods of surveying employed, they were of little value as hydrographical charts of the American coast, because they showed the depths of water in comparatively few places and but a small number of the many reefs and shoals which are found along the lake shores.

There were few light-houses and beacons to indicate the positions of dangers to navigation, and, in the absence of charts, pilots were obliged to rely upon their own knowledge, which was frequently only acquired by the vessels grounding on a shoal or striking a hidden rock.

The navigation of the lakes is attended with peculiar dangers, because, while violent gales are frequent and the storms rival those of the ocean itself, a vessel is never more than a few hours' run from the shore and can not, as is generally the case at sea, drift before the wind until the storm is over, but in a long-continued gale must be thrown upon the shore, unless a port or harbor of refuge can be entered. In 1841 a vessel leaving Chicago found no harbor or shelter in storms until the Manitou or Beaver islands were reached, and after passing the Straits of Mackinac it was again exposed without refuge on Lake Huron, except in the vicinity of Presque Isle, until the head of St. Clair River was reached. In sailing from Chicago to Buffalo the greatest difficulties were encountered in the vicinity of the Straits of Mackinac and in the west end of Lake Erie on account of the many islands, shoals, and reefs found in those localities, and at the mouth of the St. Clair River, at which no improvements had been made in 1841, and where the channels were not only circuitous and narrow but so shoal that vessels in low-water seasons frequently were compelled to have their cargoes taken over the bars in lighters.

It was therefore with the double object of furnishing reliable charts to lake vessels and of determining from the surveys the works of improvement which were necessary to the prosperity of the lake commerce that Congress in 1841 directed a survey of the Lakes, and that annual appropriations, with the single exception of the year 1847, have since been made for carrying on the survey.

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Some idea of the magnitude of the work may be had from the following dimensions:

"The American shore line of the Great Lakes and their connecting rivers, if measured in steps of 25 miles, is about 3,000 miles, but if the indentations of the shore and the outlines of the islands be included the developed shore line is about 4,700 miles in length.

"Along rivers and where a lake is narrow it is necessary for navigation that both shores be mapped. This increases the length of the shore line to be surveyed between St. Regis, N. Y., and Duluth, Minn., to about 6,000 miles." [a]

During the first ten years of the survey, while a general geodetic survey of the entire chain of lakes was contemplated for the future, and the actual operations were mainly confined to surveys of special localities where improvements were called for or where the navigation was difficult; and where the surveys were more extended they were little more than reconnaissances. This course was made necessary because the appropriations were inadequate to the purchase of the finer instruments and the support of the larger force necessary for more extensive and more exact surveys, and also because of the pressing need of improvements at particular localities, for which preliminary surveys were essential.

The execution of the survey involved a great quantity of astronomic, topographic, and hydrographic work, all of which was performed with a high degree of skill and accuracy. The result was the completion of a series of reliable charts for lake vessels and the furnishing of a basis for works of channel improvement upon the Lakes themselves and their connecting waters.

The original series consisted of 76 charts, all of which were printed from copperplates. As a result of revisions, additions, and cancellations there are now in force 104 lake-survey charts, of which 31 are printed in black from copperplates; 33 are lithographs in colors from copperplate transfers; 37 are lithographs in colors, and 3 are photolithographs in colors.

The charts issued in colors have all depths of 18 feet and less in blue, showing at a glance where vessels may proceed with safety, and are considered by vesselmen much preferable to the old style printed in plain black and white. This new series of colored charts is believed to constitute a distinct advance in chart construction and printing and meets with high favor from navigators and others.

From 1882 to June 30, 1905, a total sum of $22,837.06 was derived from the sale of charts by the Detroit office and deposited in the United States Treasury.

Up to February 20, 1890, one full set of charts was issued free to each United States registered vessel. Any additional charts furnished such vessels and all furnished for other unofficial use were sold at the uniform price of 30 cents each. On the date above mentioned the free issue, except for official purposes of the Government, was discontinued pursuant to law, and since then the charts have been sold for all private and unofficial use at prices ranging from 5 cents to 30 cents each, the price being intended in each instance to cover only the cost of paper and printing.

During the year the main work of the survey was conducted until June 15, 1905, by Maj. Walter L. Fisk, Corps of Engineers, in charge of the principal office of the survey at Detroit, Mich., and after June 15 by Maj. Lansing H. Beach, Corps of Engineers. Nearly the whole work of conducting surveys and water-level observations,

[a] From memoranda respecting the lake survey, by Gen. C. B. Comstock, published in the Report of the Chief of Engineers for 1875.

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reducing the results thereof, and of correcting and issuing charts was devolved upon that office. The district engineer officers rendered important aid by making local surveys and by regularly supplying valuable information for correcting the charts, bulletins, and supplements to the latter. These district officers are located at Duluth, Minn., Milwaukee, Wis., Chicago, Ill., Grand Rapids, Mich., Detroit, Mich., Cleveland, Ohio, and Buffalo, N. Y., with suboffices at Sault Ste. Marie, Mich., and Oswego, N. Y.

Charts may be purchased at the main office at Detroit, at the canal office at Sault Ste. Marie, Mich., and at the United States engineer office in Buffalo, N. Y. Complete sample sets may be seen at the United States engineer offices at Duluth, Minn., Milwaukee, Wis., Chicago, Ill., Grand Rapids, Mich., Cleveland, Ohio, and Oswego, N. Y., enabling purchasers to select exactly the charts they wish to order.

During the fiscal year ending June 30, 1905, the number of charts sold by the Detroit office was 9,780, and by the Buffalo office 2,044, the aggregate sales, 11,824, being 1,160 more than in 1904. The proceeds of the sales amounted to $1,939.54, and were deposited to the credit of the Treasurer of the United States. The Detroit office issued 2,685 charts for official use and the Buffalo office 70, a total of 2,755. To date more than 300,000 of these charts have been sold and issued for actual service.

During the year the Detroit office has revised, transferred to stone, and printed editions in colors from 14 copperplate charts, engraved on stone and issued in colors 8 entirely new charts of the regular series, revised and printed second editions of 2 charts previously engraved on stone. For supplements to Bulletin No. 14 and for Bulletin No. 15 two insets were engraved on stone and 6 others prepared in other ways. In addition to the above, the engraving of 5 new charts of the regular series is well advanced.

Of the entire series of charts there had been issued in colors 5 on July 1, 1900; 12 on July 1, 1901; 30 on July 1, 1902; 49 on July 1, 1903; 59 on July 1, 1904, and 73 on July 1, 1905.

There are now six parties in the field, as follows:

One engaged on resurvey of west end of Lake Erie; one on resurvey of Green Bay and the passages leading into it from Lake Michigan; one on resurvey of northern Lake Michigan and the Straits of Mackinac, and also to be engaged later on surveys of the shores of Keweenaw Point, Lake Superior; one extending primary triangulation southward along the western shore of Lake Huron; one on triangulation among Les Cheneaux Islands, and one making local surveys for new harbor charts and correction of those already issued.

Several local surveys and examinations were made to provide data for projecting new charts and correcting old ones.

The extensive revision of the charts now under way has for its object to show to date the changes which have taken place in formerly existing conditions as charted, due to natural and artificial agencies, in order better to serve the deeper-draft vessels now engaged in lake commerce. Many of the original charts were prepared having in view a navigation calling for a draft not exceeding 12 feet. The soundings were referred to planes representing mean or average stages of water, and general depths exceeding 18 feet below such

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planes were not closely developed. Present requirements of commerce demand, however, that the bottom be accurately charted to depths of not less than 30 feet in the open lakes and of 25 feet in their connecting rivers or straits, and these depths should relate to "low-water" stages instead of to the "mean stages" above mentioned. This calls for extensive surveys and a vast amount of office work, all of which must be done with great care and accuracy, and the work is now being prosecuted with a large force. To secure a satisfactory rate of progress will require an expenditure of at least $115,000 during the year ending June 30, 1907.

In addition to work relating to charts, the Detroit office continued operations during the year under the project adopted in 1898 for an exhaustive investigation of lake levels, as described in the Annual Report of the Chief of Engineers for that year, pages 3774–3776. The principal field work of the year comprised a series of winter discharge measurements of St. Marys River, taken through the ice at Sault Ste. Marie, Mich., lake temperature observations, and the maintenance of 15 self-registering water gauges on the several lakes from Ontario to Superior and Michigan, which supply an accurate and continuous record of the most minute changes in the elevation of the water surface. In Appendix E E E of this report will be found a table giving the discharges of all the Great Lakes at the mean stage of each for the past forty-five years, as determined from the monthly means shown on the plate in the same appendix. This work is now fully organized and it is highly important that it be pushed to completion as rapidly as possible. For this purpose the sum of $10,000 should be made available for expenditure during the fiscal year ending June 30, 1907.

It is therefore recommended that the appropriation for that year be made to include the two amounts indicated above, and that it be formulated as in the act of March 3, 1905, as follows:

Estimate for the fiscal year ending June 30, 1907.

For survey of northern and northwestern lakes, including all necessary expenses for preparing, correcting, extending, printing, and issuing charts and bulletins, and of investigating lake levels with a view to their regulation, to be immediately available and to remain available until expended $125,000.00

SURVEYS, ADDITIONS TO, AND CORRECTING ENGRAVED PLATES.

July 1, 1904, balance unexpended		$205,597.91
November 1, 1904, proceeds from sale of property, office of the Chief of Engineers	$105.00	
Amount appropriated by sundry civil act of March 3, 1905	100,000.00	
		100,105.00
		305,702.91
June 30, 1905, amount expended during fiscal year		121,106.56
July 1, 1905, balance unexpended		184,596.35

Bulletins.—The preparation and issue of the series of bulletins, supplementary to the charts, commenced in 1889, relating to the river and harbor improvements and navigation of the Great Lakes, was formerly done by this office, but was transferred to the Detroit office

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in 1902. Of Bulletin No. 15, the last issued there, over 2,100 copies have already been distributed to the marine interests, and requests for it are constantly being received. These bulletins are issued annually with monthly supplements through the season of navigation, and give the latest and fullest descriptions of the progress in works of river and harbor improvements intended to benefit the navigation of the Great Lakes and their connecting waters, and the results of surveys in those waters made under the direction of the Detroit office of the lake survey and the district engineer officers. Small maps showing locations of new shoals, changes in important channels, harbors not otherwise charted, etc., are inserted in both bulletins and supplements as occasion arises.

Annual water levels of the Northern and Northwestern Lakes.—A table showing the monthly water levels from July 1, 1904, to June 30, 1905, at Marquette, Mich., on Lake Superior; Milwaukee, Wis., on Lake Michigan; Sand Beach, Mich., on Lake Huron; Cleveland, Ohio, on Lake Erie, and Charlotte N. Y., on Lake Ontario, will be found in Appendix E E E.

Survey of reef in Lake Superior.—An allotment of $200 from the indefinite appropriation for "Survey of Northern and Northwestern Lakes" was made in May, 1904, for locating the reef on which the steamer *J. T. Hutchinson* stranded in December, 1903. (See Report of the Chief of Engineers for 1904, p. 2782). The survey was made under the direction of Maj. Charles L. Potter, Corps of Engineers, in July, 1904, by Mr. G. A. Marr, assistant engineer, superintendent Portage Lake canals. The tug *George Rogers* was hired for the purpose. The shoal was found to be 5½ miles west of Eagle River and 2,600 feet from shore. A least depth of 14 feet was found, low-water datum. The results were mapped and forwarded to the United States lake-survey office. The entire allotment of $200 was expended on said survey and mapping.

IMPROVEMENT OF THE YELLOWSTONE NATIONAL PARK, INCLUDING THE CONSTRUCTION, REPAIR, AND MAINTENANCE OF ROADS AND BRIDGES.

Officer in charge, Maj. Hiram M. Chittenden, Corps of Engineers.

The work has been in the charge of the Engineer Department since 1883, except during the period from August, 1894, to March, 1899.

The present project, adopted August 27, 1900, modified by authority of the Secretary of War, dated July 22, 1901, and further modified by authority of the Chief of Engineers, dated May 29, 1902, embraces the following work:

(*a*) Belt line, or main circuit, which includes all the important centers of interest in the park, viz, Mammoth Hot Springs, Norris Geyser Basin, the Firehole Geyser Basins, the Yellowstone Lake, the canyon and falls of the Yellowstone, and the section near Tower Falls.

(*b*) Four approaches leading from the boundary of the park to different points on the belt line.

(*c*) Side roads to isolated objects of interest, as well as bridle trails for use by exploring parties and by troops and scouts in patrolling the park.

(*d*) The macadamization or thorough surfacing with best material available of the belt line.

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(*e*) The provision of a sprinkling plant to keep down the dust on the main system.

(*f*) Extensive improvement at Mammoth Hot Springs, to be carried out in cooperation with the Quartermaster's Department.

By the terms of the sundry civil act of June 28, 1902, Congress adopted the approved project for the work and made provision for its completion, including also annual maintenance and repairs, at the rate of $250,000 per year for three years.

The sundry civil act of March 3, 1905, appropriated an additional sum of $133,000, of which $50,000 was for annual maintenance and repairs.

The essential features of the project upon which the appropriation was based will have been carried out by the close of the season.

The estimated total mileage of the completed system is about 294 miles in the park proper, and 351 miles including the roads in the forest reserve.

On the project for the general road system there has been expended to June 30, 1905, the sum of $1,506,563.11, including annual maintenance and repairs, and this sum will be increased to about $1,635,000 by the end of the present season. It is estimated that not less than $200,000 of this amount was expended in early work, which has since been replaced by other work, and does not therefore form a part of the completed system. Annual maintenance and repairs have cost upwards of $310,000, leaving about $1,125,000 that has gone into permanent work. The result of this expenditure has been about 350 miles of road now open to travel. The number of bridges of all sizes built is about 125.

The work done under the appropriation of April 28, 1904, and which will be completed before the close of the present season under the appropriation of March 3, 1905, is as follows:

The erection of a five-span steel arch bridge over the Middle Gardiner River near Mammoth Hot Springs, being the largest bridge in the park.

The erection of a steel truss bridge over Nez Perce Creek near the Fountain Hotel, and of another over the Firehole River above Excelsior Geyser.

The erection of a steel arch bridge over Tower Creek near the falls, and of four wooden bridges over Trout and Antelope creeks in Hayden Valley and over the Big and Little Blacktail creeks on the road between Mammoth Hot Springs and Tower Falls.

The reconstruction of wooden bridges over Gibbon River near Norris, the Firehole River, on the old freight road near the Fountain Hotel, and over the same stream above the Upper Geyser Basin.

The erection of a large wooden bridge over the Lamar River on the road to Cooke City, and also one over Grinnell Creek on the East road.

The erection of a curved viaduct on the road east of Sylvan Pass for the purpose of carrying the road over itself and by means of a loop diminishing the gradient to the adopted limit.

Extensive resurfacing and reconstruction of the roads on the main circuit from near Apollinaris Spring to Norris and thence to the

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lower end of Gibbon Canyon, and from the Fountain Hotel to the Upper Geyser Basin, and thence to the Continental Divide; also considerable work of a similar character on the road along the Yellowstone River between the lake and Grand Canyon.

The completion of the road between the Thumb and Lake by way of Natural Bridge.

Extensive reconstruction and resurfacing of the road between Norris and the Grand Canyon, including the cutting down of several of the hills and the complete realignment down the long hill next to the Grand Canyon.

The opening and completion of the road across Mount Washburn, including both the low line through Dunraven Pass and the high line passing over the summit. On the low line there still remains about half a mile where further widening will be required.

The opening up of the entire line of road between Tower Falls and Mammoth Hot Springs, including the reconstruction and enlargement of the road from Crescent Hill Canyon to Tower Falls.

A general reconstruction of the Cooke City road from the Lamar River crossing to Soda Butte.

The extensive enlargement of the road from the Canyon Hotel to Inspiration Point near the latter point and the completion of a new road from the new concrete-steel bridge over the Yellowstone to Artist Point on the right bank of the Grand Canyon.

A considerable amount of improvement work on the western approach, including widening of the road, resurfacing, and other work.

Extensive widening and enlargement of the East road from Sylvan Pass to the Shoshone River.

General repairs and maintenance of the entire system.

The extension of the sprinkling system to include 100 miles of roadway.

The erection of three station houses and 11 officers' quarters at the station houses for the superintendent.

Considerable work in the improving of the bridle trails for the use of the superintendent in patrolling the park.

Many other minor items of work pertaining to the improvement of the entire system.

As the improvement work authorized by sundry civil act of June 28, 1902, and sundry civil act of March 3, 1905, will be completed by the close of this season, the estimate submitted herewith is for maintenance only. In this connection, however, attention is invited to the report of the district officer, Major Chittenden, in which he outlines certain additional work which, in his judgment, will soon be necessary to adequately provide for the constant and rapidly increasing travel through the park.

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July 1, 1904, balance unexpended	$234,124.11
Amount received from Department of Agriculture for work done for Weather Bureau	523.15
Amount appropriated by sundry civil act approved March 3, 1905	133,000.00
	367,647.26
June 30, 1905, amount expended during fiscal year	232,085.85
July 1, 1905, balance unexpended	135,561.41
July 1, 1905, outstanding liabilities	28,602.62
July 1, 1905, balance available	106,958.79
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance and repairs, in addition to the balance unexpended July 1, 1905	75,000.00

(See Appendix F F F.)

MAPS, WAR DEPARTMENT.

The following maps have been published during the fiscal year:

Map of the Department of the Colorado.

Atlas of the Battlefield of Antietam, prepared under the direction of the Antietam Battlefield Board.

Two harbor charts for the use of the coast artillery.

Existing regulations require the commanding officer of each post where there are fixed batteries bearing upon a channel to call upon the Engineer Department for accurate charts showing the soundings to the extent of the ranges of the guns. A number of these charts will be required during the fiscal year 1907. It is urgently recommended that $5,000 be appropriated for the purpose, and an estimate of that amount is submitted.

NEW BUILDING FOR GOVERNMENT PRINTING OFFICE, AND REPAIRS AND RENT OF THE GOVERNMENT PRINTING OFFICE.

Officer in charge, Capt. John S. Sewell, Corps of Engineers; assistant, Lieut. Edward M. Markham, Corps of Engineers.

1. New building for the Government Printing Office.—The work is now complete in all particulars except for the delivery of one steam pump, which is under contract.

The balance of the appropriation has been deposited in the Treasury, and, it is understood, will be carried into the surplus fund. While the balance turned in is nearly $20,000, there is a liability for a verdict in favor of the Phœnix Iron Company for nearly $15,000, so that the amount really saved in the construction of the building is in the neighborhood of $5,000.

Amount appropriated by act of March 3, 1899	$350,000.00
Amount appropriated by act of June 6, 1900	775,000.00
Amount appropriated by act of March 3, 1901	1,304,000.00
	2,429,000.00
June 30, 1905, amount expended to date	2,409,126.67
July 1, 1905, balance unexpended	19,873.33
July 1, 1905, outstanding liabilities	710.00
July 1, 1905, balance of appropriation deposited in Treasury of United States	19,163.33

(See Appendix G G G 1.)

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2. Repairs and rent of the Government Printing Office.—During the fiscal year the following miscellaneous repairs have been attended to: New grilles on the first-story windows in lieu of the old and badly decayed wooden shutters; reconstruction of guttering and downspouts on parts of the old building not covered with new roof and provided with new gutter during the fiscal year.

The balance of the appropriation has been turned into the Treasury, and it is understood will be carried to the surplus fund, so that no further operations under this appropriation are contemplated.

Amount appropriated by act of August 18, 1894	$75,000.00
June 30, 1905, amount expended to date	62,527.69
July 1, 1905, balance deposited in Treasury United States	12,472.31

(See Appendix G G G 2.)

BUILDINGS, ARMY WAR COLLEGE, WASHINGTON, D. C., AND ENGINEER SCHOOL, WASHINGTON, D. C.

Officer in charge, Capt. John S. Sewell, Corps of Engineers; assistant, Lieut. Edward M. Markham, Corps of Engineers.

BUILDINGS, ARMY WAR COLLEGE.

The terrace of the War College building has been about 80 per cent completed. The building itself is almost up to the level of the second floor. It is expected that it will be entirely completed and ready for occupancy in the late spring of 1906.

Amount appropriated by act of June 30, 1902		$400,000.00
Amount appropriated by act of April 23, 1904		300,000.00
		700,000.00
June 30, 1905, amount expended to date		234,130.43
July 1, 1905, balance unexpended		465,869.57
July 1, 1905, outstanding liabilities	$9,455.08	
July 1, 1905, covered by existing contracts	216,036.20	
		225,491.28
July 1, 1905, balance available		240,378.29

BUILDINGS, ENGINEER SCHOOL.

During the fiscal year the following buildings at the Engineer School have been completed and occupied: Thirteen sets of officers' quarters, the officers' mess, 1 barrack building for two companies, 1 band barrack, 2 mess-hall buildings, 1 quartermaster and commissary storehouse, 1 new stable, and 1 new wagon shed.

Construction has been in progress on the following buildings: So much of a second two-company barrack building as is not interfered with by the Army General Hospital, six sets of noncommissioned officers' quarters, an engineer storehouse, a quartermaster workshop, a post bakery, foundations for bachelor officers' quarters, and two additional sets of officers' quarters. The two sets of officers' quarters are so far advanced as to be covered in, and will be entirely completed by fall. The quartermaster workshop and the post bakery are almost completed, and will be ready for occupancy probably by Sep-

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tember 1, 1905. The same is true of the portion of the second two-company barrack building under construction. The engineer storehouse has been carried to a point above the first-story level; the brickwork for four sets of noncommissioned officers' quarters has been brought to the point where it is to receive the first-story joists. Brickwork on the other two sets of noncommissioned officers' quarters is up to the finished ground level, but has not been carried any higher. Foundations for the bachelor officers' quarters have been completed, but nothing else has been done on the superstructure because of unusual and abnormal conditions which have arisen, and which throw some doubt upon the stability of the foundation. It is probable that it will not be safe to complete the erection of this building until either James Creek Canal is filled up or an adequate and suitable sea wall is built along that part of it near the site of the bachelor officers' quarters.

The original arrangement of buildings at Washington Barracks made only about 60 per cent of the reservation available for any purpose. When plans for reconstruction were adopted they were laid out so that ultimately the entire reservation will be available. The entire completion of the plan would involve the elimination of all old buildings, and this would lead to the erection of more new buildings than have been included in any estimate of cost. None of the old buildings will fit into the new plan either as to location or design; most of them are in an advanced state of deterioration, and could not be counted upon for much further useful service in any event. Ultimate economy has therefore demanded the adoption of a plan of reconstruction which can not be finished at the present time, but which will leave the future development of the post free from embarrassing conditions which have resulted from the way in which the old buildings were located.

Amount appropriated by act of June 30, 1902		$500,000.00
Amount appropriated by act of March 2, 1903		360,000.00
Amount appropriated by act of March 2, 1905		150,000.00
		1,010,000.00
June 30, 1905, amount expended to date		879,316.42
July 1, 1905, balance unexpended		130,683.58
July 1, 1905, outstanding liabilities	$6,876.20	
July 1, 1905, covered by existing contracts	36,785.82	
		43,662.02
July 1, 1905, balance available		87,021.56

(See Appendix H H H.)

ERECTION OF THE STATUE OF FREDERICK THE GREAT AT THE ARMY WAR COLLEGE.

Officer in charge, Capt John S. Sewell, Corps of Engineers; assistant, Lieut. Edward M. Markham, Corps of Engineers.

The work was authorized by the sundry civil act approved April 28, 1904.

* * * * * * *

To defray the expenses incident to the erection and dedication, upon War College grounds, Washington Barracks, of the statue of Frederick the Great, the gift to the United States of His Imperial Majesty the Emperor of Germany, to be immediately available, eight thousand dollars.

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The pedestal was purchased and placed in position, the statue placed thereon, and the unveiling ceremonies occurred on November 19, 1904.

The pedestal stands on the line of front steps leading up to the terrace in front of the War College. It occupies one of six granite bases provided for similar purposes.

All the work in connection with the statue proper has been completed, except that an inscription stating the date of dedication remains to be placed on the south side of the base of the pedestal. When this work is completed, as it will be in the near future, the balance of the appropriation will be turned into the Treasury.

Amount appropriated by act of April 28, 1904	$8,000.00
June 30, 1905, amount expended to date	7,166.74
July 1, 1905, balance unexpended	833.26
July 1, 1905, outstanding liabilities	250.00
July 1, 1905, balance available	583.26

(See Appendix I I I.)

ERECTION OF MONUMENTS TO GENERALS FRANCIS NASH AND WILLIAM LEE DAVIDSON, OF NORTH CAROLINA.

This work was in the charge of Capt. R. P. Johnston, Corps of Engineers, until May 5, 1905, and in the temporary charge of Capt. E. Eveleth Winslow, Corps of Engineers, from May 5 until June 30, 1905, when Captain Johnston resumed charge.

By resolutions dated November 4, 1777, and September 20, 1781, the Continental Congress requested the governor of North Carolina to erect monuments at the expense of the United States to the memory of Gens. Francis Nash and William Lee Davidson, of North Carolina. To carry those resolutions into effect Congress, by joint resolution approved January 30, 1903, appropriated $5,000 for each monument, the funds to be disbursed under the direction of the Secretary of War.

The duty of erecting these memorials has been assigned to the local engineer officer at Wilmington, N. C. Sites have been selected, construction carried on, and at the close of the fiscal year the monument to Gen. William Lee Davidson had been completed and that to Gen. Francis Nash was nearing completion.

MONUMENT TO GENERAL NASH.

July 1, 1904, balance unexpended	$4,951.04
June 30, 1905, amount expended during fiscal year, for works of improvement	432.55
July 1, 1905, balance unexpended	4,518.49
July 1, 1905, outstanding liabilities	58.25
July 1, 1905, balance available	4,460.24
July 1, 1905, amount covered by uncompleted contracts	4,375.00

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MONUMENT TO GENERAL DAVIDSON.

July 1, 1904, balance unexpended	$4,951.03
June 30, 1905, amount expended during fiscal year, for works of improvement	432.53
July 1, 1905, balance unexpended	4,518.50
July 1, 1905, outstanding liabilities	58.25
July 1, 1905, balance available	4,460.25
July 1, 1905, amount covered by uncompleted contracts	4,375.00

(See Appendix J J J.)

ROAD INTO MOUNT RAINIER NATIONAL PARK; SURVEY FOR WAGON ROAD FROM VALDES TO FORT EGBERT, ALASKA, AND SURVEY FOR MILITARY TRAIL BETWEEN YUKON RIVER AND COLDFOOT, ALASKA.

Officer in charge, Maj. John Millis, Corps of Engineers.

ROAD INTO MOUNT RAINIER NATIONAL PARK.

The sundry civil act of April 28, 1904, provided as follows:

For continuing the construction of the wagon road into said park heretofore surveyed and commenced under the direction of the Secretary of War, thirty thousand dollars, of which sum six thousand dollars, or so much thereof as may be necessary, shall be used by the Secretary of War in surveying and estimating the cost of a wagon road along the most practicable route from the eastern boundary of the Mount Rainier Forest Reserve into said park.

The survey for the road into the park from the eastward was completed in October, 1904, and report and estimates were submitted on January 16, 1905. The estimated cost of the proposed road was $275,600.

The report of the survey was printed as House Document No. 283, Fifty-eighth Congress, third session.

Contract was made after due advertisement for the road construction into the park from the westward. Work began in August, 1904, and was continued as long as the weather permitted. About a mile of clearing, grading, and grubbing was done, extending from Longmire Springs toward Paradise Park. Work was not resumed in the spring, owing to financial difficulties of the contractor. The contract time expired June 30, 1905, but the time was extended for a reasonable period.

Estimate for fiscal year ending June 30, 1907.

Continuing the construction of the wagon road into Mount Rainier National Park heretofore surveyed and commenced under the direction of the Secretary of War, to be immediately available	$70,000.00
July 1, 1904, balance unexpended	34,884.31
June 30, 1905, amount expended during fiscal year	13,704.70
July 1, 1905, balance unexpended	21,179.61
July 1, 1905, outstanding liabilities	21,179.61

(See Appendix K K K 1.)

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SURVEY FOR WAGON ROAD FROM VALDES TO FORT EGBERT, ALASKA, 1904 AND 1905, AND SURVEY FOR MILITARY TRAIL BETWEEN YUKON RIVER AND COLDFOOT, ALASKA, 1904 AND 1905.

Surveys for the above road and trail were provided for in the army appropriation act of April 23, 1904, and the duty of making the surveys was assigned to Maj. John Millis, Corps of Engineers, U. S. Army.

At the beginning of the year the work on both surveys was in progress.

The survey from Yukon River to Coldfoot, Alaska, was completed and party returned to Seattle on August 31, 1904.

The survey from Valdes to Fort Egbert, Alaska, was completed on August 14, 1904, and the parties returned to Seattle on September 29, 1904.

Preliminary reports on the surveys were submitted on December 15, 1904, and were published in House Document No. 192, Fifty-eighth Congress, third session.

VALDES-FORT EGBERT SURVEY.

July 1, 1904, balance unexpended	$19,931.65
Amount appropriated by sundry civil act approved March 3, 1905	5,700.63
Received by transfer	260.00
	25,892.28
June 30, 1905, amount expended during fiscal year	24,615.10
July 1, 1905, balance unexpended	1,277.18
July 1, 1905, outstanding indebtedness	1,200.00
July 1, 1905, balance available	77.18

YUKON-COLDFOOT SURVEY.

July 1, 1904, balance unexpended	$2,365.55
Amount appropriated by sundry civil act approved March 3, 1905	1,431.15
	3,796.70
June 30, 1905, amount expended during fiscal year	3,790.22
July 1, 1905, balance unexpended	6.48

(See Appendix K K K 2.)

OFFICE OF THE CHIEF OF ENGINEERS.

During the fiscal year ending June 30, 1905, the following-named officers were on duty in this office as assistants:

Maj. Frederic V. Abbot.
Maj. Harry F. Hodges.
Capt. Charles W. Kutz.

Very respectfully,

FREDERIC V. ABBOT,
Acting Chief of Engineers.

Hon. WILLIAM H. TAFT,
Secretary of War.

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APPENDIXES

TO THE

REPORT OF THE CHIEF OF ENGINEERS,

UNITED STATES ARMY.

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APPENDIXES

TO THE

REPORT OF THE CHIEF OF ENGINEERS,

UNITED STATES ARMY.

FORTIFICATIONS, ETC.

APPENDIX No. 1.

REPORT OF THE BOARD OF ENGINEERS.

THE BOARD OF ENGINEERS, ARMY BUILDING,
New York City, July 14, 1905.

GENERAL: I have the honor to submit the annual report recounting the operations of The Board of Engineers for the year ending June 30, 1905.

The following changes have taken place in the personnel of the Board since the date of the last annual report:

On June 11, 1904, Capt. W. J. Barnette, U. S. Navy, was detached from duty as a member of The Board of Engineers in connection with the defense of coal depots, and Capt. Royal R. Ingersoll, U. S. Navy, was detailed in his stead.

By paragraph 11, Special Orders, No. 262, War Department, November 7, 1904, Capt. Richard Wainwright, U. S. Navy, was assigned to duty as a member of The Board of Engineers in connection with the defense of coal depots, vice Capt. Royal R. Ingersoll, U. S. Navy, relieved.

By Department letter dated January 28, 1905, Col. W. R. Livermore, Corps of Engineers, was directed to temporarily relieve Capt. Edward H. Schulz, Corps of Engineers, of his duties as disbursing officer of The Board of Engineers.

By paragraph 3, Special Orders, No. 119, War Department, May 23, 1905, Capt. Edward H. Schulz, Corps of Engineers, was relieved from duty as recorder of The Board of Engineers.

As at present constituted, The Board of Engineers is composed of Col. Chas. R. Suter, Corps of Engineers, president; Col. Amos Stickney, Corps of Engineers; Capt. Richard Wainwright, U. S. Navy,

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during consideration of defense of coal depots only; Col. W. R. Livermore, Corps of Engineers, disbursing officer; Lieut. Col. Arthur Murray, Artillery Corps; Maj. Rogers Birnie, Ordnance Department.

The following division engineers are members of The Board of Engineers when matters pertaining to defensive works in their respective divisions are under consideration by the Board: Col. Garrett J. Lydecker, Corps of Engineers, Central Division; Col. William H. Heuer, Corps of Engineers, Northern Pacific Division; Col. Thomas H. Handbury, Corps of Engineers, Pacific Division; Lieut. Col. James B. Quinn, Corps of Engineers, Southeast Division; Lieut. Col. Clinton B. Sears, Corps of Engineers, Gulf Division.

The Board has considered the various subjects referred to it during the past fiscal year by the Chief of Engineers.

* * * * * * *

For the Board:

Very respectfully, your obedient servant,

CHAS. R. SUTER,
Colonel, Corps of Engineers,
President of the Board.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

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APPENDIX No. 2.

ENGINEER DEPOT, WASHINGTON BARRACKS.

REPORT OF MAJ. EDWARD BURR, CORPS OF ENGINEERS, FOR THE FISCAL YEAR ENDING JUNE 30, 1905.

ENGINEER SCHOOL, U. S. ARMY,
WASHINGTON BARRACKS,
Washington, D. C., September 8, 1905.

GENERAL: I have the honor to forward herewith the annual report on * * * the Engineer Depot, Washington Barracks, D. C., for the fiscal year ending June 30, 1905.

Very respectfully, your obedient servant,

EDW. BURR,
Major, Corps of Engineers,
Commanding.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

ENGINEER DEPOT, WASHINGTON BARRACKS, DISTRICT OF COLUMBIA.

1. DEPOT PROPERTY, PUBLIC BUILDINGS, BOATS, CONSTRUCTIONS, ETC.

The large accumulation of engineer property, consisting of ponton and bridge equipage; materials for bridge and ponton trains; intrenching tools and materials; materials for engineer and field service; astronomical, surveying, drawing, and electrical instruments; engineer models; photographic apparatus and supplies; materials for current repairs to buildings, boats, and machinery, has been properly cared for by civilian employees under the superintendence of a civilian storekeeper.

A portion of the property pertaining to the Washington Barracks Depot was transferred to this station from the former Willets Point, N. Y., Depot in September, 1901, on removal of the school and battalion of engineers; and on the suspension of the depots at Willets

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Point, N. Y., and New York, N. Y., 1903 and 1904, all the accumulation of property was sent to this depot. By subsequent purchases and by the receipt of property from various sources the supply on hand at the close of the present fiscal year is greater than it was in any year previous.

The storage facilities at this depot have not improved since the last report, but are, on the contrary, less than a year ago. A large brick building at the south end of the post, formerly used as a stable and subsequently for the storage of depot property, was demolished in connection with the work of construction of the War College building, and the large supply of heavy and bulky property stored therein had to be provided for elsewhere. As far as practicable all perishable property is protected from the weather, but not all of it is entirely secured from fire, dampness, and theft. All proper precautions have been taken during the year to guard against these evils. The new engineer depot storehouse, now under construction in connection with the reconstruction of Washington Barracks, D. C., will probably be completed by the end of December, 1905, and will furnish ample accommodations for storing and caring for all engineer property now in the depot.

All depot property is stored in temporary buildings situated on the Washington Barracks, D. C., reservation. The principal depot storehouse is an old stable building on the east side of the reservation, about 150 feet long by about 35 feet wide, and one story high. Other storage room was provided in the basement of one of the old company quarters, at which place the property is kept comparatively dry and secure. Additional storage room was made by the construction of temporary sheds. All large instruments are stored in a small brick building near the south end of the post, and small instruments and reconnaissance materials, including field photographic supplies, are stored in a small room on the top floor of the Academic building. All instruments, large and small, in their present locations are kept perfectly dry and practically fully secured against fire, but their locations are very inconvenient, due to their distances from the main depot office and principal storehouse. All the ponton and bridge equipments, such as wagons, pontons, lumber, and timber, were stored in the open during the entire year. During the inclement weather, in the winter, protection for this property was provided so far as the depot facilities would permit.

During the fiscal year no new constructions or additions to the existing depot buildings have been made. The construction of depot storehouse is under the supervision of the officer having charge of the reconstruction of Washington Barracks, D. C. At the close of the fiscal year the commissary and quartermaster offices and storerooms were transferred from the building heretofore occupied by them to their new building, and the old building thus vacated will be used for engineer school and depot purposes pending the completion of new buildings. The preparation of this building for the accommodation of depot and school shops and for temporary storage of property is now in hand.

Numerous repairs to depot and school buildings, instruction rooms, boats, and machinery have been made from time to time during the year.

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The construction of various parts of the ponton and bridge equipage was continued during the year in the depot carpenter shop. Considerable repairs were made to wagons pertaining to the ponton equipage prior to their departure to Manassas, Va., for use in connection with the army maneuvers in September, 1904. A detailed statement of what has been accomplished during the year in the line of ponton and bridge equipage will be found under the head of "Engineer Equipment of Troops" in this report.

In connection with the depot work a 10-ton wagon scale was bought at the close of the year, but foundations for the same have not been built. It is proposed to place it near the new engineer depot storehouse, now under construction.

2. Work of the Depot.

The usual routine care of property and buildings has continued, the incidental labor having been performed by civilian employees and, when practicable, by enlisted men of the engineer battalion detailed on extra duty for this purpose.

The general work of the depot, as in former years, included the care of all depot buildings and of all the depot property, such as tools, implements, machinery, ponton and bridge equipage, all the various surveying, astronomical, and electrical instruments, electrical appliances and machinery, reconnaissance instruments and materials, drawing and photographic supplies, intrenching tools, models, and miscellaneous stores and supplies held here for filling requisitions for use of engineer troops and other military organizations, and general supplies needed for current repairs, current use in depot shops, and for instruction purposes.

Since the beginning of the fiscal year the work of the depot has considerably increased on account of the subdepot in New York, N. Y., being abolished at the end of last fiscal year, and all the duties up to that date performed by the officer in charge at New York City were assumed here on July 1, 1904. All property that was held at the subdepot was transferred to Washington Barracks, D. C., together with all the records pertaining to that office. Although considerable additional work was added by the transfer of the subdepot from New York City to this place, all the work has been carried on without increase in the force of civilian or other employees. Requisitions for instruments and other supplies were filled promptly and carefully under the methods inaugurated in the preceding fiscal year.

Before actual operations commenced at the army maneuvers near Manassas, Va., large lots of intrenching tools and other materials were shipped to the various maneuver camps for use of engineer troops and other military organizations. Rush shipments were made daily until the actual commencement of the maneuvers. On termination of the maneuvers all property issued from the depot was returned, cleaned, and placed in storage.

Much attention was given to fully and completely fit out the companies of the Second Battalion of Engineers before their departure for the maneuver camps. Each company was furnished with the necessary field chests, made in the depot carpenter shop, for packing and transporting the company outfits, and similar chests were constructed for the outfit for battalion headquarters.

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The depot work was under the immediate supervision of the officer in charge of the Engineer Depot. Civilian clerks and one civilian storekeeper, with a limited number of mechanics and laborers, attended to the routine duty of the depot. The expense during the entire year for all labor, including clerical services, was $3,774.26. This amount includes all labor connected with the purchase, examination, caring for, and issuing surveying instruments.

Purchases under proposals and in open market were continued during the year under the allotments made by the Chief of Engineers, U. S. Army, for incidental expenses of depot and for purchase and repair of instruments. These purchases included the supplies in current use in the depot, such as miscellaneous hardware and tools, manila rope, lumber and timber, paints and oils, bar iron, canvas, stationery, and office supplies. A considerable quantity of lumber was bought during the year for the protection of property and for packing boxes.

The very limited and unsatisfactory storage facilities necessitate much and continuous attention to property stored under temporary shelter and in the open air, to guard against dampness and moisture. This property was overhauled from time to time, taken out in the dry air, cleaned, and oiled where necessary. Likewise the property stored in the basement of one of the old company quarters, composed largely of tools and hardware, was overhauled on various occasions, cleaned, and oiled.

3. Depot Instruments.

By the transfer of the subdepot from New York City on July 1, 1904, to Washington Barracks, D. C., the work of purchasing, receiving, repairing, and issuing surveying and other instruments devolved wholly on this depot. It is the designated repository for all kinds of surveying, astronomical, and reconnaissance instruments for all civil and military work under the charge of the War Department, and is also charged with the purchase of various instruments and reconnaissance outfits for the use of the Army under allotments made annually by the Chief of Engineers, U. S. Army. It is also charged with the supervision of repairs to instruments in use in the Army and by officers of the corps in charge of public works and surveys.

For the fiscal year 1905 the sum of $5,000 was allotted for the purchase and repair of such instruments as the depot may be called upon to supply or repair. As a rule all instruments issued from this depot are purchased under annual proposals. Proposals were invited June 2, 1904, and opened July 1, 1904. The specifications for these proposals did not specify quantity or kinds of instruments, but required bidders to be prepared to supply such numbers of each class as may be called for during the year at the price bid. Awards were made as a rule under "Public notice," but in some cases, when the time of delivery exceeded thirty days, emergency contracts were resorted to. But very little of the allotment above mentioned was used for stock purchases. All purchases made during the year were intended to fill duly authorized requisitions for instruments, and funds not used for purchases were economically expended in repairs to a large number of surveying and other instruments.

No accumulation of unserviceable instruments in need of repairs is permitted. All instruments received at this depot are examined

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immediately on arrival, and the necessary repairs are made. Estimates received and repairs made during the year were entirely satisfactory, and it has been fully ascertained to be more economical in every respect to have repairs made in the vicinity of the depot. The cost of repairs formerly made in New York City exceeds the cost of repairs made here and instruments shipped any distance by rail are always subject to minor damage and loss of adjustment in transit, notwithstanding the care exercised in packing. A great number of surveying instruments have been repaired during the year by local instrument makers, and defects in such instruments are rarely reported by the officer to whom they are issued.

As stated in last report, all large instruments, such as transits, levels, plane tables, sextants, and astronomical instruments are stored in a small brick building at the south end of the post. The instruments have been properly cared for in this building and all necessary precautions against fire and theft are taken. The use of this building for this purpose will be continued until the new storehouse now under construction is completed and turned over to the depot by the officer in charge of reconstruction of Washington Barracks, D. C.

All instruments stored in the above-mentioned building are properly guarded against moisture, are subject to frequent inspection, and are systematically classified and numbered. A complete record is kept of all large instruments passing through the depot, including dates of receipt and issue. All instruments, such as sketching cases, compasses, rulers, triangles, etc., are stored in a secure room on the top floor of a brick building, used as an academic building, where they are well cared for, the necessary shelving for the proper storage having been provided.

Requisitions from officers in charge of public works and surveys for large instruments are ordinarily for transits or levels, and a large number of these classes of instruments have been issued during the year. Although there are many transits and levels in stock, the number of modern and improved instruments among them is very limited, and the greater part of those on hand are of old or antiquated patterns, whose use on any work of importance is undesirable and not economical. The funds annually appropriated for the purchase and repair of instruments are so small that but very few large instruments can be purchased, and the issues during the past year were largely of old instruments in store.

Instruments turned in to the depot are ordinarily the oldest and least serviceable of those on hand in the shipping office, and the depot, under existing regulations, serves excellently to determine the desirability of retaining such instruments in service. As soon as time will permit a thorough examination of all the larger instruments in stock will be made, to determine and select the most antiquated instruments, with a view to their disposition by proper authority. Some of the instruments turned in under Circular No. 15, Office of the Chief of Engineers, 1904, are forty or fifty years old and are of such obsolete patterns that their repair or reissue for any purpose is inadvisable.

In addition to meeting payments for surveying instruments and repairs to instruments from the appropriation of $5,000, various reconnaissance instruments for issue under General Orders, No. 24, current series, amounting to $1,365, were purchased under authority

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from the Chief of Engineers, U. S. Army, leaving but $3,635 for purchase and repairs during the entire year.

The instruments repaired, purchased, received, and issued during the year are listed in the following tables:

(*a*) REPAIRED.

51 engineers' transits.
12 sextants.
2 theodolites.
1 current meter.
14 aneroid barometers.
23 prismatic compasses.
3 steel chains, 100 foot.
11 odometers.
1 clinometer.
1 hygrometer.
29 engineers' levels.
1 surveyor's compass.
3 plane tables.
13 cavalry sketching cases.
1 mercurial barometer.
22 level rods.
8 sets drawing instruments.
3 pocket compasses.
1 german silver protractor.

The foregoing enumerated instruments were repaired at a total cost of $1,747.83. The average expense for repairs to transits was about $16, and for levels about $12. No average of the small instruments can be given, as the repairs to these are subject to much variation.

(*b*) PURCHASED.

3 engineers' transits.
1 pantograph, complete.
10 New York level rods.
1 surveyor's compass, with staff.
1 plane table.
50 pocket compasses.
10 odometers.
1 slide rule.
4 tallying instruments.
2 city engineers' steel tapes.
3 engineers' levels.
1 marine night glass.
5 Philadelphia level rods.
9 hygrometers.
31 clinometers.
30 prismatic compasses.
6 steel tapes, 50 and 100 foot.
3 thermometers.
1 rod level, and a few minor small instruments.

The cost of the above instruments was $3,273.26, and in addition thereto 100 prismatic compasses and 100 pedometers were purchased from same appropriation for use in filling requisitions under General Orders, No. 24, current series.

Numerous other purchases were made also under allotments from appropriation for "Engineer Equipment of Troops" and "Equipment of Officers' Schools, Military Posts," which are reported in detail under the heading "Engineer Equipment of Troops."

(*c*) ISSUED.

Issues of surveying instruments to officers engaged on public works and surveys on duly approved requisitions were continued under the same conditions as in the previous fiscal year, and were as follows:

16 engineers' transits.
14 engineers' levels.
5 sextants.
5 artificial horizons.
4 binocular field glasses.
12 steel chains, 100 feet, with pins.
2 pantographs.
51 thermometers.
2 aneroid barometers.
2 theodolites.
9 level rods.
1 polar planimeter.
1 plane table.
5 large chronometers.
1 current meter.
9 hygrometers.
1 self-registering tide gauge, and numerous other smaller instruments.

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A number of requisitions were made during the year for a special kind of tide-gauge paper, of which there is an ample supply in the depot, and 17,000 feet of this paper were issued.

All the issues just enumerated were regularly transferred to the officer making the requisition therefor. Many issues of various large and small instruments were made from the depot to engineer troops serving at this port for use in connection with instruction in their special duties. There were also numerous instruments issued from the depot for use by a detachment of engineer troops from this post engaged in making surveys of the several maneuver camps near Manassas, Va., in the early part of the fiscal year. All instruments so issued are returned to the depot on termination of the instruction and the work for which they were used. As a rule, these instruments when returned need cleaning and overhauling, and this as a rule is done immediately, so that all instruments are again ready for further calls.

(*d*) RECEIVED FROM VARIOUS POINTS.

Under Circular No. 15, Office of the Chief of Engineers, May 27, 1904, the following instruments were turned into this depot, viz:

35 engineers' transits.
18 level rods.
6 sextants.
2 large theodolites.
3 large chronometers.
2 hygrometers.
1 plane table.
6 odometers.
14 engineers' levels.
4 stadia rods.
1 beam compass.
1 astronomical transit.
1 zenith telescope.
1 mercurial barometer.
16 prismatic compasses.
4 clinometers, and a number of other smaller instruments.

Nearly all of the above-enumerated instruments required more or less repairs when received.

During the months of January and February, 1905, twenty-five blast meters were turned into this depot by the officer formerly in charge of the subdepot in New York City.

Under the allotment of $4,600 made from the appropriation for gun and mortar batteries, act of April 21, 1904, to be applied to the purchase of articles of engineer equipment for issue to the militia of the State of New York, the following supplies were purchased by the officer formerly in charge of the subdepot in New York City, and the accounts therefor paid by this depot, viz:

1 oil engine, complete, 20 horsepower.
1 LeBlanc tide gauge, with all necessary accessories.
1 search-light outfit, complete, with all accessories.
6 hard-rubber triangles.
6 T squares, hard rubber.
6 triangular boxwood scales.
6 sets drawing instruments.

The above-mentioned property was regularly invoiced to the governor of the State of New York.

The funds from the above-mentioned appropriation which were used in payment for these supplies were credited to this appropriation by the transfer of the necessary amount from appropriation "New Arms and Equipment for Organized Militia," the transfer being made by Treasury settlement dated March 16, 1905.

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4. Engineer Equipment of Troops.

Under the appropriation for "Engineer Equipment of Troops, 1905," the sum of $13,000 was assigned at the beginning of the fiscal year for disbursement at Washington Barracks, D. C., and a project for the expenditure of this sum was submitted to the Chief of Engineers, U. S. Army, and was approved June 15, 1904. In addition to the above $13,000, various small allotments were made from same appropriation near the close of the fiscal year, amounting to $4,826.10. The total sum so allotted during the year was $17,826.10, which was entirely expended and pledged at the close of the year.

In addition to the above-mentioned allotments, the Chief of Engineers, U. S. Army, under date of September 19, 1904, assigned to this depot the sum of $5,000 from the appropriation for "Equipment of Officers' Schools, Military Posts, 1905," for "purchase of instruments." This amount was also entirely expended and pledged at the close of the fiscal year.

Engineer field supplies of all descriptions required for field service of engineer troops and for engineer officers at the various division and department headquarters have been procured from time to time and issued on duly approved requisitions.

The four companies of the Second Battalion of Engineers stationed at this post have been supplied during the year with minor articles as were expended in current use and instruction purposes, and by replacing such other articles as were rendered unserviceable in the regular line of duty.

In connection with the army maneuvers held in September, 1904, much attention was given the subject of properly fitting out the engineer companies that took part in the maneuvers with all the necessary field implements and instruments. The matter of supplying the required tool boxes to these companies was taken up in the early part of July, 1904, and, after consultation with the commanding officers of the four companies stationed at this post, suitable sizes and patterns of such tool boxes were decided upon. The work of construction was carried on in the depot carpenter shop under the supervision of one of the company commanders, and the required number of boxes were completed in time to be taken by the companies for use at the maneuvers. In addition to the company tool boxes, a set of similar tool boxes was constructed for carrying the engineer-equipment outfit designated for battalion headquarters.

All the companies of the Second Battalion of Engineers and the battalion headquarters are now provided with the required outfit of tool chests for carrying the engineer equipment heretofore issued and as authorized by the Chief of Engineers, U. S. Army, November 12, 1903.

In connection with the army maneuvers near Manassas, Va., in September, 1904, large numbers of various intrenching tools, such as intrenching shovels, pick mattocks, and machetes were shipped to the maneuver camp for probable distribution among the troops participating in the maneuvers. On termination of the maneuvers all these tools were returned to this depot. Several hundred leather carrying slings and leather pouches for intrenching tools were purchased and taken to the maneuver camps. In addition to these tools, 288 patent-lever wire cutters were obtained and taken to the maneuver camps for experimental use in actual service.

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All intrenching tools, instruments, drawing materials, etc., heretofore obtained from funds pertaining to appropriations for engineer equipment of troops are stored in the engineer depot storage rooms. They are cared for by the same employees, and receipts and issues are attended to in conjunction with the general work of the depot. No additional expense was incurred in attending to all engineer-equipment matters except the pro rata payment to office and depot employees.

Under date of January 7, 1905, a proposed War Department general order relating to the allowance of reconnaissance instruments to be furnished to the Army by the Engineer Department was received from the office of the Chief of Engineers, U. S. Army, with instructions to purchase the instruments listed in the allowance table of the proposed general orders.

In accordance with the above instructions work was commenced in preparing preliminary lists to ascertain the number of the designated instruments on hand in serviceable condition, and to determine the number that would have to be purchased to fill all requisitions that probably would be made on this depot. The matter was thoroughly investigated and a report was submitted to the Chief of Engineers, U. S. Army, on January 24, 1905, with recommendation for the purchase of such supplies as would probably be required, subject to the amount of funds available. Under date of February 1, 1905, the Chief of Engineers, U. S. Army, approved the recommendations above referred to.

No definite action was taken until General Orders, No. 24, current series, were published, and not until duly approved requisitions were referred to this office under the above orders. During the month of March 22 of such requisitions were received at this office, 165 during the month of April, 53 during the month of May, and 5 during the month of June, or, in all, to the end of the fiscal year, 245 requisitions.

In March orders were placed for the following instruments, intended for issue under the orders above referred to, and after due consideration had been given to the most suitable article for the purpose, viz:

400 pocket compasses.
12 odometers.
16 T squares, 42 inch.
16 rubber rulers.
16 drawing boards, 31 by 42 inches.
700 pace tallies.
16 metallic tape lines.
16 semicircular G. S. protractors.
32 rubber triangles.
9 sets drawing instruments.

All the above were purchased under standing proposals for the fiscal year 1905.

Orders for other designated instruments were postponed until more requisitions come to hand, in order that some information might be obtained as to the probable number of the different instruments that would be called for.

During the months of May and June, 1905, orders were placed for the following articles under the available funds and under the funds allotted during the month of June, 1905, viz:

1,200 celluloid protractors.
200 brass service clinometers.
100 semicircular protractors.
100 rubber triangles.
200 prismatic compasses.
200 pedometers.
112 metallic tapes, 50 foot.
112 new pattern cavalry sketching cases.

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The orders given for the above-enumerated articles, with some few exceptions, were covered by emergency contracts, amounting to, in all, $12,787.26. Deliveries by the makers of these instruments commenced in March, 1905, but the filling of requisitions was not begun until May, 1905. At the close of the fiscal year 103 of the requisitions on hand had been filled. Thesse 103 requisitions included the following articles, viz:

24 cavalry sketching cases.
28 pocket compasses.
54 clinometers.
18 pedometers.
48 field-note pads.
1 drawing board.
1 T square.
1 steel chain, with pins.
42 prismatic compasses.
95 rectangular protractors.
97 pace tallies.
36 field-note books.
4 odometers.
1 semicircular protractor.
2 metallic tapes, 50 foot.
103 special instrument boxes.

In connection with the issue of reconnaissance outfits to all military organizations and posts, it was recommended that each outfit be furnished in a suitable box for the entire equipment, such a box having been devised at this depot. This box is provided with partitions, forming compartments for the various articles, and weighs but 12 pounds when empty. Six hundred of these boxes were ordered and delivered before the close of the fiscal year, and the 103 shipments referred to above were made in them.

Much attention was given the subject of supplying the most suitable and approved instruments under General Orders, No. 24, current series. The rectangular boxwood protractor was replaced by a strong transparent celluloid protractor with modifications in the scales. The prismatic compass was improved over the former pattern in various respects. The clinometer (Abney level) was replaced by a new pattern service clinometer. The present style of cavalry sketching case was much improved, and a sample case was made in accordance with the views of the Board of Officers having under consideration the field equipment of engineer troops.

All instruments ordered for use in supplying reconnaissance outfits under General Orders, No. 24, current series, are marked "Engr. Dpt. U. S. A. 1905." In addition to this they are numbered consecutively, beginning with No. 1. The marking and numbering is done by stamping and engraving at a very slight expense. In making shipments to the various localities the number of each instrument is noted on the invoice and receipt, and record is kept at the depot of each issue made and of the number of each instrument issued.

The following table gives the various kinds and qualities of instruments, etc., required to be supplied under General Orders, No. 24, current series, to the various military organizations, viz:

For each company of infantry, troop of cavalry, battery of field artillery, and company of coast artillery—

1 sketching case.
1 box compass.
1 hand level, or clinometer.
1 notebook (field).
1 prismatic compass.
2 rectangular protractors.
1 pace tally.
1 reconnaissance pad.

In addition to the above, to each company of infantry one pedometer and to each battery of field artillery two odometers. For each post garrisoned by infantry, cavalry, or field artillery—

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2 sketching cases.
1 prismatic compass.
1 box compass.
2 rectangular protractors.
2 clinometers.
1 triangle, rubber, 60°.
2 pace tallies.
2 field-note books.
1 semicircular protractor.
1 set drawing instruments.
1 drawing board, 31 by 42 inches.
1 T square, 42 inches.
1 straightedge, 42 inches.
1 triangle, rubber, 45°.
1 triangular scale, 12 inches, boxwood.
1 metallic tape, 50 feet.
1 steel chain, 100 feet, with pins.
2 field-note pads.

In addition to the foregoing articles, the special box mentioned for packing and transporting the reconnaissance outfit is issued to each organization.

All arrangements for filling requisitions for reconnaissance outfits have been completed by the end of the fiscal year, and shipments can be made hereafter promptly, provided that there be no delay in delivery of such instruments as are not usually kept in stock by dealers.

No purchase of field-note books or field-note pads was necessary, as the supply received here from the Chief of Engineers, U. S. Army, during the previous fiscal year is sufficient at the present time to meet all demands.

In addition to the reconnaissance outfits furnished on the requisitions heretofore mentioned, forty-eight requisitions for miscellaneous instruments, drawing materials, photographic supplies, etc., were referred to this office by the Chief of Engineers, U. S. Army. The greater portion of these requisitions came from the chief engineer officers of military divisions. Some were from the military attachés serving with the Russian and Japanese armies in the field, and some from other sources, all of a military character. All requisitions were filled promptly on receipt at this office. No delays occurred in filling requisitions, excepting only when the articles required were not in stock. The following statement shows the quantities and articles shipped from this depot on the forty-eight requisitions above mentioned, viz:

7 engineers' transits.
3 engineers' levels.
8 aneroid barometers.
1 stadia rod.
3 level rods.
19 clinometers.
1 plane table.
1 large pantograph.
1 surveyors' compass.
14 pedometers.
2 steel rulers.
18 pace tallies.
8 odometers.
2 pocket sextants.
186 field-note books.
38 field-note pads.
84 rolls assorted blue and black print papers, each roll 10 yards.
1 engineer's transit, with solar attachment.
12 assorted metallic tapes.
22 cavalry sketching cases.
5 steel chains, 100 feet, with pins.
1 large G. S. protractor.
15 prismatic compasses.
7 assorted steel tapes.
4 folding stadia rods.
6 paper protractors.
33 pocket compasses.
28 Abbot's protractors.
66 bottles assorted drawing ink.
4 sets drawing instruments.
52 sheets unchangeable drawing board.
2 proportional dividers.
4 large drawing boards.
2,000 feet paper for sketching boards.
10 rolls tracing paper.
30 dozen assorted pencils.
11 rolls tracing cloth.
10 gross assorted pens.
205 yards white muslin.
8 rolls drawing paper.
24 blank notebooks.
2 folding kodaks and accessories.
4 special field photographic outfits.
1 photographic outfit for local use.
500 extra rolls of photographic films.
100 small intrenching shovels.
100 small intrenching pick mattocks and numerous other minor drawing, office, and field supplies, intended for military purposes at the various points from which requisitions were made.

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Under authority of the Chief of Engineers, U. S. Army, various technical books were purchased and issued for use in equipping the headquarters of the Second Battalion of Engineers. It has been found advantageous, in connection with the duties devolved upon the officers of the Corps of Engineers serving with the engineer battalions, to include in the regular equipment a small technical library.

Purchases of instruments and reconnaissance outfits have been made during the fiscal year under proposals opened July 1, 1904, and holding good for the entire fiscal year. The bids received were in the form of trade catalogues and a list of special articles with special prices noted. Almost all small purchases under these proposals were made under the usual "Public notice," but in some cases, when the amount was large and delivery could not be made within thirty days from date of order, emergency contracts were entered into. During the year four emergency contracts were entered into, involving a total sum of $13,789.26.

With the view to improving the various parts forming the existing engineer-equipment outfit, investigations and trials were continued during the entire year. Various experimental tools, such as peavies, saws, folding saws, and double-bitted axes, were procured and put to actual trials. Much attention was given to the investigations and trials of the various cavalry sketching cases, prismatic compasses, clinometers, plane tables, etc. A number of sample instruments were procured and tested.

A final report in the matter of all intrenching tools and instruments submitted to this office for examination, trial, and report was submitted to the Chief of Engineers, U. S. Army, on March 14, 1905, together with photographs of the various tools referred to in this report.

Assistance has been given the Board of Engineer Officers on Field Equipment for Engineer Troops by furnishing to this Board all the records, tools, and instruments desired for consideration during the last and present fiscal year. Numerous photographs of tools and instruments were made for the use of the above Board.

As stated in last year's report, an improvement was made in the carrying strap of the present cavalry sketching case, by replacing the old-style attachment of the strap by a new device. Over two hundred cavalry sketching cases have been provided during the year with the new attachment. The detaching of the old attachments and putting in place the new attachments was accomplished in the depot machine shop by hired labor.

Repairs to instruments were continued during the year under the same conditions as in the previous fiscal year. But a very few large surveying instruments were turned into the depot for repairs during the year. Of small reconnaissance instruments, such as cavalry sketching cases, prismatic compasses, aneroid barometers, clinometers, etc., large numbers were received at the depot from various localities. As a rule all these small instruments were in need of considerable repairs and of minor parts which were missing on receipt of the articles at this depot.

PONTON AND BRIDGE EQUIPAGE.

Much time and attention was given during the entire year to the ponton and bridge equipage cared for by the depot at Washington

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Barracks, D. C. The ponton equipage cared for during the year in the depot consists of the one division of each of reserve and advance guard train, brought from Willets Point in 1901, and enough balks, chess, trestles, and canvas ponton boats, procured at Washington, D. C., during the past two years, for completing one more division of each train. The funds allotted from appropriations for engineer equipment of troops have been so limited since the establishment of the depot at this post, and the demands on these funds so numerous for other military purposes, that no additional wooden ponton boats for the reserve train and no wagons for either train could be purchased. The funds assigned to this office did not even admit the replacing of the old and unserviceable wagons pertaining to the two divisions brought here in 1901. At the beginning of the fiscal year it was intended to procure eight wooden ponton boats for the second division of the reserve train with the funds allotted for fiscal year 1905, but so many unforeseen expenses were incurred in repairing and completing the old wagons of the two divisions that no funds remained available for this purpose.

The ponton equipage in stock has been cared for during the year. Owing to the existing limited storage facilities all wagons, wooden ponton boats, and other bulky materials have been without proper shelter. During the inclement weather temporary covering for the balks and chess was provided with materials on hand. With the limited funds available for ponton equipage but very few additions could be made during the year by purchase. Two hundred and seventy chess, short and long, contracted for during the last fiscal year were delivered in August, 1904.

Purchases of supplies for completing and repairing the ponton equipage were as follows, viz:

20 boat anchors.
36 wooden buckets.
36 iron buckets.
3,000 pounds nails and spikes.
5,000 pounds manila rope.
18 feed boxes.
21 wagon wheels.
18 wagon tongues.
6 wagon axles.
96 sets attachments for single and double trees.
750 yards canvas, and other minor articles of hardware.

Of the miscellaneous lumber procured during the past fiscal year, the following additional ponton equipage was constructed in the depot carpenter and blacksmith shops, viz:

6 sets of side frames for canvas pontons.
8 boxes for canvas ponton covers.
150 long chess.
30 trestle balk.
80 long balk.
80 short balk.
120 short chess.

In addition to the above, four experimental trestle caps were built, and six long balk of cypress and six long balk of spruce were constructed. Twenty-one old wagon wheels, on ponton wagons, were replaced by new wheels, ten wagon tongues were used in replacing old and worn-out tongues, and a large number of chains, draft rods, and stay chains for doubletrees were made.

With the view to furnishing a proper outfit of ponton equipage to the three companies from the Second Battalion of Engineers who took part in the army maneuvers near Manassas, Va., in September, 1904, work was undertaken at the close of the last fiscal year and

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continued in the new fiscal year in overhauling all the ponton equipage in stock. Materials needed for completing all necessary accessories were procured in July, 1904, and with a considerable number of all the more important parts of the equipage in stock, nothing remained requiring completion except the ponton wagons pertaining to the two divisions brought from Willets Point, N. Y., in 1901. These wagons had been undergoing alterations for some time, principally with a view to replacing the old-style rigid splinter bars with double and single trees of modern design. On further examination of the wagons considerable other repairs and alterations were found necessary. A number of extra wagon wheels, wagon tongues, and other minor parts were needed. These were ordered, but unusually long delay in delivery was caused by the fact that these wagons have been in store since 1866 and every spare part ordered for them had to be made to order. The work undertaken on these wagons was intended to fit them for use with six animals.

The work necessary to complete enough wagons for use at the maneuvers was completed as well as it was possible by about the middle of August. The ponton train that accompanied the Second Battalion of Engineers to the maneuvers near Manassas, Va., consisted of four wooden ponton boats, seventeen ponton wagons, and all the needed outfit for one division of reserve ponton equipage, including as many extra trestles as could be conveniently carried for use in the probable construction of trestle bridges. During the march of the battalion to maneuver camp near Manassas, Va., the wagons were found to be unserviceable for actual service, although much time and expense was incurred in repairing and fitting them up for the road, and over $1,500 for extra wagon parts and hired labor had been expended in overhauling these seventeen wagons. These wagons have been in store at Willets Point, N. Y., since the close of the civil war. They have been repaired from time to time, and on removal of the Engineer School and Depot from Willets Point, N. Y., to Washington Barracks, D. C., in 1901, thirty wagons were included in the property brought here, thirty being the number of wagons required for one division each of reserve and advance guard ponton equipage.

On return of the ponton train from the maneuver camps to the depot all that remained good and serviceable on these wagons were the few new wagon wheels and wagon tongues recently purchased. In view of the condition of these wagons a recommendation was made in the Annual Report for the Engineer Depot for the year 1904 for providing funds for the purchase of new wagons for the two divisions brought from Willets Point and for two additional divisions now in progress of completion at the engineer depot. No provisions were, however, made for this very urgently needed purpose in the appropriations for fiscal year 1906, and, as a matter of fact, all reference to ponton trains has been omitted from the usual appropriation.

In the absence of the proper ponton wagons a bridge train is absolutely immobile. The cost of the ponton wagons required for equipping one division of ponton train amounts to about one-fifth part of the cost of the entire division. The thirty wagons now on hand do not warrant any further repairs, but should be condemned, and the Army is now entirely without a bridge train fit for the field.

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It is earnestly recommended that steps be taken to provide ample funds for rebuilding and remodeling the ponton trains now at this depot according to improved designs now under consideration by the Board on Engineer Equipment, for which an estimate of $50,000, under the heading of "Estimates for fiscal year 1907" is made in this report. The funds, if appropriated for the purpose asked for, should be made available immediately on the passage of the act appropriating the same, and should, if practicable, remain "available until expended." Much delay and difficulty is experienced in obtaining suitable materials for bridge trains, and the work can scarcely be completed within one fiscal year. Ample time is essential for the consideration and trial of boats and material to be procured under the future recommendations of the Board of Engineer officers on field equipment for engineer troops.

In the design and construction of a military bridge train to be transported with an army on wagons over roads such as must be used in this country in every campaign it is essential to reduce the weight of all parts to the lowest limit consistent with securing a serviceable equipment. Selected lumber of the very best quality is the first requisite in such an equipment. This lumber is not available from stock in the hands of dealers, and experience in the past two years shows that a delay of from three to six months follows each attempt to purchase this essential element of the equipment. The wagons for transporting the bridge material must be of special design. They are not carried in stock, and must be made to order, with the delays consequent thereto. It is evident, therefore, that if the Army is to be provided with a bridge train within the first few months following a declaration of war this train must be prepared during peace and maintained in readiness for field service.

STATEMENT OF FUNDS.

I. Engineer depots, fiscal year 1904:		
1. For incidental expenses of depot (incidentals)—		
July 1, 1904, balance unexpended		$449.73
June 30, 1905, amount expended during fiscal year	$441.45	
June 30, 1905, amount turned into the Treasury during the fiscal year, in compliance with G. O. No. 73, War Department, December 30, 1903	8.28	
		449.73
2. For purchase and repair of instruments (instruments)—		
July 1, 1904, balance unexpended		115.53
June 30, 1905, amount expended during fiscal year		115.53
II. Engineer depots, fiscal year 1905:		
From the sums appropriated by Congress for the fiscal year ended June 30, 1905, the following amounts were allotted by the Chief of Engineers, U. S. Army, for disbursement at Washington Barracks, D. C., viz:		
1. For incidental expenses of the depot (incidentals)		$8,500.00
June 30, 1905, amount expended during fiscal year	$8,155.26	
July 1, 1905, outstanding liabilities	344.74	
		8,500.00

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2. For purchase and repair of instruments (instruments)----		$5,000.00
During the year the following amount was allotted by the Chief of Engineers, U. S. Army, on account of this appropriation, being reimbursements for loss of and damage to engineer property----------		21.09
		5,021.09
June 30, 1905, amount expended during fiscal year ----------	$3,543.89	
July 1, 1905, outstanding liabilities----------	1,477.20	
		5,021.09
III. Engineer equipment of troops, fiscal year 1904—For engineer equipment:		
July 1, 1904, balance unexpended----------		$2,265.44
June 30, 1905, amount expended during fiscal year--	$2,264.53	
June 30, 1905, amount turned into the Treasury during fiscal year, in compliance with G. O. No. 73, War Department, December 30, 1903----------	.91	
		2,265.44
IV. Engineer equipment of troops, fiscal year 1905, for engineer equipment:		
From the above appropriation, made by act of Congress approved April 23, 1904, the following allotments were assigned to this office by the Chief of Engineers, U. S. Army, at various times during the fiscal year, and in accordance with the detailed project for the expenditure thereof; for instruments, intrenching tools, ponton trains, drawing materials, etc., viz:		
June 15, 1904, amount allotted----------		$13,000.00
April 10, 1905, amount allotted----------		1,408.66
May 9, 1905, amount allotted----------		5.30
June 7, 1905, amount allotted----------		1,000.00
June 12, 1905, amount allotted----------		117.22
June 22, 1905, amount allotted----------		1,762.59
June 26, 1905, amount allotted----------		509.96
June 30, 1905, amount allotted----------		22.37
Total of allotments----------		17,826.10
June 30, 1905, amount expended during fiscal year ----------	$10,702.20	
July 1, 1905, outstanding liabilities----------	7,123.90	
		17,826.10
V. Equipment of officers' schools, military posts, fiscal year 1905:		
Under date of September 19, 1904, the Chief of Engineers, U. S. Army, allotted the following sum from the above appropriation for purchase of reconnaissance instruments and other supplies to be issued to military organizations and military posts, as provided for in G. O. No. 89, A. G. O., 1903, and modified in G. O. No. 24, War Department, Washington, February 14, 1905, viz:		
September 19, 1904, amount allotted----------		$5,000.00
November 5, 1904, the following amount was assigned by the Chief of Engineers, U. S. Army, on account of this appropriation, being reimbursement for engineer property lost in transit----------		50.49
		5,050.49
June 30, 1905, amount expended during fiscal year----------		490.69
July 1, 1905, balance unexpended----------		4,559.80
July 1, 1905, outstanding liabilities----------		4,559.80

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VI. Gun and mortar batteries (act of June 6, 1902):

1. For purchase and repair of instruments—		
July 1, 1904, balance unexpended		$405.77
June 30, 1905, amount expended during fiscal year		405.77
2. Act of April 21, 1904, the following allotment was made by the Chief of Engineers, U. S. Army, for purchase of articles for engineer equipment for issue to the militia of the State of New York, viz—		
For purchase of articles for engineer equipment		4,600.00
June 30, 1905, amount expended during fiscal year	$4,513.71	
June 30, 1905, amount turned into the Treasury to the credit of the above appropriation	86.29	
		4,600.00

Of the amount expended, viz, $4,513.71, the sum of $4,491.03 was reimbursed from appropriation for "New arms and equipment for organized militia" by Treasury settlement dated March 16, 1905. The difference arising in the two amounts, viz, $22.68, covered an expenditure on account of mileage to officer making purchase of the supplies.

VII. Examinations, surveys, and contingencies of rivers and harbors.—For purchase and repair of instruments:

July 1, 1904, balance unexpended	$273.02
June 30, 1905, amount expended during fiscal year	83.25
July 1, 1905, balance unexpended	189.77
July 1, 1905, outstanding liabilities	46.05
July 1, 1905, balance available	143.72

VIII. Emergency fund, War Department (act of March 3, 1899).—For equipment of electrical laboratory at Engineer School, Washington Barracks:

July 1, 1904, balance unexpended	$35.35
June 30, 1905, amount expended during fiscal year	35.35

IX. Improving harbor at Honolulu, Hawaii:

The following allotment was made by the Chief of Engineers, U. S. Army, May 20, 1905, for purchase of instruments for issue to the officer in charge of improving harbor at Honolulu, Hawaii, viz:

For purchase of instruments	$265.75
June 30, 1905, amount expended to end of fiscal year	292.75

NEW APPROPRIATIONS.

The following items have been allotted by the Chief of Engineers, U. S. Army, from appropriations contained in the act of Congress for the support of the Army for the fiscal year ending June 30, 1906, for disbursements at Washington Barracks, D. C., viz:

1. Engineer depots, 1906, act of March 2, 1905, for incidental expenses of depot (incidentals)	$6,500.00
2. Engineer depots, 1906, act of March 2, 1905, for purchase and repair of instruments (instruments)	5,000.00
3. Engineer equipment of troops, 1906, act of March 2, 1905, for intrenching tools, instruments, drawing materials, etc., for use in the engineer equipment of troops	5,000.00
Total	16,500.00

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APPENDIX No. 3.

ENGINEER DEPOT, FORT LEAVENWORTH, KANSAS.

REPORT OF MAJ. THOS. H. REES, CORPS OF ENGINEERS, FOR THE FISCAL YEAR ENDING JUNE 30, 1905.

FORT LEAVENWORTH, KANS.,
July 11, 1905.

GENERAL: I have the honor to inclose herewith, in duplicate, annual report of the Engineer Depot, Fort Leavenworth, Kans., for the fiscal year ending June 30, 1905.

Very respectfully, your obedient servant,

THOS. H. REES,
Major, Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

UNITED STATES ENGINEER DEPOT, FORT LEAVENWORTH, KANSAS.

BUILDINGS.

A plat of ground in the northwestern part of this post is set aside for the engineer park, corrals, stables, shops, storehouses, and depot.

The buildings contemplated in a project which has received the approval of the Secretary of War are the following:

1 shop building.
1 horse stable.
1 mule stable.
1 storehouse.
2 ponton sheds for advance-guard train.
2 ponton sheds for reserve train.

Of these there are constructed or now under construction:

1 shop building.
1 horse stable (under construction).
1 storehouse.
1 ponton shed for advance-guard train.
1 ponton shed for reserve train.

The shop building is a small structure that was designed as a shop of instruction for engineer soldiers, and is inadequate for use as a shop of construction in connection with the depot. Outline plans have been submitted for a new shop building for the depot work. The necessity for such a shop has been so great during the past year that one of the ponton sheds was temporarily converted into a shop, although it was much needed for its legitimate purpose.

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The storehouse is a building 242 feet long and 40 feet wide, provided with a standard-gauge track through the center and with an overhead traveling crane of 3 tons capacity. It has just been completed and will be used for the storage of bridge equipage and other supplies, much of which has heretofore suffered from exposure to the weather.

It is proposed, when new tracks are laid to the quartermaster yards, to run a spur into this storehouse, so that cars may be loaded and unloaded by means of the crane.

The ponton sheds, built and proposed, are designed to accommodate two divisions of the reserve train and two divisions of the advance-guard train, the wagons and loads being complete and ready at all times to be hitched up and placed en route.

OPERATIONS.

The following allotments of funds were made for the expenses of the depot, viz:

1. Engineer depots, 1905	$3,000
2. Engineer equipment of troops, 1905	8,284

The first was expended in purchasing depot supplies, such as photographic and drawing material and shop supplies; in the purchase of artillery harness for the bridge train, and in payment of enlisted men engaged on extra duty in building pontoons, chess, and balk.

The second allotment, $8,284, for engineer equipment of troops, was applied as follows:

For salary of stenographer, and for making plates in the preparation of Engineer Field Manual	$580.20
Diving apparatus	495.00
Lumber for chess	3,319.37
Machinery for shops	591.67
Engineer equipment of companies of First Battalion of Engineers and ponton train	1,498.28
Harness for bridge train	126.00
Withdrawn and transferred to Lieutenant-Colonel Leach, at Washington, to continue preparation of Engineer Field Manual	1,669.80
Total	8,280.32

WORK ACCOMPLISHED.

Fifteen wooden pontons were built, using Oregon fir purchased during the previous fiscal year. This was the best substitute that could be found for white pine, which is no longer procurable in the lengths required.

The fir is not so workable or so light as the pine, but is probably just as strong and durable.

An experimental ponton wagon was constructed having in view the production of a lighter wagon with standard wheels and improved coupling pin. The objects sought were attained and the new wagon is believed to be better than the type of 1865.

A satisfactory tool wagon for an engineer company has not yet been devised. Tool wagons of a new design were built for the four engineer companies of the First Battalion, and while an improvement

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on the old design, they are still lacking in convenience of arrangement and in capacity. The action of the Board convened at Washington to consider engineer equipment is awaited before undertaking further construction in this direction.

Experiments were continued with a view to developing a more satisfactory tool pouch for pack transportation. The pouch now used is too heavy, but no satisfactory substitute for it has been found.

In addition to the above there have been a multitude of minor operations not easily classified, having reference to the care, preservation, extension, improvement, and repairs of engineer equipment of all kinds, to the shoeing of 272 animals, and to the making and repairing of harness and saddle equipment.

Money statements.

Allotment from appropriation for "Engineer Depots, 1905," for hire of three telephones, incidental expenses of depot, shop expenses, lubricants, etc., and extra-duty pay.

Amount of allotment		$3,000.00
June 30, 1905, amount expended during year		2,994.52
July 1, 1905, balance unexpended		5.48
July 1, 1905, outstanding liabilities		5.00
July 1, 1905, balance available, to be turned into Treasury United States		.48

Allotment from appropriation for "Engineer equipment of troops, 1905," for printing manual, salary of stenographer, making plates, engineer equipment, construction, repair, outfit, and diving apparatus, complete.

Amount of allotment		$8,284.00
Withdrawn in December, 1904	$1,444.80	
Withdrawn in January, 1905	225.00	
		1,669.80
		6,614.20
June 30, 1905, amount expended during year		6,541.16
July 1, 1905, balance unexpended		73.04
July 1, 1905, outstanding liabilities		69.36
July 1, 1905, balance available, to be turned into Treasury United States		3.68

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RIVERS AND HARBORS, ETC.

APPENDIX A.

IMPROVEMENT OF RIVERS AND HARBORS IN MAINE AND NEW HAMPSHIRE.

REPORT OF LIEUT. COL. W. M. BLACK, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1905, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Lubec channel, Maine.
2. Narraguagus River, Maine.
3. Breakwater from Mount Desert to Porcupine Island, Bar Harbor, Maine.
4. Harbor at Sullivan Falls, Maine.
5. Union River, Maine.
6. Bagaduce River, Maine.
7. Penobscot River, Maine.
8. Harbor at Bucksport, Maine.
9. Camden Harbor, Maine.
10. Harbor at Rockland, Maine.
11. Carvers Harbor, Vinalhaven, Maine.
12. Georges River, Maine.
13. New Harbor, Maine.
14. Damariscotta River, Maine.
15. Kennebec River, Maine.
16. Portland Harbor, Maine.
17. Saco River, Maine.
18. Kennebunk River, Maine.
19. York Harbor, Maine.
20. Harbor at Isles of Shoals, Maine.
21. Cocheco River, New Hampshire.
22. Exeter River, New Hampshire.
23. Harbor of Refuge at Little Harbor, New Hampshire.
24. Protection and preservation of navigable waters.
25. Removing sunken vessels or craft obstructing or endangering navigation.

UNITED STATES ENGINEER OFFICE,
Portland, Me., July 24, 1905.

GENERAL: I have the honor to forward annual report for the fiscal year 1905 for river and harbor works in my charge.

* * * * * * *

Very respectfully, your obedient servant,

W. M. BLACK,
Lieut. Col., Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

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A 1.

IMPROVEMENT OF LUBEC CHANNEL, MAINE.

The only work during the year was the completion of a contract for dredging, which was accomplished on the 27th of July, 1905. Under this contract 130,266 cubic yards of material were excavated, at a price of 24⅝ cents per cubic yard. This completed the existing project, under which a total of 402,380 cubic yards of material have been excavated.

Money statement.

July 1, 1904, balance unexpended	$33,305.76
June 30, 1905, amount expended during fiscal year, for works of improvement	17,741.56
July 1, 1905, balance unexpended	15,564.20

APPROPRIATIONS.

March 3, 1879	$44,000
June 14, 1880	20,000
March 3, 1881	45,000
August 2, 1882	20,000
July 5, 1884	10,000
August 5, 1886	10,000
August 11, 1888	20,000
August 18, 1894	5,000
August 18, 1894, unexpended balance for improving St. Croix River, made available for Lubec channel	35,000
June 3, 1896	32,000
March 3, 1899	25,000
June 13, 1902	53,000
Total	319,000

CONTRACT IN FORCE DURING FISCAL YEAR ENDING JUNE 30, 1904.

Name of contractor: Eastern Dredging Company.
Date of contract: October 18, 1902.
Date of approval: November 22, 1902.
Time for commencement: April 29, 1903.
Time for completion: June 29, 1904. (Waived.)
Rate:
Dredging, 24⅝ cents per cubic yard.
Removing bowlders, $5 per ton of 2,000 pounds.

COMMERCIAL STATISTICS.

Receipts and shipments, 1904.

	Tons.
Brick	1,200
Coal	5,000
Fish	44,000
General merchandise	9,500
Grain and flour	5,000
Lumber and wood	7,000
Potatoes	2,000
Salt	2,500
Total	76,200

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Arrivals and departures during calendar year 1904.

Steamers: Coastwise, draft 15 feet	172
Sailing vessels:	
Foreign (average tonnage 90, draft 10 feet)	42
Coastwise (average tonnage 200, draft 12 feet)	47

Vessels built during the year, 1 steamer, 15 tons.
There is no record for the year 1904 of vessels passing through the channel.
Number of passengers in 1904, 1,716.

A 2.

IMPROVEMENT OF NARRAGUAGUS RIVER, MAINE.

There were no operations during the year and no expenditures.

The project is regarded as having been completed, but the depth has not maintained, and additional work will probably become necessary at a not distant date.

Money statement.

July 1, 1904, balance unexpended	$356.19
July 1, 1905, balance unexpended	356.19

APPROPRIATIONS.

For improvement above Millbridge:		
March 3, 1871	$12,000	
June 10, 1872	10,000	
		$22,000
For improvement below Millbridge:		
August 5, 1886	10,000	
August 11, 1888	10,000	
September 19, 1890	7,500	
July 13, 1892	7,500	
August 18, 1894	5,000	
June 3, 1896	5,000	
March 3, 1899	5,000	
		50,000
Total		72,000

COMMERCIAL STATISTICS.

Receipts and shipments, 1904.

	Tons.
Bricks	100
Coal	1,000
General merchandise	9,000
Grain and flour	2,800
Lime and cement	75
Lobsters and clams	400
Lumber and wood	27,600
Salt	150
Sardines	800
Total	41,925

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Arrivals and departures during calendar year 1904.

Steamers:	
Coastwise, average draft 8½ feet	200
Coastwise, average draft 7 feet	250
Sailing vessels: Coastwise, draft 10 feet	350

Vessels built during the year: One three-masted schooner, 400 gross tons; 1 four-masted schooner, 1,496 gross tons.

Number of passengers in 1904, 1,157.

A 3.

BREAKWATER FROM MOUNT DESERT TO PORCUPINE ISLAND, BAR HARBOR, MAINE.

There were no operations during the year and no expenditures. Approximately one-half the work covered by the project has been accomplished.

It is proposed to expend the additional appropriation recommended in continuing the construction of the breakwater.

No commercial statistics could be obtained.

Money statement.

July 1, 1904, balance unexpended	$210.82
July 1, 1905, balance unexpended	210.82
Amount (estimated) required for completion of existing project	230,200.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	50,000.00

APPROPRIATIONS.

August 11, 1888	$50,000	June 3, 1896	$10,000
September 19, 1890	50,000	March 3, 1899	20,000
July 13, 1892	50,000		
August 18, 1894	10,000	Total	190,000

A 4.

IMPROVEMENT OF HARBOR AT SULLIVAN FALLS, MAINE.

There were no operations during the year and no expenditures. About 70 per cent of the work covered by the project has been accomplished.

It is proposed to expend the additional appropriation recommended in continuing the excavation of rock at ledges C and B.

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Money statement.

July 1, 1904, balance unexpended	$204.36
July 1, 1905, balance unexpended	204.36
Amount (estimated) required for completion of existing project	20,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	10,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

APPROPRIATIONS.

March 3, 1871	$10,000.00
June 10, 1872	25,000.00
June 3, 1896	5,000.00
March 3, 1899	5,000.00
June 13, 1902	5,000.00
Total	50,000.00

COMMERCIAL STATISTICS.

Receipts and shipments, 1904.

	Tons.
Coal	200
Granite	30,000
Lumber and wood	1,000
General merchandise	200
Total	31,400

Arrivals and departures during calendar year 1904.

Sailing vessels:	
Coastwise, average 225 tons, draft 10 feet or more	200
Coastwise, average 75 tons, draft less than 10 feet	52
Steamers: Coastwise, average 150 tons	20

A 5.

IMPROVEMENT OF UNION RIVER, MAINE.

There were no operations during the year and no expenditures. The work called for by the project is regarded as completed, though of doubtful permanence in some respects.

Money statement.

July 1, 1904, balance unexpended	$2,898.64
July 1, 1905, balance unexpended	2,898.64

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APPROPRIATIONS.

July 11, 1870	$15,000
March 3, 1871	15,000
June 3, 1896	15,000
March 3, 1899	15,000
June 6, 1900	115,000
Total	175,000

COMMERCIAL STATISTICS.

Receipts and shipments, 1904.

	Tons.
Bricks	700
Cement and lime	115
Coal	2,200
General merchandise	2,035
Hardware and iron	75
Lumber and wood	9,836
Total	14,961

Arrivals and departures during calendar year 1904.

Vessels, average tonnage 125 gross tons, draft 10 feet	250
Vessel built, 167 gross tons, 140 net tons	1

One new line of steamboats established (Rockland, Bluehill and Ellsworth Steamboat Line, 2 steamers).

Nearly all commodities, except coal, received at Ellsworth come now by rail instead of by water. Shipments from Ellsworth by rail are increasing annually, with corresponding decrease in shipments by water.

A 6.

IMPROVEMENT OF BAGADUCE RIVER, MAINE.

There were no operations during the year. The work of continuing the excavation of bowlders at Winslows Island and the dredging of a basin at Bowden's wharf was again offered by public advertisement dated April 28, 1905, but no bids were received. The appropriation is so small that bidders hesitate to undertake the expense of moving a plant to this remote locality. An arrangement has, however, been made with a contractor for dredging at New Harbor and Damariscotta River to undertake this job also at reasonable prices, and the work will be done during the present season.

Probably not more than 25 per cent of the work included in the original project has been accomplished.

It is proposed to apply the available balance and the additional appropriation estimated in continuing the excavation of the channel at Winslows Island.

The improvement is regarded as of doubtful public benefit, but if it is to be continued in the interest of economy appropriations should be made in larger amounts for the reason above noted.

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Money statement.

July 1, 1904, balance unexpended	$3,254.59
June 30, 1905, amount expended during fiscal year, for works of improvement	119.80
July 1, 1905, balance unexpended	3,134.79
July 1, 1905, outstanding liabilities	2.86
July 1, 1905, balance available	3,131.93
July 1, 1905, amount covered by uncompleted contracts	2,713.80
Amount (estimated) required for completion of existing project	18,875.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	5,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

APPROPRIATIONS.

August 11, 1888	$3,000	March 3, 1899	$3,000
September 19, 1890	4,000	June 13, 1902	3,000
July 13, 1892	5,000		
August 18, 1894	5,000	Total	28,000
June 3, 1896	5,000		

CONTRACT IN FORCE.

Name of contractor: Eastern Dredging Company.
Date of contract: June 28, 1905.
Date of approval: July 21, 1905.
Time for commencement: 150 days after notification of approval.
Time for completion: 90 days after commencement.
Rate:
Shoals A and B, $2 per cubic yard.
Area near Bowden's wharf, 30 cents per cubic yard.

COMMERCIAL STATISTICS.

Receipts and shipments, 1904.

	Tons.
Bricks	10,000
Coal	3,200
Cod and mackerel lines	400
Cotton	350
Fish	300
General merchandise	30,000
Grain	14,000
Granite	1,500
Lumber and cooperage	27,000
Lime, cement, etc	10,000
Phosphate	200
Wood	6,000
Total	102,950

The foregoing statement includes the business done at Castine, at the mouth of the river.

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A 7.

IMPROVEMENT OF PENOBSCOT RIVER, MAINE.

There were no operations during the year, and the expenditures were limited to $44.66.

The results aimed at by the project are regarded as practically accomplished.

There is a demand for a widening of the deep-water area of Bangor Harbor, and the act of 1905 provided for a preliminary examination, which has been made, and a survey ordered.

Money statement.

July 1, 1904, balance unexpended	$8,610.39
June 30, 1905, amount expended during fiscal year, for works of improvement	44.66
July 1, 1905, balance unexpended	8,565.73

APPROPRIATIONS.

March 2, 1829 (for survey)	$300
July 11, 1870 (at Bangor and below)	15,000
March 3, 1871 (at Bangor and below)	50,000
June 10, 1872	40,000
March 3, 1873	20,000
June 23, 1874	20,000
March 3, 1875 ($10,000 to be expended at or near Bucksport Narrows)	25,000
August 14, 1876 ($4,000 to be expended at or near Bucksport Narrows)	10,000
June 18, 1878 ($2,500, or so much thereof as necessary, to be expended at or near Bucksport Narrows)	12,000
March 3, 1879	6,000
July 5, 1884 (for Bangor Harbor and Penobscot River)	20,000
August 5, 1886 (for widening channel at Bangor and removing obstructions near Crosbys Narrows)	15,000
August 11, 1888 ($20,000 to be expended between Bangor and Crosbys Narrows and $30,000 between Bucksport and Winterport)	50,000
September 19, 1890 (for continuing improvement and for dredging near Sterns's mill)	25,000
July 13, 1892	40,000
March 3, 1899	28,000
Total	376,300

COMMERCIAL STATISTICS.

Receipts and shipments, 1904.

	Tons.
Cement, lime, and fertilizer	12,685
Coal	426,423
Grain, hay, and provisions	14,376
General merchandise	36,469
Ice	21,086
Iron and steel	3,713
Lumber and wood	238,601
Oil	12,078
Sand, clay, gravel, and bricks	2,908
Shooks, box	5,494
Spool bars	11,610
Stone	26,830
Total	812,273

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Arrivals and departures during calendar year 1904.

Steamers:	
Foreign, total tonnage 12,341 tons	9
Coastwise, average 450 tons	1,056
Sailing vessels:	
Foreign, total tonnage 17,711 tons	30
Coastwise, average 450 tons	2,418

One four-masted schooner of 1,589 gross tons was built during the year, and another was commenced of 830 gross tons.

Number of passengers in 1904, 39,597.

A 8.

IMPROVEMENT OF HARBOR AT BUCKSPORT, MAINE.

As stated in the last annual report, the project and the contract covering the work were completed July 7, 1903, giving the full projected depth of 16 feet at mean low tide in front of the wharves.

While the work will probably not be absolutely permanent, there has as yet been no occasion to doubt that it will be reasonably so.

No commercial statistics could be obtained.

Money statement.

July 1, 1904, balance unexpended	$1,685.36
June 30, 1905, amount expended during fiscal year, for works of improvement	106.35
July 1, 1905, balance unexpended	1,579.01

APPROPRIATION.

June 13, 1902	$20,000

A 9.

IMPROVEMENT OF CAMDEN HARBOR, MAINE.

There were no operations during the year and no expenditures.

The work covered by the project has been completed.

No commercial statistics could be obtained.

Money statement.

July 1, 1904, balance unexpended	$173.68
July 1, 1905, balance unexpended	173.68

APPROPRIATIONS.

March 3, 1873	$10,000	August 18, 1894	$12,000
June 23, 1874	10,000	June 3, 1896	10,000
March 3, 1875	10,000	June 13, 1902	7,400
August 11, 1888	5,000		
September 19, 1890	6,000	Total	82,400
July 13, 1892	12,000		

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A 10.

IMPROVEMENT OF HARBOR AT ROCKLAND, MAINE.

Operations consisted in placing 19,716 tons of stone on the sea slope of the breakwater, which had been disturbed by ice and wave action during the winter 1903–4. The work was done under contract, and cost $1.07 per ton of 2,000 pounds. The project is regarded as completed, subject to any work that may be needed from time to time until the breakwater slopes have assumed a condition of permanence.

Money statement.

July 1, 1904, balance unexpended	$34,551.27
June 30, 1905, amount expended during fiscal year, for works of improvement	24,518.05
July 1, 1905, balance unexpended	10,033.22
July 1, 1905, outstanding liabilities	201.95
July 1, 1905, balance available	9,831.27

APPROPRIATIONS.

June 14, 1880	$20,000	August 18, 1894	$30,000
August 2, 1882	40,000	June 3, 1896	25,500
July 5, 1884	40,000	June 4, 1897	350,000
August 5, 1886	22,500	July 1, 1898	300,000
August 11, 1888	30,000		
September 19, 1890	37,500	Total	925,500
July 13, 1892	30,000		

CONTRACT IN FORCE DURING FISCAL YEAR ENDING JUNE 30, 1905.

E. S. Belden & Sons, for placing about 20,000 tons of stone on outer slope of breakwater; price, $1.07 per ton of 2,000 pounds; dated September 6, 1904; approved September 26, 1904; to be commenced October 27, 1904, and to be completed in six working months.

Contract completed.

COMMERCIAL STATISTICS.

Receipts and shipments, 1904.

	Tons.
Brick, cement, sand, etc	2,900
Coal	80,000
Fish, salt, etc	18,250
General merchandise	75,000
Hay and straw	2,145
Ice	11,500
Lime	225,000
Lumber and ship timbers	33,500
Oil and stone	8,750
Sawdust and ashes	2,625
Steel rails and castings	2,500
Wood and cooperage	50,000
Total	512,170

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Arrivals and departures during calendar year 1904.

Steamers:	
Coastwise, 400 to 1,500 tons each	712
Coastwise, 25 to 400 tons	2,190
Coastwise, under 25 tons	350
Sailing vessels:	
Foreign	53
Coastwise, for refuge	2,000
Coastwise	3,175
Vessels built during the year	2

Number of passengers in 1904, 97,449.

A 11.

IMPROVEMENT OF CARVERS HARBOR, VINALHAVEN, MAINE.

There were no operations during the year and no expenditures. The work is regarded as completed.

Money statement.

July 1, 1904, balance unexpended	$2,158.40
July 1, 1905, balance unexpended	2,158.40

APPROPRIATIONS.

June 3, 1896	$10,000
March 3, 1899	15,000
June 13, 1902	20,000
Total	45,000

COMMERCIAL STATISTICS.

Receipts and shipments, 1904.

	Tons.
Coal, wood, hay, and merchandise	12,800
Fish, bait, ice, and salt	14,000
Lobsters	850
Stone	37,000
Total	64,650

Arrivals and departures during calendar year 1904.

Steamers:	
Coastwise	800
Vessels 9 to 18 feet draft, 1 to 400 tons	225
Vessels 7 to 16 feet, 10 to 200 tons	800
For refuge only	500
Boats, 4 to 8 feet draft, 5 to 15 tons each	90
Vessels 50 to 75 tons	4

Three small vessels building, 10 to 20 tons.

A 12.

IMPROVEMENT OF GEORGES RIVER, MAINE.

There were no operations during the fiscal year. The project is completed and nothing is proposed beyond an examination, when opportunity offers, to ascertain as to the permanency of the dredged channel.

No commercial statistics could be obtained.

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Money statement.

July 1, 1904, balance unexpended	$357.09
June 30, 1905, amount expended during fiscal year, for works of improvement	145.00
July 1, 1905, balance unexpended	212.09

APPROPRIATIONS.

June 3, 1896	$10,000
March 3, 1899	10,000
June 13, 1902	6,000
Total	26,000

A 13.

IMPROVEMENT OF NEW HARBOR, MAINE.

No work was done during the year. A contract has been made for doing all the work covered by the project. It is expected to be accomplished during the present season.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1905	$10,500.00
June 30, 1905, amount expended during fiscal year, for works of improvement	129.75
July 1, 1905, balance unexpended	10,370.25
July 1, 1905, outstanding liabilities	12.60
July 1, 1905, balance available	10,357.65
July 1, 1905, amount covered by uncompleted contracts	9,229.50

APPROPRIATION.

March 3, 1905	$10,500

CONTRACT IN FORCE DURING FISCAL YEAR ENDING JUNE 30, 1905.

Eastern Dredging Company, dated June 28, 1905, for dredging 31,500 cubic yards measured in place, at 29.3 cents per cubic yard, to be commenced within sixty days after notification of approval of contract and completed within one hundred and twenty days after commencement.

COMMERCIAL STATISTICS.

Receipts and shipments, 1904.

	Tons.
Coal and lumber	3,639
Fish	2,929
General merchandise	1,781
Total	8,349

Number of passengers in 1904, 1,500.

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A 14.

IMPROVEMENT OF DAMARISCOTTA RIVER, MAINE.

No work was done during the year. A contract has been made for doing all the work covered by the project. It is to be accomplished during the present season.

No commercial statistics could be obtained.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1905	$5,000.00
June 30, 1905, amount expended during fiscal year, for works of improvement	25.53
July 1, 1905, balance unexpended	4,974.47
July 1, 1905, outstanding liabilities	5.60
July 1, 1905, balance available	4,968.87
July 1, 1905, amount covered by uncompleted contracts	4,177.36

APPROPRIATION.

March 3, 1905	$5,000

CONTRACT IN FORCE DURING FISCAL YEAR ENDING JUNE 30, 1905.

Eastern Dredging Company, dated June 28, 1905, for dredging 4,444 cubic yards, measured in place, at 94 cents per cubic yard, to be commenced within sixty days after notification of approval of contract and to be completed within forty-five days after commencement.

A 15.

IMPROVEMENT OF KENNEBEC RIVER, MAINE.

The work covered by the general project for improvement has been accomplished, except at Beef Rock shoal, where the depth has not been maintained nor the training wall entirely completed.

Under the project of 1902 for a greater depth between Gardiner and Augusta no actual work has yet been done. Proposals were opened for the second time on August 1, 1905, but the price bid was still in excess of the authorized cost. The disposal of the dredgings is the factor to which the high bids are attributed. This matter has now been taken up on somewhat different lines and it is proposed to again advertise the work at an early date.

It is proposed to apply a portion of the balance available for general improvement in dredging in the vicinity of Swan Island and the funds available and recommended for the work between Gardiner and Augusta to the dredging of the projected channel between those places.

The river and harbor act of March 3, 1905, directs a preliminary examination of the Kennebec River from the mouth to Gardiner.

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Money statement.

GENERAL IMPROVEMENT.

July 1, 1904, balance unexpended	$17,413.12
June 30, 1905, amount expended during fiscal year for works of improvement	737.45
July 1, 1905, balance unexpended	16,675.67
July 1, 1905, outstanding liabilities	75.00
July 1, 1905, balance available	16,600.67

BETWEEN GARDINER AND AUGUSTA.

July 1, 1904, balance unexpended	$40,000.00
July 1, 1905, balance unexpended	40,000.00
Amount (estimated) required for completion of existing project	41,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement in addition to the balance unexpended July 1, 1905	41,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

APPROPRIATIONS.

March 2, 1827	$4,000	June 23, 1874	$12,000
March 19, 1828	3,500	March 3, 1875	15,000
April 23, 1830	5,000	March 3, 1881	10,000
August 30, 1852	6,000	August 11, 1888	75,000
June 23, 1866	20,000	September 19, 1890	50,000
March 2, 1867	30,000	July 13, 1892	100,000
April 10, 1869	14,850	August 18, 1894	50,000
July 11, 1870	15,000	June 3, 1896	55,000
March 3, 1871	15,000	June 13, 1902	40,000
June 10, 1872	8,000		
March 3, 1873	12,000	Total	540,350

COMMERCIAL STATISTICS.

Receipts and shipments, 1904.

	Tons.
Cement and plaster	2,290
Coal	115,000
General merchandise	20,000
Hay	500
Ice	200,000
Iron and steel	5,000
Lumber	116,200
Pulp	3,521
Salt	969
Sand	2,500
Stone	3,000
Total	468,980

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Arrivals and departures during calendar year 1904.

Steamers, coastwise, average draft 12 feet	1,350
Sailing vessels:	
Foreign, average draft 12 feet	28
Coastwise, average 800 tons, 15 feet draft	1,200
Tugs on the river	6
Ferryboats	2
Vessels built during the year	27

Number of passengers in 1904, 88,954.

A 16.

IMPROVEMENT OF PORTLAND HARBOR, MAINE.

There were no operations during the fiscal year 1905. By the sundry civil act of March 3, 1905, Congress authorized an amendment to the project by which the 30-foot channel is to be continued up Fore River as far as the Boston and Maine Railroad bridge and a channel of entrance to Back Cove dredged to the same depth. The width in each case is be about 300 feet, and the work is to be done without increasing the total estimated cost of the project.

Specifications have been prepared and proposals invited by public advertisement, the bids to be opened July 12, 1905.

The funds, available and recommended, are proposed to be applied in carrying out the work covered by the amendment of 1905.

Money statement.

July 1, 1904, balance unexpended	$13,779.58
Amount appropriated by river and harbor act approved March 3, 1905	100,000.00
	113,779.58
June 30, 1905, amount expended during fiscal year, for works of improvement	868.42
July 1, 1905, balance unexpended	112,911.16
July 1, 1905, outstanding liabilities	115.02
July 1, 1905, balance available	112,796.14
Amount (estimated) required for completion of existing project	139,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	139,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

APPROPRIATIONS.

July 4, 1836, for breakwater	$10,000.00
March 3, 1837, for breakwater	25,000.00
July 7, 1838, for breakwater	26,366.00
June 23, 1866, for extending breakwater, but unexpended balance made available for excavating middle ground by joint resolution of June 5, 1868	105,111.05
July 11, 1870, for improving harbor	10,000.00
March 3, 1871, for improving harbor	40,000.00
June 10, 1872, for improving Portland Harbor and Back Bay	45,000.00
March 3, 1873, for improving harbor	50,000.00

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June 23, 1874, for improving harbor	$20,000.00
March 3, 1875, for improving harbor	20,000.00
March 3, 1881, for improving harbor	20,000.00
August 2, 1882, for improving harbor	35,000.00
July 5, 1884, for improving harbor	30,000.00
August 5, 1886, for improving harbor	30,000.00
August 5, 1886, for Back Cove	26,250.00
August 11, 1888, for improving harbor	40,000.00
August 11, 1888, for Back Cove	25,000.00
September 19, 1890, for improving harbor	40,000.00
September 19, 1890, for Back Cove	25,000.00
July 13, 1892, for improving harbor	30,000.00
July 13, 1892, for Back Cove	20,000.00
August 18, 1894, for Back Cove	20,000.00
June 3, 1896	20,000.00
June 4, 1897	350,000.00
July 1, 1898	200,000.00
March 3, 1901	21,000.00
March 3, 1905	100,000.00
Total	1,383,727.05

COMMERCIAL STATISTICS.

Receipts and shipments, 1904.

	Tons.
Apples	14,314
Beef	43,769
Bricks and clay	52,872
Brimstone	14,829
Cattle on hoof	21,898
Cement, lime, pipe, and plaster	15,232
Coal	1,220,477
Cotton and cotton goods	9,325
Fertilizer	15,000
Fish	31,022
General merchandise	265,877
Grain, flour, and hay	263,412
Leather and hides	6,590
Lumber and ship timbers	72,370
Machinery and iron	6,580
Molasses and sugar	17,600
Oatmeal	4,810
Oil and oilcloth	29,810
Paper and rags	49,950
Provisions and canned goods	65,775
Sand and stone	11,863
Total	2,233,475

Arrivals and departures during calendar year 1904.

Steamers:	
Foreign, 21 to 26 feet draft	192
Coastwise, 1,600 to 3,000 tons, draft 11 to 18 feet	1,350
Coastwise, 7 to 8½ feet, 77 to 170 tons	1,176
Coastwise, 7 to 8½ feet, 100 to 200 tons	3,650
Sailing vessels:	
Foreign, under 2,000 tons	6
Foreign barges, under 2,000 tons	36
Coastwise, over 2,000 tons, draft 16 to 19 feet	81
Coastwise, under 2,000 tons	86
Coastwise	29
Coastwise barges, over 2,000 tons	20
Coastwise barges, under 2,000 tons	80

Number of passengers in 1904, 1,301,742.

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A 17.

IMPROVEMENT OF SACO RIVER, MAINE.

[This work was in the charge of Col. W. S. Stanton, Corps of Engineers, to March 31, 1905.]

There were no expenditures during the fiscal year and no work was done.

On June 30, 1905, the entire existing project, or only 43 per cent of the existing project, dependent upon whether the project embraces the extension of the breakwater 2,200 feet to Sharp ledge, has been completed.

It is proposed to apply the available balance and the additional appropriation recommended to extending the breakwater toward Sharp ledge.

Money statement.

July 1, 1904, balance unexpended	$5,241.63
July 1, 1905, balance unexpended	5,241.63
Amount (estimated) required for completion of existing project	200,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	40,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

APPROPRIATIONS.

1824, application not designated	$5,000	August 5, 1886	$12,500
March 2, 1827	7,000	August 5, 1886	12,500
June 23, 1866	40,000	August 11, 1888	12,500
March 2, 1867	40,000	August 11, 1888	10,000
July 25, 1868	20,000	September 19, 1890	65,000
April 10, 1869	22,275	July 13, 1892	25,000
July 11, 1870	10,000	August 18, 1894	10,000
March 3, 1871	15,000	June 3, 1896	10,000
June 10, 1872	15,000	March 3, 1899	5,000
July 5, 1884	15,000	Total	351,775

NOTE.—In 1867 $3.25 was carried to surplus fund.

COMMERCIAL STATISTICS.

Receipts and shipments, 1904.

	Tons.
Coal	39,040
Gravel	360
Lumber	330
Total	39,730

Arrivals and departures during calendar year 1904.

Sailing vessels, draft 9 to 14 feet; barges, draft 9 to 14 feet	58

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A 18.

IMPROVEMENT OF KENNEBUNK RIVER, MAINE.

No work was done during the fiscal year on the existing project, which covers the repair of two piers at the mouth and a wharf just inside the river.

It is proposed to apply the available funds to carrying out the repairs indicated above.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1905	$3,500.00
July 1, 1905, balance unexpended	3,500.00

APPROPRIATIONS.

March 2, 1829	$5,000	March 3, 1871	$5,000
March 2, 1831	1,175	August 14, 1876	5,000
February 24, 1832	1,700	March 3, 1879	2,000
June 28, 1834	10,300	June 14, 1880	2,000
July 2, 1836	7,500	March 3, 1881	2,000
March 3, 1837	3,000	September 19, 1890	20,000
July 7, 1838	8,000	March 3, 1905	3,500
August 30, 1852	7,500		
July 11, 1870	5,000	Total	88,675

NOTE.—Amount carried to surplus fund, $1,590.99.

COMMERCIAL STATISTICS.

The commerce consisted of about 2,000 tons of coal. Two barges were built during the year.

A 19.

IMPROVEMENT OF YORK HARBOR, MAINE.

There were no expenditures during the year and no work was done. Bids for doing all the work (dredging) covered by the new project were opened June 30, 1905, and a contract will be made under which it will probably be accomplished during the present season. The funds available will be applied to this purpose.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1905	$13,400.00
July 1, 1905, balance unexpended	13,400.00
July 1, 1905, outstanding liabilities	50.00
July 1, 1905, balance available	13,350.00

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APPROPRIATIONS.

August 5, 1886	$15,000	July 13, 1892	$9,000
August 11, 1888	10,000	March 3, 1905	13,400
September 19, 1890	10,000		

COMMERCIAL STATISTICS.

Receipts and shipments, 1904.

	Tons.
Bricks	18,600
Coal	3,300
Total	21,900

A 20.

IMPROVEMENT OF HARBOR AT ISLES OF SHOALS, MAINE.

[This work was in the charge of Col. W. S. Stanton, Corps of Engineers, to March 31, 1905.]

No work was done during the year. The expenditures were for liabilities incurred during the previous fiscal year. The project is completed.

Money statement.

July 1, 1904, balance unexpended	$5,551.34
June 30, 1905, amount expended during fiscal year, for works of improvement	3,752.94
July 1, 1905, balance unexpended	1,798.40

APPROPRIATIONS.

March 3, 1821	$2,500.00
May 7, 1822	11,500.00
	14,000.00
Carried to surplus fund in 1824	748.39
	13,251.61
June 13, 1902	30,000.00
Total	43,251.61

COMMERCIAL STATISTICS.

Receipts and shipments, 1904.

	Tons.
Coal	500
Lumber	15
Fish	1,000
Total	1,515

Number of passengers in 1904, 5,000.

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A 21.

IMPROVEMENT OF COCHECO RIVER, NEW HAMPSHIRE.

[This work was in the charge of Col. W. S. Stanton, Corps of Engineers, to March 31, 1905.]

There were no operations during the fiscal year 1905. The project is regarded as about 97 per cent completed.

It is proposed to apply the available funds to redredging a portion of the channel at Dover, N. H., and to finishing an uncompleted section a short distance below.

Money statement.

July 1, 1904, balance unexpended	$889.07
Amount appropriated by river and harbor act approved March 2, 1905	21,711.00
	22,600.07
June 30, 1905, amount expended during fiscal year, for works of improvement	191.28
July 1, 1905, balance unexpended	22,408.79
July 1, 1905, outstanding liabilities	50.00
July 1, 1905, balance available	22,358.79

APPROPRIATIONS.

July 4, 1836	$5,000	August 5, 1886	$10,000
March 3, 1837	5,000	August 11, 1888	9,000
March 3, 1871	10,000	September 19, 1890	25,000
June 10, 1872	10,000	July 13, 1892	15,000
March 3, 1873	10,000	August 18, 1894	15,000
June 23, 1874	10,000	June 3, 1896	15,000
March 3, 1875	25,000	March 3, 1899	20,000
August 14, 1876	14,000	June 13, 1902	30,000
June 18, 1878	6,000	March 3, 1905	21,711
August 2, 1882	28,000		
July 5, 1884	28,000	Total	311,711

COMMERCIAL STATISTICS.

Receipts and shipments, 1904.

	Tons.
Brick	71,525
Coal	69,824
Lime and cement	35,000
Lumber	45,000
Phosphates	250
Potatoes and apples	30
Sand	5,000
Wood	3,000
Total	229,629

Arrivals and departures during calendar year 1904.

Barges, schooners, and tugs	300

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A 22.

IMPROVEMENT OF EXETER RIVER, NEW HAMPSHIRE.

[This work was in the charge of Col. W. S. Stanton, Corps of Engineers, to March 31, 1905.]

There were no expenditures during the fiscal year 1905, and no operations.

The project is completed.

Money statement.

July 1, 1904, balance unexpended	$745.58
July 1, 1905, balance unexpended	745.58

APPROPRIATIONS.

June 14, 1880	$20,000
March 3, 1881	15,000
March 3, 1899	12,000
June 13, 1902	7,000
Total	54,000

A 23.

HARBOR REFUGE AT LITTLE HARBOR, NEW HAMPSHIRE.

[This work was in the charge of Col. W. S. Stanton, Corps of Engineers, to March 31, 1905.]

Operations during the fiscal year 1905 consisted in repair of the breakwaters. In the north breakwater 446 tons of stone were placed, and in the south breakwater 30 tons. Seventeen coping stones were replaced.

The project itself is completed.

Money statement.

July 1, 1904, balance unexpended	$9,650.57
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	999.64
July 1, 1905, balance unexpended	8,650.93

APPROPRIATIONS.

August 5, 1886	$10,000	June 3, 1896	$10,000
August 11, 1888	20,000	March 3, 1899	12,000
September 19, 1890	40,000	June 13, 1902	13,000
July 13, 1892	30,000		
August 18, 1894	10,000	Total	145,000

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COMMERCIAL STATISTICS.

Receipts and shipments, 1904.

The commerce is inconsiderable. The improvement is designed to afford a harbor of refuge for yachts and coastwise vessels. During the year 1904, 466 vessels are reported to have anchored behind the breakwaters, including 101 steamers, 131 schooners, and 234 sloops.

A 24.

PROTECTION AND PRESERVATION OF THE NAVIGABLE WATERS OF THE UNITED STATES.

It has been estimated that the coast of Maine in its meanderings has a length of about 3,000 miles. With its multitude of small inlets and streams a vast number of small bridges have been constructed, and questions in connection with them are constantly arising. The coast population is largely interested in fishing and coast trading. The protection of the interests of navigation brings upon this office a great amount of work, consisting of small items, few of which are of great importance in themselves but the aggregate represents a large total. In the fiscal year ending June 30, 1904, this office has acted upon 31 fish-weir cases, 15 wharves, 2 embankments or dams, 19 bridges, besides much business in the matter of obstruction of navigable waters by mill waste. Some of these cases are easily disposed of; others require considerable investigation, study, and correspondence, and in frequent cases journeys to the localities. No funds have been asked for this class of business, but it is assuming such magnitude that it is felt that some special provision should be made. The duties devolving upon this office with respect to the protection of navigable waters are rapidly enlarging, and an annual allotment or appropriation of $3,000 could be profitably applied to this purpose.

A 25.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

The wreck of the schooner *Olive Branch* was an obstruction to navigation of Penobscot River at South Brewer, Me. It was removed in October, 1904, at a total cost of $384.61.

The owners of a small wooden schooner named *Silas McLoon*, moored it in Rockport Harbor and allowed it to sink. After some correspondence the owners raised and removed the vessel in November, 1904. There was no expense to the United States.

It was reported that the schooner *A. H. Whitmore*, derelict, had been placed in Stonington Harbor in such manner as to obstruct navigation.

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APPENDIX B.

IMPROVEMENT OF RIVERS AND HARBORS IN VERMONT, IN EASTERN MASSACHUSETTS, AND IN NEW YORK ON LAKE CHAMPLAIN.

REPORT OF COL. W. S. STANTON, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1905, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Harbor at Newburyport, Massachusetts.
2. Merrimac River, Massachusetts.
3. Powow River, Massachusetts.
4. Essex River, Massachusetts.
5. Harbor of refuge at Sandy Bay, Cape Ann, Massachusetts.
6. Harbor at Rockport, Massachusetts.
7. Harbor at Gloucester, Massachusetts.
8. Harbor at Manchester, Massachusetts.
9. Harbor at Beverly, Massachusetts.
10. Salem Harbor, Massachusetts.
11. Sea wall at Marblehead, Massachusetts.
12. Harbor at Lynn, Massachusetts.
13. Mystic and Malden rivers and Mystic River below the mouth of Island End River, Massachusetts.
14. Harbor at Boston, Massachusetts.
15. Weymouth and Town rivers, Massachusetts.
16. Harbor at Scituate, Massachusetts.
17. Harbor at Duxbury, Massachusetts.
18. Harbors at Plymouth and Provincetown, Massachusetts.
19. Harbor at Burlington, Vermont.
20. Otter Creek, Vermont.
21. Harbor at Plattsburg, New York.
22. Narrows of Lake Champlain, New York and Vermont.
23. Removing sunken vessels or craft obstructing or endangering navigation.

HARBOR LINES.

24. Charles River at Boston, Massachusetts.

UNITED STATES ENGINEER OFFICE,
Boston, Mass., July 20, 1905.

GENERAL: I have the honor to transmit herewith annual reports for the works of river and harbor improvement in my charge for the fiscal year ended June 30, 1905.

Very respectfully, your obedient servant,

W. S. STANTON,
Colonel, Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

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B 1.

IMPROVEMENT OF HARBOR AT NEWBURYPORT, MASSACHU

During the fiscal year, 11,328 tons of stone were deposited south jetty, of which 10,480 tons were used in building 197 feet to the full cross section and 75 feet of core below the g mean low water, and 848 tons were used in retopping 300 feet previously completed.

On June 30, 1905, the project was about 75 per cent accomp

It is proposed to apply the available balance and appro recommended to extension and any necessary maintenance of

Money statement.

July 1, 1904, balance unexpended		$32
Amount appropriated by river and harbor act approved March 3, 1905		30
		62
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$12,768.27	
For maintenance of improvement	1,093.92	
		13
July 1, 1905, balance unexpended		48
July 1, 1905, outstanding liabilities		1
July 1, 1905, balance available		47
July 1, 1905, amount covered by uncompleted contracts		14
Amount (estimated) required for completion of existing project		201
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905. Submitted in compliance with requirements of sundry civil act of June 4, 1897.		30

APPROPRIATIONS.

June 14, 1880	$50,000	August 18, 1894	$20
March 3, 1881	40,000	June 3, 1896	16
August 2, 1882	40,000	March 3, 1899	25
July 5, 1884	40,000	June 13, 1902	30
August 5, 1886	37,500	March 3, 1905	30
August 11, 1888	25,000		
September 19, 1890	25,000	Total	398
July 13, 1892	20,000		

CONTRACT IN FORCE.

Contractor: Joseph J. Callahan, Atlantic, Mass.
Date of contract: July 6, 1904.
Date of approval: July 18, 1904.
Date of commencement: July 15, 1904.
Date of completion: September 30, 1905.
For rubblestone in jetties at Newburyport Harbor, Mass., at $1.29 per ton of 2,000 pounds.

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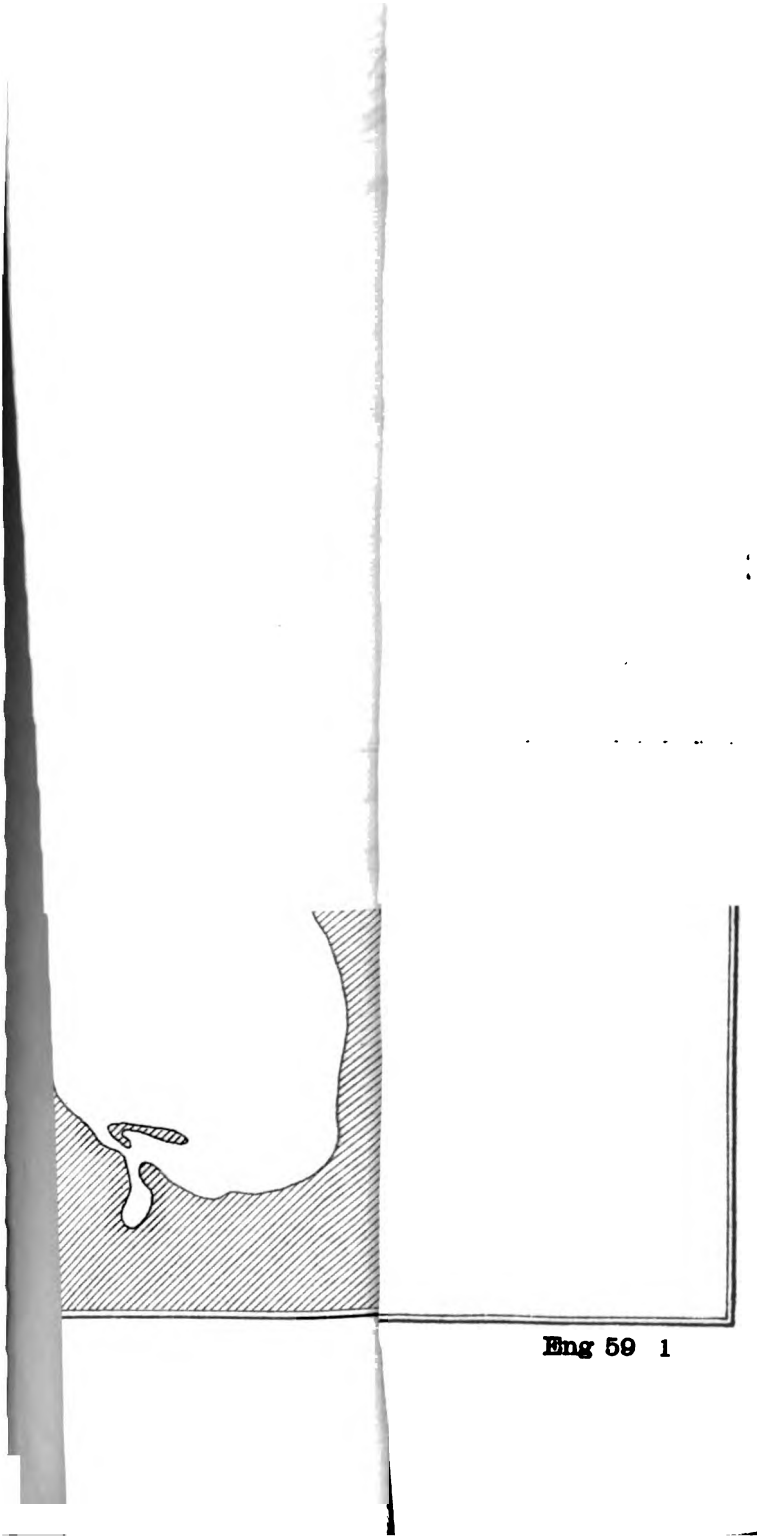

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COMMERCIAL STATISTICS.

Articles.	1903.	1904.
	Tons.	*Tons.*
Coal	140,118	153,855
Brick	400	
Stone		705
Oil		3,000
Pulp wood		542
Total	140,518	158,102

Of this freight 76,527 tons were reshipped in lighters to points on Merrimac and Powow rivers.

During the year 1904 there were 194 arrivals of vessels. The vessels frequenting this harbor are barges and schooners, with an average tonnage of 1,000; greatest draft, 15 feet.

B 2.

IMPROVEMENT OF MERRIMAC RIVER, MASSACHUSETTS.

For want of funds no work was done during the fiscal year ending June 30, 1905, when, of the 15,550 linear feet (3 miles) of channel that was to be dredged through eight shoals below the highway bridge at Haverhill 95 per cent was completed, but in the 2,750 feet of channel between the bridges at Haverhill, to be improved by the excavation of hard material, bowlders, and rock, no work had been done.

It is proposed to apply the available balance and the additional appropriation recommended to completing the project by extending the channel 2,750 feet from the highway bridge at Haverhill to the Boston and Maine Railroad bridge and by dredging to the full width through the shoal 3,000 feet above Rocks bridge.

Money statement.

July 1, 1904, balance unexpended	$576.41
Amount appropriated by river and harbor act approved March 3, 1905	40,000.00
July 1, 1905, balance unexpended	40,576.41
July 1, 1905, outstanding liabilities	176.24
July 1, 1905, balance available	40,400.17
Amount (estimated) required for completion of existing project	51,442.70
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	51,442.70

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

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APPROPRIATIONS.

May 23, 1828	$32,100.00	March 3, 1879	$5,000.00
April 2, 1830	3,506.72	June 14, 1880	12,000.00
March 2, 1831	16,000.00	March 3, 1881	9,000.00
March 2, 1833	4,900.00	August 2, 1882	9,000.00
June 28, 1834	3,860.00	July 5, 1884	3,500.00
June 4, 1842	8,000.00	September 19, 1890	10,000.00
July 11, 1870	25,000.00	July 13, 1892	1,500.00
March 3, 1871	25,000.00	June 3, 1896	5,000.00
June 10, 1872	25,000.00	March 3, 1899	40,000.00
March 3, 1873	25,000.00	June 13, 1902	40,000.00
June 23, 1874	10,000.00	March 3, 1905	40,000.00
March 3, 1875	12,000.00		
June 18, 1878	10,000.00	Total	375,366.72

NOTE.—In 1835, $900 was carried to surplus fund.

COMMERCIAL STATISTICS.

Articles.	1903.	1904.
	Tons.	*Tons.*
Coal	65,000	75,680
Brick	400	
Stone		705
Oil		1,600
Pulp wood		542
Total	65,400	76,527

B 3.

IMPROVEMENT OF POWOW RIVER, MASSACHUSETTS.

For want of funds no work was done upon this improvement during the fiscal year ended June 30, 1905.

By section 7 of the river and harbor act approved March 3, 1905. the provisions of river and harbor acts theretofore passed providing for the prosecution of work upon this project were repealed.

Money statement.

July 1, 1904, balance unexpended	$59.28
July 1, 1905, balance unexpended	59.28

APPROPRIATIONS.

August 11, 1888	$3,000	June 3, 1896	$12,000
September 19, 1890	5,000	March 3, 1899	12,000
July 13, 1892	4,000		
August 18, 1894	15,000	Total	51,000

COMMERCIAL STATISTICS.

Coal:	Tons.
1903	14,000
1904	10,377

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B 4.

IMPROVEMENT OF ESSEX RIVER, MASSACHUSETTS.

Complaint was made in May, 1905, that the improved channel in this river, reported February 2, 1901, as completed, was obstructed by a group of bowlders in midchannel, about 1,300 feet below the head of navigation, on which the depth was less than that prescribed in the project, and their removal, in completion of the project, authorized May 29, was completed June 24, 1905.

Money statement.

July 1, 1904, balance unexpended	$3,540.79
July 1, 1905, balance unexpended	3,540.79
July 1, 1905, outstanding liabilities	265.00
July 1, 1905, balance available	3,275.79

APPROPRIATIONS.

July 13, 1892	$5,000
August 18, 1894	5,000
June 3, 1896	5,000
March 3, 1899	10,000
Total	25,000

COMMERCIAL STATISTICS.

The commerce of the river is chiefly confined to the product of the three shipyards at Essex, where there are built annually about 30 schooners, each of about 125 tons register, at an average cost of $12,000.

B 5.

IMPROVEMENT OF HARBOR OF REFUGE AT SANDY BAY, CAPE ANN, MASSACHUSETTS.

During the fiscal year there were deposited in the breakwater 94,296½ tons of rubblestone, of which 62,510½ tons were placed in the western and 31,786 tons in the southern arm, all under the contract with Rockport Granite Company and Pigeon Hill Granite Company. This stone carried the western arm for a length of 280 feet (station 50+30 to 53+10) to the height of 12 feet below mean low water, with a width of 117 feet at the top, except for a small bench on the inner slope 13 feet deep and 17 feet wide, and for the same length carried the core of the superstructure up to mean low water with a width of 30 feet on top. The 31,786 tons deposited in the southern arm were placed on its seaward and harbor faces to fill them out to the prescribed slopes.

To June 30, 1905, 37 per cent of the total quantity of rubblestone

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required had been deposited in the substructure, which is approximately 28 per cent of the entire quantity of stone of all classes required for the breakwater.

It is proposed to apply the balance available and the appropriation recommended to the further extension of the rubble mound in the western arm up to the plane of mean low water and to placing a part of the selected stones on the faces of the southern and western arms.

Money statement.

July 1, 1904, balance unexpended	$92,855.66
Amount appropriated by river and harbor act approved March 3, 1905	100,000.00
	192,855.66
June 30, 1905, amount expended during fiscal year, for works of improvement	92,898.59
July 1, 1905, balance unexpended	99,957.07
July 1, 1905, outstanding liabilities	225.50
July 1, 1905, balance available	99,731.57
July 1, 1905, amount covered by uncompleted contracts	180,000.00
Amount (estimated) required for completion of existing project	5,454,952.25
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	100,000.00

APPROPRIATIONS.

July 5, 1884	$100,000	June 3, 1896	$150,000
August 5, 1886	100,000	March 3, 1899	250,000
August 11, 1888	100,000	June 13, 1902	200,000
September 19, 1890	150,000	March 3, 1905	100,000
July 13, 1892	150,000		
August 18, 1894	150,000	Total	1,450,000

CONTRACTS IN FORCE.

Contractor: Rockport and Pigeon Hill Granite companies, Rockport, Mass.
Nature of work: Construction of breakwater.
Date of contract: February 28, 1903.
Date of approval: March 16, 1903.
Date of commencement: On or before May 1, 1903.
Date of completion: On or before June 30, 1905.
Price: 73 cents per ton of 2,000 pounds for rubblestone, delivered in breakwater.

Contractors: The Federal Contracting Company, of New York, N. Y.
Date of contract: June 21, 1905.
Date of approval: July 12, 1905.
Date of commencement: Within thirty days after notification of approval.
Date of completion: On or before June 30, 1907.
For construction of breakwater: 300,000 tons of rubblestone, at 60 cents per ton of 2,000 pounds.

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COMMERCIAL STATISTICS.

Articles.	1903.	1904.
	Tons.	*Tons.*
Stone	424,600	364,700
Coal	10,100	13,050
Fish	1,860	1,890
Oil		59
Total	436,560	379,699

The value of this improvement is in the refuge it will provide for coastwise vessels.

B 6.

IMPROVEMENT OF HARBOR AT ROCKPORT, MASSACHUSETTS.

During the fiscal year 130.6 cubic yards of rocks were removed from the harbor under the contract with Hiram W. Phillips, completing the approved project.

Money statement.

July 1, 1904, balance unexpended	$3,179.13
June 30, 1905, amount expended during fiscal year, for works of improvement	3,179.13

APPROPRIATIONS.

March 2, 1829	$150.00	March 3, 1847	$645.30
July 4, 1836	10,000.00	June 13, 1902	22,000.00
March 3, 1837	20,000.00		
July 7, 1838	20,000.00	Total	91,232.57
February 13, 1845	18,437.27		

NOTE.—In 1833, $3.32 was carried to surplus fund.

CONTRACT IN FORCE.

Contractor: Hiram W. Phillips, Quincy, Mass.
Date of contract: October 6, 1904.
Date of commencement: October 10, 1904.
Date of completion: December 15, 1904.
For removing 130.6 cubic yards of ledge from Rockport Harbor, at $17.33 per cubic yard.
Contract completed.

COMMERCIAL STATISTICS.

Articles.	1903.	1904.
	Tons.	*Tons.*
Coal	2,500	700
Stone	990	1,500
Fish	881	250
Total	4,371	2,450

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B 7.

IMPROVEMENT OF HARBOR AT GLOUCESTER, MASSACHUSETTS.

During the fiscal year 843 linear feet of the superstructure were completed. There were deposited in the breakwater 34,040½ tons of stone, embracing 4,982 tons of rubblestone in the substructure, 16,322½ tons of dimension stone in the superstructure, 5,034 tons of rubblestone in the interior of the superstructure, and 3,865 tons of rubblestone in leveling the substructure preparatory to receiving the dimension stone in the superstructure, and 3,837 tons of riprap stone in an apron along the base of the superstructure on the seaward side.

To June 30, 1905, 92 per cent of the project had been accomplished.

It is proposed to apply the available balance and additional appropriation recommended to the completion of the breakwater and of the rubble mound to the height of 20 feet above mean low water for a light-house site at its end; also any balance remaining toward removal of Round Rock.

Money statement.

July 1, 1904, balance unexpended	$109,820.66
Amount appropriated by sundry civil act approved March 3, 1905	50,000.00
	159,820.66
June 30, 1905, amount expended during fiscal year, for works of improvement	105,748.16
July 1, 1905, balance unexpended	54,072.50
July 1, 1905, outstanding liabilities	41,159.30
July 1, 1905, balance available	12,913.20
July 1, 1905, amount covered by uncompleted contracts	6,512.05
Amount (estimated) required for completion of existing project	17,083.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	17,083.00

APPROPRIATIONS.

March 3, 1823 [a]	$6,000	March 3, 1899	$40,000
June 10, 1872	10,000	June 13, 1902	75,000
August 5, 1886	5,000	March 3, 1903	60,000
August 11, 1888	10,000	April 28, 1904	100,000
September 19, 1890	15,000	March 3, 1905	50,000
July 13, 1892	40,000		
August 18, 1894	40,000	Total	485,000
June 3, 1896	34,000		

CONTRACT IN FORCE.

Contractor: Rockport and Pigeon Hill Granite Companies, Rockport, Mass.
Nature of work: Construction of breakwater.
Date of contract: February 28, 1903.

[a] Authority: Index (1866–1900) to reports of Chief of Engineers. No record of its expenditure is found.

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Date of approval: March 17, 1903.
Date of commencement: On or before May 1, 1903.
Date of completion: On or before September 30, 1906.
Price:
Rubblestone in substructure and in the apron, $1.07 per ton of 2,000 pounds.
Dimension stone in superstructure, $4.80 per ton of 2,000 pounds.
Rubblestone in interior of superstructure, $1.97 per ton of 2,000 pounds.
Galvanized steel cramps in place, 15 cents per pound.
Supplemented by contract of November 11, 1903, for 4,100 tons, more or less, of stone used in leveling substructure already built.

COMMERCIAL STATISTICS.

[Furnished by the collector of customs at Gloucester, Mass.]

Amount of revenue collected.

1903	$11,263
1904	12,688

Receipts and shipments.

Articles.	1903.	1904.	Articles.	1903.	1904.
	Tons.	*Tons.*		*Tons.*	*Tons.*
Coal	100,000	110,000	Fish	65,000	51,765
Lumber	10,500	12,000	Cordwood	.....	3,988
Brick	1,000	1,000	Lime	1,200	1,300
Stone, sand, and gravel	4,000	6,550	Miscellaneous	104,160	80,000
Oil	2,000	2,000			
Iron	11,000	10,563	Total	328,501	263,526
Salt	29,641	84,385			

During the year 1904 about 85,000 passengers were carried to and from Gloucester by steamer. Thirty-nine schooners, with a gross tonnage of 3,650, were built in the vicinity during the year.

B 8.

IMPROVEMENT OF HARBOR AT MANCHESTER, MASSACHUSETTS.

For want of funds no work has been done upon this improvement during the fiscal year ending June 30, 1905, at which date the project was 31 per cent accomplished.

It is proposed to apply the balance available and the appropriation recommended to dredging to extend the channel 75 to 100 feet wide, in accordance with the project, to the town landing.

Money statement.

July 1, 1904, balance unexpended	$314.43
July 1, 1905, balance unexpended	314.43
Amount (estimated) required for completion of existing project	15,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	15,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

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APPROPRIATIONS.

August 11, 1888	$2,500
September 19, 1890	5,000
July 13, 1892	6,800
March 3, 1899	5,000
June 13, 1902	5,000
Total	24,300

COMMERCIAL STATISTICS.

	Tons.
Lumber	175
Stone	1,600
Total	1,775

B 9.

IMPROVEMENT OF BEVERLY HARBOR, MASSACHUSETTS.

A survey was made of the ledges of rock to be removed within the limits of the project to obtain the depth of 18 feet at mean low water, and proposals were invited for excavating as much of the rock as the available funds will permit, to which the entire available balance will be applied.

To June 30, 1905, the project of improvement was 91 per cent accomplished.

Money statement.

July 1, 1904, balance unexpended	$2,338.92
June 30, 1905, amount expended during fiscal year, for works of improvement	485.45
July 1, 1905, balance unexpended	1,853.47

APPROPRIATION.

June 13, 1902	$10,000

COMMERCIAL STATISTICS.

Shipments and receipts.

Articles.	1903.	1904.	Articles.	1903.	1904.
	Tons.	*Tons.*		*Tons.*	*Tons.*
Coal	77,229	103,000	Shingles		10
Lumber	6,000	6,333	Oil barrels	87	144
Stone	1,510	1,000	Sand	654	478
Iron		715	Piling	23	
Oil	6,462	27,000	Salt	88	
Lime and cement	982				
Fish	150	168	Total	93,085	138,848

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During the year 1904, 149 vessels arrived and 149 departed, the average tonnage being 476 and the average draft 15 feet.

The maximum draft and cargo of coal-carrying vessels arriving during the year were: Of schooners, draft 21 feet, cargo 1,800 tons; of barges, draft 22 feet, cargo 3,700 tons.

B 10.

IMPROVEMENT OF HARBOR AT SALEM, MASSACHUSETTS.

Proposals were opened June 26, 1905, for the dredging necessary to obtain by December 31, 1905, the authorized channel, to which purpose the balance available will be applied.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1905	$12,000.00
July 1, 1905, balance unexpended	12,000.00
July 1, 1905, outstanding liabilities	32.36
July 1, 1905, balance available	11,967.64

APPROPRIATIONS.

March 3, 1873	$15,000
June 3, 1874	10,000
September 19, 1890	14,000
July 13, 1892	14,000
March 3, 1905	12,000
Total	65,000

NOTE.—In 1899 $631.34 was carried to surplus fund.

COMMERCIAL STATISTICS.

[For South River.]

	Tons.
Coal	109,592
Lumber	325
Cement	400
Wood	525
Ties	225
Sand	900
Total	111,967

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B 11.

REPAIR OF SEA WALL AT MARBLEHEAD, MASSACHUSETTS.

For the reason that there is at present no purpose to which the available balance can be advantageously applied, nothing was done during the fiscal year.

Money statement.

July 1, 1904, balance unexpended	$918.38
June 30, 1905, amount expended during fiscal year, for works of improvement	2.38
July 1, 1905, balance unexpended	916.00

APPROPRIATIONS.

August 30, 1852	$500
March 3, 1899	1,000
Total	1,500

B 12.

IMPROVEMENT OF HARBOR AT LYNN, MASSACHUSETTS.

Under authority of the act of March 3, 1905, a continuing contract was made June 19, 1905, for completing by June 30, 1907, the entire project of improvement, to which purpose it is proposed to apply the available balance and the additional appropriation recommended.

Under this contract dredging commenced June 29, 1905, and 1,161 cubic yards had been dredged at the end of the fiscal year, when 13 per cent of the approved project had been accomplished.

Money statement.

July 1, 1904, balance unexpended	$6,436.44
Amount appropriated by river and harbor act approved March 3, 1905	40,000.00
	46,436.44
June 30, 1905, amount expended during fiscal year, for works of improvement	69.91
July 1, 1905, balance unexpended	46,366.53
July 1, 1905, outstanding liabilities	488.40
July 1, 1905, balance available	45,878.13
July 1, 1905, amount covered by uncompleted contracts	135,980.85
Amount (estimated) required for completion of existing project	97,937.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	97,937.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

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APPROPRIATIONS.

August 2, 1882	60,000	June 3, 1896	$20,000
August 5, 1886	6,000	June 13, 1902	25,000
August 11, 1888	10,000	March 3, 1905	40,000
September 19, 1890	15,000		
July 13, 1892	10,000	Total	193,500
August 18, 1894	7,500		

CONTRACT IN FORCE.

Contractor: Bay State Dredging Company, Boston, Mass.
Date of contract: June 18, 1905.
Date of approval: July 12, 1905.
Date of commencement: Within thirty days after notification of approval.
Date of completion: On or before June 30, 1907.
For dredging 646,000 cubic yards, more or less, in Lynn Harbor, Mass., at 20.95 cents per cubic yard.

COMMERCIAL STATISTICS.

[Through the courtesy of the collector of customs at Marblehead, Mass.]

Shipping.

Vessels.	Entrances.	Clearances.
Foreign	20	19
Domestic	2,068	2,063

Amount of revenue collected, $4,971.89.

Freight.

	Tons.
Coal	228,173
Lumber	6,448
Laths	150
Stone	3,207
Iron	1,115
Wood	608
Sand	35,334
Gravel	207
Miscellaneous	15,122
Total	290,364

B 13.

IMPROVEMENT OF MYSTIC AND MALDEN RIVERS AND MYSTIC RIVER BELOW THE MOUTH OF ISLAND END RIVER, MASSACHUSETTS.

(A) MYSTIC RIVER.

Proposals were opened June 27, 1905, for the dredging necessary to complete the improvement, to which purpose the available balance will be applied.

On June 30, 1905, 62 per cent of the approved project had been accomplished.

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Money statement.

July 1, 1904, balance unexpended	$3,500.00
Amount appropriated by river and harbor act approved March 3, 1905	6,500.00
July 1, 1905, balance unexpended	10,000.00

(B) MALDEN RIVER.

That part of the river embraced in the project above the first bridge at Malden having been reported June 28, 1902, unworthy of improvement, the available balance will be applied to maintenance in redredging the channel, completed in 1897, below that bridge to the depth of 12 feet at mean high water and width of 75 feet. Proposals for the necessary dredging were opened June 27, 1905.

Money statement.

July 1, 1904, balance unexpended	$1,964.00
Amount appropriated by river and harbor act approved March 3, 1905	12,500.00
July 1, 1905, balance unexpended	14,464.00
July 1, 1905, outstanding liabilities	32.12
July 1, 1905, balance available	14,431.88

(C) MYSTIC RIVER BELOW MOUTH OF ISLAND END RIVER, MASSACHUSETTS.

Proposals were opened June 26, 1905, for dredging the channel 25 feet deep at mean low water, to the width of 200 feet below Chelsea bridge, and of 300 feet above that bridge to the mouth of Island End River, to which purpose the available balance will be applied. The additional appropriation recommended will be applied to dredging the channel below Chelsea bridge to the projected width of 300 feet, completing the improvement except the 800 feet above the mouth of Island End River, where no work has been done.

On June 30, 1905, 43 per cent of the approved project had been accomplished.

Money statement.

July 1, 1904, balance unexpended	$244.31
Amount appropriated by river and harbor act approved March 3, 1905	31,000.00
July 1, 1905, balance unexpended	31,244.31
July 1, 1905, outstanding liabilities	32.47
July 1, 1905, balance available	31,211.84
Amount (estimated) required for completion of existing project	167,547.50
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	100,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

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APPROPRIATIONS.

Act of—	Mystic River (upper).	Malden River.	Mystic River below mouth of Island End River.	Total.
August 2, 1882		$10,000		$10,000
July 13, 1892	$5,000	5,000		10,000
August 18, 1894	5,000	5,000		10,000
June 3, 1896	5,000	5,000		10,000
March 3, 1899	2,500	2,500		5,000
Do			$50,000	50,000
June 6, 1900		[a]5,000		5,000
June 13, 1902	1,000	5,000	19,000	25,000
March 3, 1905	6,500	12,500	31,000	50,000
Total	25,000	50,000	100,000	175,000

[a] Allotment.

COMMERCIAL STATISTICS.

Mystic and Malden rivers.

	Coal.	Lumber.	Stone.	Molasses.	Total.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Mystic River above Western Division bridge	20,100	165	4,500	1,200	25,965
Malden River	75,225				75,225

Mystic River.

[Commerce using channel below mouth of Island End River.]

	Tons.		Tons.
Coal	2,136,318	Cinder	9,545
Lumber	95,270	Wood	22,196
Sand, stone, and gravel	50,192	Hay	3,612
Brick	2,351	Lime	13,165
Grain	22,136	Cement	8,763
Cotton	82,366	Pulp wood	10,420
Steel	2,911	Fertilizers	12,424
Iron	7,090	Flour	9,870
Oil	3,801	Molasses	1,200
Pyrites	4,536	Kaolin	400
Coal tar	8,068	Chemicals	204
Logs	42,742	Miscellaneous	285,775
Pitch	2,571		
Brimstone	3,081	Total	2,841,007

B 14.

IMPROVEMENT OF HARBOR AT BOSTON, MASSACHUSETTS.

TWENTY-SEVEN FOOT CHANNEL.

During the fiscal year, under the contract for removing to the depth of 27 feet at mean low water from the lower main ship channel 21 ledges, embracing 3.7 acres and amounting to 19,008 cubic yards at $9.73 per cubic yard, about 356 holes have been drilled and blasted on 11 ledges, covering 3.07 acres, about completing the blasting of all ledges embraced in the contract. From 11 ledges 85,722.5 cubic yards,

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scow measurement, were removed; but only two ledges (Nos. 20 and 32) that covered 11,790 square feet and contained 484 cubic yards (measured in situ) have been entirely removed to this date. On the 19 other ledges scattering fragments of rock or points remain to be removed to complete the contract.

Although the contractors have been repeatedly and with emphasis reminded of their unsatisfactory progress and have been repeatedly urged to hasten the work, at the close of the fiscal year June 30, 1905, it was eighteen months behind time, an excess of 90 per cent over the time stipulated in the specifications. As they had previously dredged a part of the lower main ship channel to the depth of 27 feet and as the excavation of rock of the same character was in progress in the upper main ship channel when the contractors were at work in the harbor, they had, before bidding, exceptional opportunities for obtaining full information of the conditions affecting the work required by the contract.

The contract, made April 26, 1905, for excavating rock under the 35-foot project to the depth of 35 feet at mean low water embraces 1,338 cubic yards of rock above the depth of 27 feet within the limits of the 27-foot project, the removal of which will be paid for from the balance available for the 27-foot project.

Under the contract with the Submarine Contracting Company for removing to the depth of 27 feet at mean low water from the lower main ship channel 3 ledges, covering 3,470 square feet, amounting to 223 cubic yards, at $18.50 per cubic yard, and from the upper main ship channel 11 ledges, covering 28,610 square feet, amounting to 2,066 cubic yards, at $15.50 per cubic yard, the removal of the 3 ledges in the lower main ship channel has been completed. Of the 11 ledges in the upper main ship channel 4 ledges (Nos. 1, 6, 7*a*, and 9) have been entirely removed to the depth of 27 feet at mean low water, 6 have been partially drilled and blasted, and upon one no work has been done. Early in the fiscal year the contractors discontinued the use of their chisel or rock crusher and installed upon their scow two steam drills with which they have since made better progress. At the close of the fiscal year June 30, 1905, the work is twelve months behind time, an excess of 133 per cent over the time stipulated in the contract, owing to the failure of the contractors to timely provide a plant adapted to the work.

In maintenance of that part of the lower main ship channel extending from President Roads to a point a little outside of Hunts Ledge, there were dredged during the year 26,600 cubic yards of sand, gravel, and clay, by a dredge, with tug and scows, all officered and manned complete, hired at $247 per day, costing 79½ cents per cubic yard.

In maintenance of that part of the lower main ship channel extending from Nix Mate to the lower end of Gallops Island, there were dredged by the United States hydraulic dredge *Genl. Gillespie*, between January 21 and April 17, 1905, 46,841 cubic yards of mud, sand, gravel, and clay, costing for the operation and care of the dredge and supervision of the work about 44 cents per cubic yard.

The dredging both by hired dredge and by the United States dredge *Genl. Gillespie* was skimming for the removal of numerous widely scattered shoals.

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THIRTY-FOOT CHANNEL.

Under the supplemental contract with G. H. Breymann & Bros., to widen 55 feet to the west the seaward reach of the channel 1,200 feet wide to avoid the costly removal of 5 ledges in its easterly 55 feet, 39,568 cubic yards of sand, gravel, and clay were removed at 35 cents per cubic yard.

Under emergency contract with G. H. Breymann & Bros., 2 ledges (Nos. 1 and 7) containing 156 cubic yards of rock, situ measurement, were removed to the depth of 30 feet below mean low water, at $30 per cubic yard, completing the inner arm and the rock excavation in the outer arm of the channel.

On June 30, 1905, about 98 per cent of this project had been completed.

It is proposed to apply the available balance in dredging necessary to complete the channel 1,200 feet wide and 30 feet deep at mean low water.

THIRTY-FIVE FOOT CHANNEL.

Under this project 2,242,502.5 cubic yards of mud, sand, clay, etc., were dredged, and 4.2 cubic yards of bowlders over 6 tons in weight each were removed, of which 2,090,111 cubic yards of mud, sand, clay, etc., and 4.2 cubic yards of bowlders were dredged from the channel extending from the Charles River and Chelsea bridges and the navy-yard to President Roads, and 152,391.5 cubic yards of sand, gravel, and clay from the channel extending in Broad Sound from President Roads to the sea.

Of the foregoing quantities there were dredged, under the contract with Breymann Brothers (division 1), above President Roads, 442,370 cubic yards, at 20 cents per cubic yard, and in Broad Sound 55,707 cubic yards, at 39 cents per cubic yard; under the contract with Morris & Cumings Dredging Company (division 2), above President Roads, 281,644 cubic yards of mud, sand, and clay, at 23.4 cents per cubic yard, and 4.2 cubic yards of bowlders at $12 per cubic yard, and in Broad Sound 96,684.5 cubic yards, at 40 cents per cubic yard; under the contract with George H. Breymann (division 3), above President Roads, 648,968 cubic yards, at 23½ cents per cubic yard; and under the contract with Eastern Dredging Company and New England Dredging Company (division 4), above President Roads, 717,129 cubic yards, at 23.9 cents per cubic yard.

April 26, 1905, a contract was made with G. H. Breymann & Bros., for excavating 16,555 cubic yards of ledge rock in the upper main ship channel off Governors Island, of which 1,338 cubic yards being above the depth of 27 feet below mean low water and within the limits of the 27-foot channel will be paid for from funds available for the 27-foot project.

It is proposed to apply the available balance and additional appropriation recommended to dredging and rock excavation.

Fifteen per cent of the volume of excavation required by the project has been done, but as there will be a large amount of costly rock excavation which has not been commenced, less than 15 per cent of the project has been accomplished.

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SEA WALLS.

MAINTENANCE.

On Deer Island 350 feet of joints in the Middle Head sea wall were repointed, 70 linear feet of foundation repaired with concrete, and 260 yards of back filling put in place.

On Rainsford Island 184 linear feet of the coping course in the sea wall and 167 square yards of paving were reset and 45 tons of riprap were replaced to protect the foundation of the wall.

On Great Brewster Island about 80 tons of riprap stone were set to protect the southwestern end of the sea wall and 750 linear feet of joints were repointed.

On Georges Island 142 linear feet of the coping course in the sea wall and 94 square yards of paving were reset.

It is proposed to apply the available balance to maintenance of the sea walls.

TRIBUTARY CHANNELS.

Charles River.—The river and harbor act of September 19, 1890, appropriated—

twenty thousand dollars for continuing improvement of Charles River: *Provided*, That no expenditure of said twenty thousand dollars shall be made until the draws in the Arsenal street and Market street bridges shall be made to conform to the projected channel without cost to the United States.

To June 7, 1884, the improvement was completed up to Arsenal Street Bridge, on which date the work was discontinued to await the alteration of the bridges to conform to the requirement in the above act. The improvement remaining to be made under the project is to extend the channel 80 feet wide and 6 feet deep 3,900 feet, to the Market Street Bridge, and from Market Street Bridge 8,725 feet, to the dam at Watertown, 60 feet wide and 2 feet deep.

The Arsenal Street Bridge has been altered to conform to the foregoing requirements, but the alteration has not been made in the Market Street Bridge, and no work has been done on the improvement during the fiscal year.

By provisos in the following acts of Congress amounts as follows have been appropriated for this improvement from appropriations for the improvement of Boston Harbor:

June 14, 1880	$22,500
March 3, 1881	35,000
September 19, 1890	20,000
Total	77,500
Amount not yet appropriated	47,500
Total estimated cost of existing project	125,000

On June 30, 1905, the project has been 40 per cent completed.

There is available for this improvement $20,000 appropriated by the act of September 19, 1890, which amount is included in the "balance available, $158,370.69," shown in the money statement for "General improvement, Boston Harbor," and which it is proposed to apply to maintenance and, if authorized by Congress, to the continuation of the channel to Brackett's wharf.

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Fort Point channel.—For the reason that sufficient funds were not available, no work has been done on this improvement during the fiscal year ended June 30, 1905, at which date the improvement had been 33 per cent completed.

It is proposed to apply the additional appropriation recommended to the completion of the improvement.

There has been applied to this improvement, from appropriations for the improvement of Boston Harbor, by proviso in the—

Act of August 5, 1886	$18,750
Amount not yet appropriated	60,000
Total estimated cost of existing project	78,750

Chelsea Creek.—Proposals were invited June 14, 1905, for the dredging necessary to complete the project, to which purpose will be applied the available balance $52,997.06 included in the balance available in the money statement for "General improvement, Boston, Harbor."

On June 30, 1905, 17 per cent of the project had been completed.

There has been appropriated for this improvement from appropriations for the improvement of Boston Harbor—

By proviso in the act of June 3, 1896	$7,000
By proviso in the act of March 3, 1899	5,000
By allotment from appropriation act of June 13, 1902	3,000
By allotment from appropriation act of March 3, 1905	50,000
Total estimated cost of existing project	65,000

There is available for this improvement $52,997.06, which amount is included in the "balance available, $158,370.69" shown in the money statement for "General improvement, Boston Harbor."

Money statements.

PROJECT FOR GENERAL IMPROVEMENT.

July 1, 1904, balance unexpended	$59,981.44
Amount appropriated by river and harbor act approved March 3, 1905	100,000.00
	159,981.44
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	1,083.91
July 1, 1905, balance unexpended	158,897.53
July 1, 1905, outstanding liabilities	526.84
July 1, 1905, balance available	158,370.69
Amount (estimated) required for completion of existing project	73,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the baalnce unexpended July 1, 1905	26,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

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PROJECT FOR 27-FOOT CHANNEL.

July 1, 1904, balance unexpended		$335,166.94
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$162,037.35	
For maintenance of improvement	40,335.78	
		202,373.13
July 1, 1905, balance unexpended		132,793.81
July 1, 1905, outstanding liabilities		9,249.84
July 1, 1905, balance available		123,543.97
July 1, 1905, amount covered by uncompleted contracts		63,761.74

PROJECT FOR 30-FOOT CHANNEL.

July 1, 1904, balance unexpended	$120,154.80
June 30, 1905, amount expended during fiscal year, for works of improvement	23,453.86
July 1, 1905, balance unexpended	96,700.94
July 1, 1905, outstanding liabilities	11,328.09
July 1, 1905, balance available	85,372.85
July 1, 1905, amount covered by uncompleted contracts	12,493.40

PROJECT FOR 35-FOOT CHANNEL.

July 1, 1904, balance unexpended	$853,860.57
Amount appropriated by sundry civil act approved March 3, 1905	970,000.00
	1,823,860.57
June 30, 1905, amount expended during fiscal year, for works of improvement	518,386.40
July 1, 1905, balance unexpended	1,305,474.17
July 1, 1905, outstanding liabilities	129,373.85
July 1, 1905, balance available	1,176,100.32
July 1, 1905, amount covered by uncompleted contracts	1,774,017.23
Amount (estimated) required for completion of existing project	5,924,248.68
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	600,000.00

APPROPRIATIONS.

March 2, 1825	$52,972.56	March 3, 1841	$1,500.00
March 19, 1828	2,000.00	August 31, 1842	2,000.00
May 23, 1828	87,000.00	March 3, 1843	16,000.00
March 2, 1829	7,310.54	July 20, 1848	40,000.00
March 2, 1831	5,000.00	August 30, 1852	30,000.00
March 2, 1831	12,390.00	July 2, 1864	40,000.00
February 24, 1832	9,000.00	July 2, 1864	10,000.00
July 3, 1832	60,000.00	February 28, 1865	3,000.00
July 4, 1836	15,000.00	February 28, 1865	20,000.00
July 7, 1838	7,353.00	June 12, 1866	50,000.00
March 3, 1841	1,000.00	June 12, 1866	75,000.00

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March 2, 1867	$375,000.00	September 19, 1890	$145,000.00
July 25, 1868 [a]	43,000.00	July 13, 1892	300,000.00
April 10, 1869 [a]	82,170.00	August 18, 1894	200,000.00
April 10, 1869 [a]	24,750.00	June 3, 1896	70,000.00
July 11, 1870	100,000.00	June 4, 1897 [c]	400,000.00
March 3, 1871	100,000.00	July 1, 1898 [c]	250,000.00
June 10, 1872	75,000.00	March 3, 1899	75,000.00
March 3, 1873	150,000.00	March 3, 1899 [c]	163,751.00
June 23, 1874	100,000.00	June 6, 1900 [c]	317,000.00
March 3, 1875 [b]	90,000.00	March 3, 1901 [c]	133,000.00
August 14, 1876	50,000.00	June 13, 1902	100,000.00
June 18, 1878	55,000.00	June 13, 1902	600,000.00
March 3, 1879	50,000.00	June 28, 1902 [c]	175,000.00
June 14, 1880	75,000.00	March 3, 1903 [c]	150,000.00
March 3, 1881	100,000.00	April 28, 1904 [c]	350,000.00
August 2, 1882	96,500.00	March 3, 1905 [c]	970,000.00
July 5, 1884	5,000.00	March 3, 1905	100,000.00
August 5, 1886	56,250.00		
August 11, 1888	125,000.00	Total	6,797,947.10

NOTE.—From 1830 to 1872 $1,619.52 was carried to surplus fund.

CONTRACTS IN FORCE.

THIRTY-FIVE-FOOT CHANNELS.

Division 1.—Contract dated February 25, 1903: Breymann Brothers, of oledo, Ohio, contractors, to dredge 1,875,000 cubic yards, more or less, at 20 nts per cubic yard, from section 1, and 570,000 cubic yards, more or less, at 39 nts per cubic yard, from section 1a, total 2,445,000 cubic yards; approved arch 12; to be commenced by September 13, 1903; to be completed by Decem- r 31, 1907.

Division 2.—Contract dated February 26, 1903: Morris & Cumings Dredging ompany, of New York, N. Y., contractors, to dredge 1,875,000 cubic yards, more less, at 23.4 cents per cubic yard, from section 2, and 570,000 cubic yards, ore or less, at 40 cents per cubic yard, from section 2a, total 2,445,000 cubic rds; approved March 12; to be commenced by September 13, 1903; to be com- eted by December 31, 1907.

Division 3.—Contract dated February 25, 1903: George H. Breymann, of oledo, Ohio, contractor, to dredge 1,875,000 cubic yards, more or less, at 23.5 nts per cubic yard, from section 3, and 570,000 cubic yards, more or less, at 39 nts per cubic yard, from section 3a, total 2,445,000 cubic yards; approved arch 12; to be commenced by September 14, 1903; to be completed by Decem- r 31, 1907.

Division 4.—Contract dated February 19, 1903: Eastern Dredging Company nd New England Dredging Company, of Boston, Mass., contractors, to dredge 875,000 cubic yards, more or less, at 23.9 cents per cubic yard, from section 4, nd 570,000 cubic yards, more or less, at 39.7 cents per cubic yard, from section , total 2,445,000 cubic yards; approved March 16; to be commenced by Sep- mber 16, 1903; to be completed by December 31, 1907.

Contract dated April 26, 1905: G. H. Breymann & Bros., of Toledo, Ohio, ntractors, to excavate 16,555 cubic yards of ledge in Boston Harbor, Massa- usetts, at $16 per cubic yard situ measurement; approved June 2, 1905; to commenced thirty days after date of notice of approval; to be completed cember 31, 1906.

BROAD SOUND CHANNEL.

Contract dated March 13, 1900: G. H. Breymann & Bros., of Toledo, Ohio, ntractors, to dredge 836,082 cubic yards, more or less, of material from Broad und channel, Boston Harbor, Massachusetts, at 35 cents per cubic yard;

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[a] Allotment.
[b] Excluding $10,000 allotted to Hingham Harbor.
[c] Sundry civil act.

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approved March 31, 1900; to be commenced July 1, 1900; to be completed June 30, 1902; time for completion waived for a reasonable period.

Contract supplemental to above entered into August 25, 1903, for dredging 75,292 cubic yards additional at the same price.

Contract dated August 12, 1904: G. H. Breymann & Bros., of Toledo, Ohio, contractors, for removing 156 cubic yards of ledge from Broad Sound channel, Boston Harbor, Massachusetts, at $30 per cubic yard situ measurement; to be commenced August 20, 1904; to be completed October 31, 1904; contract completed.

TWENTY-SEVEN-FOOT CHANNEL.

Contract dated April 30, 1902: G. H. Breymann & Bros., of Toledo, Ohio, contractors, to excavate 19,008 cubic yards, more or less, of ledge in the lower main ship channel, Boston Harbor, Massachusetts, at $9.73 per cubic yard situ measurement; approved June 3, 1902; to be commenced August 5, 1902; to be completed December 31, 1903; time limit for completion waived for a reasonable period.

Contract dated September 26, 1903: Submarine Contracting Company, of New York, N. Y., contractors, to excavate 2,066 cubic yards, more or less, of ledge, at $15.50 per cubic yard, from the upper main ship channel, and 223 cubic yards, more or less, at $18.50 per cubic yard, from the lower main ship channel, Boston Harbor, Massachusetts; approved October 19, 1903; to be commenced within thirty days from date of notification of approval of contract; to be completed June 30, 1904; time limit for completion waived for a reasonable period.

Contract dated August 9, 1904: John H. Gerrish, of Melrose, Mass., contractor, for furnishing dredging plant in Boston Harbor, Massachusetts, at the rate of $247 per day; to be commenced within ten days after date of signature of contract and to be completed December 1, 1904; time of completion waived; contract completed December 14, 1904.

GENERAL.

Contract dated April 1, 1905: C. W. Howard, of Peak Island, Me., contractor, for furnishing steamer *Comet*, at the rate of $9 per day; to be commenced immediately after date of signature of contract and to be completed December 31, 1905.

Contract dated April 1, 1905: Commercial Wharf Company, of Boston, Mass., contractors, for rent of wharf at Boston, Mass., at the rate of $150 per month; to be commenced at date of contract and to expire by limitation December 31, 1907, but may be terminated by either party upon one month's notice in writing.

COMMERCIAL STATISTICS FOR BOSTON HARBOR.

The following statement concerning the foreign trade at the port of Boston is compiled from statistics and records of the Boston Chamber of Commerce and of the collector of the port. It comprises only imports and exports and does not include domestic, coastwise, and local traffic. Vessels engaged in the coastwise trade, unless they have in their cargoes bonded merchandise to the value of $350 or more, are not required by law to take out clearance papers, and no statistics of their carrying trade are accessible.

During 1904 the foreign trade of the port made a slight gain both as to imports and exports over the previous year. The increase was not, however, sufficient to enable the port to regain the second place among the great ports of the country in the total value of her trade, although in the volume of her imports Boston easily holds the second position.

Year.	Imports.	Exports.	Total.
1904	$86,268,648	$87,866,428	$174,135,076
1903	82,762,828	86,429,988	169,192,816
1902	78,144,123	86,655,666	164,799,789

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In addition, the in-transit and transshipment trade passing through the port of Boston (principally to and from Canada) amounted to $22,653,083, making the total foreign trade through the port during the year 1904, $196,738,159.

The leading articles of import and export at the port of Boston for the year ending December 31, 1904, with the value and tonnage of each, were as follows:

EXPORTS.

Articles.	Tons.	Value.
Provisions, including animals	296,506	$44,011,076
Leather, and manufactures	26,685	12,753,640
Cotton, and manufactures	40,686	8,595,331
Breadstuffs	282,203	5,906,533
Iron and steel manufactures	140,096	4,297,181
Miscellaneous	.....	12,302,667
Total	.....	87,866,428

IMPORTS.

Articles.	Tons.	Value.
Wool	42,394	$18,382,610
Fibers and grasses and manufactures	88,599	12,856,141
Hides and skins	61,460	8,131,608
Sugar	183,106	7,312,971
Cotton and manufactures	18,698	7,556,949
Chemicals, drugs, and dyes	40,109	4,243,877
Leather and manufactures	1,024	2,374,280
Iron and steel and manufactures	79,000	2,470,638
Miscellaneous	.....	22,969,574
Total	.....	86,268,648

The trans-Atlantic traffic maintained during the year 1904 the growth that has characterized it during the last few years. The following table shows the passenger movement during the past three years:

Arrived and sailed.	1904.	1903.	1902.
Cabin passengers	24,599	26,055	20,867
Steerage passengers	77,155	75,690	65,982
Total	101,754	101,745	86,849

Maximum draft of vessels leaving harbor (1904)[a]	feet	28½
Maximum draft of vessels entering harbor (1904)[a]	do	27
Total sailings by steamship lines to European ports		345
Total collections of revenue by the collector of customs for the year ended December 31, 1904		$23,102,087.97

Arrivals and departures.

Year.	Arrivals.			Departures.		
	Coastwise.	Foreign.	Total.	Coastwise.	Foreign.	Total.
1901	10,415	1,957	12,372	2,141	1,824	3,965
1902	8,516	1,898	10,414	2,396	1,648	4,044
1903	9,316	1,740	11,056	2,310	1,449	3,759
1904	8,799	1,516	10,315	1,933	1,355	3,288

[a] In April, 1905, the Liverpool and Boston service was increased by the passenger steamship *Arabic*, of 15,801 tons and draft of 33 feet 10½ inches.

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Tonnage of vessels arriving and leaving port of Boston.

Year.	Foreign.			Coastwise.		
	Entrances.	Clearances.	Total.	Arrivals.	Tonnage.	Total tonnage in and out.
1901	2,475,436	2,210,686	4,686,122	10,415	8,724,118	17,448,296
1902	2,614,817	2,063,399	4,698,216	8,516	7,291,961	14,583,862
1903	2,886,181	2,283,287	5,119,468	9,316	8,419,789	16,839,578
1904	2,642,902	2,157,966	4,800,868	a 8,799	8,410,364	16,820,728

a Not including 4,056 fishing vessels, which landed 82,094,166 pounds of fish, valued at $2,066,293.

TRIBUTARY CHANNELS, BOSTON HARBOR.

(*a*) *Charles River (above Harvard Bridge).*

	Tons.
Coal	112,482

(*b*) *Fort Point Channel.*

Coal	995,181
Lumber	97,756
Brick	28,698
Stone	16,548
Sugar	153,228
Cotton	2,700
Steel	1,500
Molasses	3,800
Iron	7,870
Oil	25,375
Salt	4,846
Fish	6,000
Wood	6,025
Lime	18,275
Cement	22,144
Sand	13,677
Gravel	9,168
Plaster	2,478
Miscellaneous	73,296
Total	1,488,565
Passengers	5,851

(*c*) *Chelsea Creek.*

Coal	4,165
Brick	490
Total	4,655

B 15.

IMPROVEMENT OF WEYMOUTH AND TOWN RIVERS, MASSACHUSETTS.

(A) WEYMOUTH FORE RIVER (BELOW WEYMOUTH FORE RIVER BRIDGE).

The entire estimated cost of this improvement—$57,500—was appropriated by the act of March 3, 1905, with the proviso:

That no part of this sum shall be expended until the Secretary of War shall have received satisfactory assurance that the improvement of that portion of the

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Weymouth River which lies above the improvement herein mentioned, and of the Town River, except so much as is herein provided for, shall hereafter be maintained by the State of Massachusetts, or other agency, without expense to the Government of the United States.

May 26, 1905, the legislature of Massachusetts passed and the governor approved a resolve as follows:

That the condition set forth in the act of Congress known as the river and harbor bill, and approved March the third, nineteen hundred and five, which requires that the sum appropriated by Congress by said act for completing the improvement of Town River and of Weymouth Fore River in this Commonwealth shall not be expended until the Secretary of War shall have received satisfactory assurance that the improvement of that part of the Weymouth River which lies above the improvement provided for by the said act of Congress, and also the improvement of the Town River, except so much thereof as is provided for by the said act, shall hereafter be maintained by the Commonwealth of Massachusetts, or other agency, without expense to the Government of the United States, is hereby accepted, and the said condition shall be observed by the Commonwealth in accordance with the terms of the act of Congress aforesaid.

The resolve was accepted by the Secretary of War June 7, 1905.

The appropriation available will be applied to dredging, proposals for which were advertised for June 22, and will be opened July 22, 1905.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1905	$57,500.00
July 1, 1905, balance unexpended	57,500.00
July 1, 1905, outstanding liabilities	47.50
July 1, 1905, balance available	57,452.50

(B 1) WEYMOUTH RIVER (ABOVE WEYMOUTH FORE RIVER BRIDGE).

On June 26, 1905, proposals were opened for dredging to restore a practicable channel of the depth of 6 feet from Richards's wharf to the head of the improvement and to widen the channel, to which purposes the available balance will be applied.

On June 30, 1905, the project for improving Weymouth River above the bridge was 95 per cent accomplished.

Money statement.

July 1, 1904, balance unexpended	$5,289.12
July 1, 1905, balance unexpended	5,289.12
July 1, 1905, outstanding liabilities	26.07
July 1, 1905, balance available	5,263.05

(B 2) WEYMOUTH BACK RIVER.

For lack of funds no work was done during the fiscal year ending June 30, 1905, when the project was 60 per cent accomplished.

The available balance and additional appropriation recommended will be applied to dredging the channel to the projected dimensions.

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Money statement.

July 1, 1904, balance unexpended	$746.41
July 1, 1905, balance unexpended	746.41
Amount (estimated) required for completion of existing project	9,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	9,500.00

(C) TOWN RIVER.

On June 26, 1905, proposals were opened for completing the project and dredging for maintenance, to which purposes the available balance will be applied.

On June 30, 1905, the project was 80 per cent accomplished.

Money statement.

July 1, 1904, balance unexpended	$9,885.65
Amount appropriated by river and harbor act approved March 3, 1905	9,827.41
July 1, 1905, balance unexpended	19,713.06
July 1, 1905, outstanding liabilities	26.06
July 1, 1905, balance available	19,687.00

APPROPRIATIONS.

Act of—	(A) Weymouth Fore River.	(B 1) Weymouth River (upper).	(B 2) Weymouth Back River.	(C) Town River.	Total.
September 19, 1890		$10,000			$10,000.00
July 13, 1892		10,000			10,000.00
August 18, 1894		2,500	$2,500		5,000.00
June 3, 1896		5,000	10,000		15,000.00
Do				$10,000.00	10,000.00
March 3, 1899				8,000.00	8,000.00
Do		10,000			10,000.00
June 13, 1902		5,250		9,750.00	15,000.00
March 3, 1905	$57,500				57,500.00
Do				9,827.41	9,827.41
Total	57,500	42,750	12,500	37,577.41	150,327.41

COMMERCIAL STATISTICS.

Weymouth River.

Articles.	1903.	1904.
	Tons.	*Tons.*
Coal	84,702	86,441
Lumber	5,100	6,989
Lime	270	175
Brick	2,343	684
Sand	344	
Gravel		315
Steel		600
Railroad ties		1,023
Miscellaneous		617
Total	92,759	95,843

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Weymouth (Back) River.

Articles.	1903.	1904.
	Tons.	*Tons.*
Coal	10,000	3,098
Pyrites		3,595
Raw and manufactured fertilizer products	122,000	117,863
Miscellaneous	600	135
Total	132,600	124,691

Town River.

Articles.	1903.	1904.
	Tons.	*Tons.*
Coal	2,512	1,836
Lumber	1,400	4,500
Stone	45,548	37,640
Total	49,460	43,976

B 16.

IMPROVEMENT OF HARBOR AT SCITUATE, MASSACHUSETTS.

For want of funds no work has been done upon this improvement during the fiscal year ending June 30, 1905.

On June 30, 1905, 50 per cent of breakwater construction and 21 per cent of the dredging had been accomplished.

It is proposed to apply the appropriation recommended to dredging the channel from the sea to the docks in the harbor, 6 feet deep at mean low water and 100 feet wide, as recommended by the Board of Engineers for Rivers and Harbors. (Annual Report of the Chief of Engineers for 1903, p. 780.)

Money statement.

Amount (estimated) required for completion of existing project.....$186,500.00

Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement..... 18,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.

APPROPRIATIONS.

March 2, 1829	$180	September 19, 1890	$10,000
August 30, 1852	1,000	July 13, 1892	10,000
June 14, 1880	7,500	August 18, 1894	10,000
March 3, 1881	10,000	June 3, 1896	6,000
August 2, 1882	10,000	March 3, 1899	15,000
July 5, 1884	10,000		
August 5, 1886	10,000	Total	[a]104,680
August 11, 1888	5,000		

[a] From 1831 to 1858, inclusive, $89.02 were carried to surplus fund.

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COMMERCIAL STATISTICS.

Articles.	1903.	1904.
	Tons.	*Tons.*
Coal	4,975	5,200
Lumber and shingles	2,925	5,000
Brick	561	600
Lime	162	350
Sand	.....	180
Total	8,623	11,330

B 17.

IMPROVEMENT OF HARBOR AT DUXBURY, MASSACHUSETTS.

For want of funds no work has been done upon this improvement during the fiscal year ending June 30, 1905, at which date the project was 81 per cent accomplished.

It is proposed to apply the additional appropriation recommended to increasing the width of the channel to the widths authorized by the project and to maintenance in restoring the depth where the shoaling has occurred in the channel near the wharf.

Money statement.

Amount (estimated) required for completion of existing project	$5,820.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	5,820.00

APPROPRIATIONS.

July 4, 1836	$5,000
June 10, 1872	10,000
March 3, 1873	10,000
March 3, 1899	12,000
Total	37,000

COMMERCIAL STATISTICS.

Articles.	1903.	1904.
	Tons.	*Tons.*
Coal	256	942
Lumber	546	463
Laths and shingles	.....	89
Total	802	1,494

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B 18.

IMPROVEMENT OF PLYMOUTH AND PROVINCETOWN HARBORS, MASSACHUSETTS.

(A) PLYMOUTH HARBOR.

In protecting the weak sections of Long Beach 4,256 tons of riprap stone were deposited, under a contract with Smith & Robinson, extending the stone dike previously built for a distance of 1,375 feet.

On June 30, 1905, the project for the protection of the beach and the return of Eel River to its former course had been substantially completed.

It is proposed to apply the available balance for beach protection ($2,565.82) to repairing the riprap dike on the beach, and the available balance for dredging ($2,178.10) to the maintenance of the channel in the harbor.

Money statement.

July 1, 1904, balance unexpended	$14,162.11
June 30, 1905, amount expended during fiscal year, for works of improvement	9,418.19
July 1, 1905, balance unexpended	4,743.92
July 1, 1905, outstanding liabilities	110.00
July 1, 1905, balance available	4,633.92
Amount (estimated) required for completion of existing project	20,700.00

APPROPRIATIONS.

May 26, 1824	$20,000.00	March 3, 1875	$10,000.00
March 3, 1825	5,712.00	June 18, 1878	5,000.00
March 25, 1826	13,184.90	March 3, 1879	3,500.00
April 23, 1830	1,850.00	June 14, 1880	10,000.00
March 2, 1831	2,820.00	March 3, 1881	10,000.00
July 3, 1832	2,500.00	August 2, 1882	14,000.00
March 2, 1833	600.00	July 5, 1884	10,000.00
June 28, 1834	2,000.00	August 5, 1886	6,000.00
March 3, 1835	700.00	August 11, 1888	6,000.00
July 2, 1836	500.00	September 19, 1890	8,000.00
July 7, 1838	2,400.00	July 13, 1892	9,500.00
August 31, 1852	5,000.00	August 18, 1894	1,500.00
June 23, 1866 (allotment)	8,315.00	June 3, 1896	1,500.00
July 11, 1870	10,000.00	March 3, 1899	{10,000.00 {75,000.00
March 3, 1871	10,000.00		
June 10, 1872	2,500.00	June 13, 1902	4,000.00
March 3, 1873	3,000.00		
June 23, 1874	5,000.00	Total	280,081.90

NOTE.—From 1842 to 1859, inclusive, $90.16 were carried to surplus fund.

CONTRACT IN FORCE.

Contractor: Smith & Robinson, New York, N. Y.
Date of contract: August 10, 1904.
Date of approval: August 23, 1904.
Date of commencement: August 15, 1904.
Date of completion: December 31, 1904. (Time of completion waived. Contract completed April 29, 1905.)

For 1,350 feet of riprap dike (estimated at 3,150 tons of stone) on Long Beach, Plymouth Harbor, at $2.09 per ton of 2,000 pounds.

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COMMERCIAL STATISTICS.

Entrances and clearances.

Vessels.	Entrances.	Clearances.
Foreign		2
Domestic	73	71

Freight.

Articles.	1903.	1904.
	Tons.	*Tons.*
Coal	29,642	38,086
Lumber	4,500	5,700
Stone		5,000
Fish		400
Miscellaneous		200
Total	34,142	49,386

Passengers carried in 1904, 49,335.

(B) PROVINCETOWN HARBOR.

During the fiscal year, under emergency contract with Edwin Canney, 1,093 tons of rubblestone were deposited at Long Point, completing to the full cross section 120 linear feet of new breakwater and retopping 65 feet of old breakwater.

In the vicinity of Abel Hill dike, by hired labor, 191 feet of double bulkhead, 420 feet of single bulkhead, and 10,964 feet of sand catches were built, and 906 feet of bulkhead and 1,800 feet of sand catches repaired; at Wood End bulkhead 1,750 linear feet of sand catches were built; and minor repairs were made in maintaining the protective works on the beach.

It is proposed to apply the available balance and the additional appropriation recommended to works of protection for preserving and strengthening the barrier of beach and sand dunes that protects and preserves the harbor, and to insure also a moderate balance available for contingencies to prevent or repair any breach of the beach which is liable to occur in storms of exceptional severity occurring at high tides and which if not repaired at once would entail largely increased cost or threatened disaster to the harbor.

Money statement.

July 1, 1904, balance unexpended		$13,161.73
Amount appropriated by river and harbor act approved March 3, 1905		5,000.00
		18,161.73
June 30, 1905, amount expended during fiscal year, for works of improvement		4,887.06
July 1, 1905, balance unexpended		13,274.67
July 1, 1905, outstanding liabilities		1,172.10
July 1, 1905, balance available		12,102.57
July 1, 1905, amount covered by uncompleted contracts		410.98
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905		10,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.		

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APPROPRIATIONS.

[ay 19, 1826	$3,500.00	August 14, 1876	$4,000.00
[arch 2, 1829	3,500.00	June 18, 1878	1,000.00
[arch 2, 1831	2,050.00	March 3, 1879	1,000.00
[arch 3, 1832	4,600.00	June 14, 1880	500.00
ıne 28, 1834	4,400.00	March 3, 1881	5,000.00
[arch 3, 1835	4,400.00	August 2, 1882	5,000.00
ıly 2, 1836	4,400.00	July 5, 1884	2,000.00
ıly 7, 1838	4,500.00	August 5, 1886	3,000.00
ugust 30, 1852	5,000.00	August 11, 1888	3,000.00
ıne 28, 1864 [a]	30,000.00	September 19, 1890	7,500.00
ıne 23, 1866	43,068.44	July 13, 1892	1,500.00
ıly 28, 1866	8,000.00	August 18, 1894	1,500.00
pril 10, 1869 [a]	8,910.00	June 3, 1896	1,500.00
[arch 3, 1871	6,000.00	March 3, 1899	10,000.00
ıne 10, 1872	5,000.00	June 13, 1902	11,000.00
[arch 3, 1873	6,000.00	March 3, 1905	5,000.00
ıne 23, 1874	6,000.00		
arch 3, 1875	5,000.00	Total	220,828.44

CONTRACT IN FORCE.

Contractor: Edwin Canney, Pigeon Cove, Mass.
Date of contract: October 19, 1904.
Date of commencement: November 1, 1904.
Date of completion: December 31, 1904. (Time of completion waived.)
For 1,170 tons of stone in breakwater at Long Point, at $2.17 per ton of 2,000 ınds.

COMMERCIAL STATISTICS.

[Through the courtesy of the collector of customs, Barnstable, Mass.]

Freight.

Articles.	1902.	1903.	1904.	Articles.	1902.	1903.	1904.
	Tons.	*Tons.*	*Tons.*		*Tons.*	*Tons.*	*Tons.*
al	8,960	6,000	6,500	Sand	.....	.....	1,000
t	8,500	700	800	Stone	.....	.....	400
mber	1,536	1,500	1,600	Wood	.....	.....	300
ne and cement	80	.....	60	Miscellaneous	5,000	8,000	800
ck	135	100	20				
h	.....	.....	10,000	Total	24,211	11,300	21,480

ssengers carried in 1904 27,000
ıount of revenue collected $136.74

This is an important harbor of refuge, being the only harbor from Boston 2 miles north) to Vineyard Haven (about the same distance south) that ll admit large vessels. It is estimated that 4,000 vessels of all nationalities ited the harbor in 1904 for shelter.

[a] Allotments.

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B 19.

IMPROVEMENT OF HARBOR AT BURLINGTON, VERMONT.

During the fiscal year 641 linear feet of decayed superstructure were removed, 609 feet of new concrete parapet erected, and 20 linear feet of concrete decking laid, fully completing 20 linear feet of new superstructure.

An examination of the substructure by a diver showed the lake wall to be carried away and more or less damaged, necessitating repairs to 114 linear feet of the substructure between stations 34+94 and 36+8, which will be made in the ensuing fiscal year.

On June 30, 1905, the extension of the breakwater had been 40 per cent accomplished; the repairs and rebuilding, 52 per cent.

It is proposed to apply the available funds and the additional appropriation recommended to repairs and maintenance in replacing the decayed timber superstructure with superstructure of stone and concrete.

Money statement.

July 1, 1904, balance unexpended	$43,116.48
Amount appropriated by river and harbor act approved March 3, 1905	20,000.00
	63,116.48
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	21,220.03
July 1, 1905, balance unexpended	41,896.45
July 1, 1905, outstanding liabilities	5,009.20
July 1, 1905, balance available	36,887.25
July 1, 1905, amount covered by uncompleted contracts	16,960.62
Amount (estimated) required for completion of existing project	141,855.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	20,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

July 4, 1836	$10,000.00	March 3, 1879	$15,000.00
March 3, 1837	10,000.00	June 14, 1880	10,000.00
July 7, 1838	50,000.00	March 3, 1881	10,000.00
June 11, 1844	10,000.00	August 2, 1882	12,000.00
August 30, 1852	10,000.00	July 5, 1884	50,000.00
May 19, 1864	308.00	August 5, 1886	18,750.00
June 28, 1864	13,500.00	August 11, 1888	35,000.00
June 23, 1866	27,672.20	September 19, 1890	20,000.00
March 2, 1867	80,000.00	August 18, 1894	10,000.00
July 11, 1870	25,000.00	June 3, 1896	10,000.00
March 3, 1871	30,000.00	March 3, 1899	15,000.00
June 10, 1872	30,000.00	June 6, 1900	[a] 5,000.00
March 3, 1873	25,000.00	June 13, 1902	57,750.00
June 23, 1874	25,000.00	March 3, 1905	20,000.00
March 3, 1875	25,000.00		
August 14, 1876	20,000.00	Total	699,980.20
June 18, 1878	20,000.00		

NOTE.—In 1872, $6,669.13 was carried to surplus fund and not expended.

[a] Allotment.

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CONTRACT IN FORCE.

Contractor: John Cashman, Quincy, Mass.
Nature of work: Repair of breakwater.
Date of contract: March 30, 1903.
Date of approval: April 15, 1903.
Date of commencement: On or before June 1, 1903.
Date of completion: On or before November 30, 1905.
Price:
Removing old superstructure, $7 per linear foot.
Concrete in place in parapet, $8 per cubic yard.
Concrete in footing blocks, $9 per cubic yard.
Concrete in decking, $7 per cubic yard.
Concrete in bags, $10 per cubic yard.
Stone blocks in coping of deck and under footing blocks on lake side, $10 per cubic yard.
Riprap stone, $7 per cord.
Timber and plank, $40 per 1,000 feet B. M.
Tie-rods, 1¼ inches by 16 feet, $7 each.
Tie-rods, 1¼ inches by 10 feet, furnished by the United States, $4 each.
Tie-rods, 1¼ inches by 10 feet, furnished by the contractor, $6 each.
Use of plant, $4 per hour.

COMMERCIAL STATISTICS.

Articles.	1902.	1903.	1904.
	Tons.	*Tons.*	*Tons.*
Coal	32,379	61,085	66,726
Lumber	41,691	20,946	28,333
Stone	7,790	6,435	2,253
Cement and plaster			1,781
General merchandise	20,965	18,297	8,328
Total	102,825	106,763	107,421

Passengers carried in 1904, 90,301.

B 20.

IMPROVEMENT OF OTTER CREEK, VERMONT.

No funds are available, and no work has been done upon this improvement during the fiscal year.

To June 30, 1905, the project is about 85 per cent completed.

Money statement.

Amount (estimated) required for completion of existing project.... $11,248.00

APPROPRIATIONS.

June 10, 1872	$10,000	September 19, 1890	$5,000
March 3, 1875	5,000	July 13, 1892	10,000
June 18, 1878	8,000	August 18, 1894	5,000
March 3, 1879	5,000	June 3, 1896	5,000
June 14, 1880	2,000	March 3, 1899	1,000
March 3, 1881	2,000		
August 2, 1882	2,000	Total	62,500
August 11, 1888	2,500		

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COMMERCIAL STATISTICS.

Articles.	1903.	1904.
	Tons.	*Tons.*
Coal	4,000	5,000
Lumber	600	600
Kaolin	500	300
General merchandise	200	250
Total	5,300	6,150

Passengers carried in 1904, 1,380.

B 21.

IMPROVEMENT OF HARBOR AT PLATTSBURG, NEW YORK.

For want of funds no work was done during the fiscal year ending June 30, 1905. The project has been completed.

Money statement.

July 1, 1904, balance unexpended	$227.52
June 30, 1905, amount expended during fiscal year, for works of improvement	75.85
July 1, 1905, balance unexpended	151.67

APPROPRIATIONS.

July 4, 1836	$10,000.00	March 3, 1873	$10,000.00
March 3, 1837	10,000.00	June 23, 1874	5,000.00
July 7, 1838	27,500.00	March 3, 1879	2,000.00
March 3, 1843	2,680.01	June 14, 1880	1,000.00
June 11, 1844	10,000.00	August 5, 1886	5,000.00
May 19, 1864 (allotment)	2,000.00	August 11, 1888	7,000.00
March 2, 1867	26,000.00	September 19, 1890	[a] 32,500.00
July 11, 1870	10,000.00	June 13, 1902	5,000.00
March 3, 1871	15,000.00		
June 10, 1872	10,000.00	Total	190,680.01

COMMERCIAL STATISTICS.

Articles.	1903.	1904.	Articles.	1903.	1904.
	Tons.	*Tons.*		*Tons.*	*Tons.*
Hay	500	700	Potatoes	1,800	1,080
Coal	13,000	11,000	Apples	.....	936
Pulp wood	2,000	140	Miscellaneous	241,000	245,290
Iron	1,500	50			
Lime and cement	50	.....	Total	261,080	261,107
Lumber	1,230	1,911			

Three passenger steamers made daily trips to this port. Total number of passengers carried, 77,401.

Canal boats of an average tonnage of 100, tugs of an average tonnage of 70, and passenger steamers from 250 to 800 tons, frequent the harbor.

[a] $239.25 returned to Treasury.

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B 22.

IMPROVEMENT OF NARROWS OF LAKE CHAMPLAIN, NEW YORK AND VERMONT.

Examinations were made at several localities with a view to providing fenders along the rocky banks of the channel in completion of the project.

It is proposed to apply the available balance to providing timber fenders at Pulpit Point and the "Narrows" for protecting vessels from collision with the rocky banks of the channel and to dredging for maintenance should it prove necessary.

Money statement.

July 1, 1904, balance unexpended	$1,292.88
Amount appropriated by river and harbor act approved March 3, 1905	2,500.00
	3,792.88
June 30, 1905, amount expended during fiscal year, for works of improvement	81.27
July 1, 1905, balance unexpended	3,711.61

APPROPRIATIONS.

August 5, 1886	$30,000	June 13, 1902	$17,500
August 11, 1888	15,000	March 3, 1905	2,500
July 13, 1892	18,500		
March 3, 1899	5,000	Total	90,000
June 6, 1900	[a] 1,500		

COMMERCIAL STATISTICS.

Amount of freight passing through the Narrows of Lake Champlain.

Articles.	1903.	1904.	Articles.	1903.	1904.
	Tons.	*Tons.*		*Tons.*	*Tons.*
Coal	202,000	192,219	Hay	38,545	10,833
Lumber and timber	71,595	113,359	Lime, etc	22,000	19,721
Sugar	188	500	Pulp wood	140,306	219,314
Apples		354	Miscellaneous	16,890	9,924
Potatoes		1,902			
Iron and iron ore	96,000	82,966	Total	590,789	651,592
Salt	1,265	500			

B 23.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

Wreck of steamship Kiowa, off Point Allerton, at entrance to Boston Harbor, Massachusetts.—This vessel was sunk in collision December 26, 1903, in about 30 feet depth at mean low water, near the track of deep-draft vessels and in the track of lighter-draft vessels, about 1 mile from the entrance to Boston Harbor, between Boston light and Point Allerton. The vessel was of steel, of 2,953 gross tons, and contained about 400,000 feet of hard pine lumber. The owners having failed to accomplish its removal, it was reported to the Department June 30, 1904, as a dangerous obstruction to navigation. Proposals were ob-

[a] Allotment.

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tained after advertisement for thirty days and the contract for removing the wreck awarded August 22, 1904, to the lowest bidder, Boston Towboat Company, of Boston, Mass., who on December 20, 1904, had reduced the wreck to the required depth of 30 feet at mean low water, so that it was no longer a menace to navigation, and on January 18, 1905, completed the disposition of the wreckage. The total cost to the United States was $8,800.

Wrecks in Lake Champlain, New York.—Canal boat *Julius Fulton, Jr.*, of 98 tons gross, about 96 feet long, 17 feet beam, was sunk by the ice during the winter of 1903–4 in about 3 feet of water at low stages of the lake at its mooring, on the north side of the wharf of the Rutland Railroad Company, at Rouse Point, N. Y. Canal boat *Russell Wright*, 98 feet long, with cargo of 160 tons of iron ore, was sunk October 29, 1904, in 8 feet of water about 400 feet from shore, opposite the docks at Port Henry, N. Y. Canal boat *Anna Weightman*, 98 tons gross, with a cargo of 160 tons of iron ore, was sunk November 13, 1904, in 5 feet depth at low-water stage, about 90 feet from shore at Port Henry, N. Y.

For the removal of these wrecks allotments were made as follows: November 28, 1904, $300; March 21, 1905, $2,000; total, $2,300. After thirty days' newspaper advertisement proposals were opened March 6, 1905, and the contract for removing the wrecks awarded to Van Sant & Boehm, of Atlantic City, N. J. Work was commenced April 25, completed May 31, and final report submitted June 9, 1905, the total cost to the United States being $2,300.

Schooner Albert H. Harding at entrance to Pigeon Cove Harbor, Cape Ann, Massachusetts.—This vessel, which in the spring of 1905 had been wrecked on the west shore of Pigeon Cove Harbor, on May 13 floated out to and sunk in about 16 feet of water, in mid-channel, about 150 feet seaward from the entrance to the harbor, where it was a very dangerous menace to navigation. The owner having in writing abandoned the wreck, proposals were obtained by circular letter, and by telegraphic authority from the Chief of Engineers an informal agreement was made with the lowest bidder, Edwin Canney, of Pigeon Cove, Mass., for its removal. Work was begun June 5 and completed June 12 with allotment of $300, made May 26. Final report was submitted June 14, 1905.

B 24.

MODIFICATION OF HARBOR LINES IN CHARLES RIVER AT BOSTON, MASSACHUSETTS.

CITY OF BOSTON,
BOARD OF COMMISSIONERS OF THE DEPARTMENT OF PARKS,
Jamaica Plain, Mass., April 8, 1904.

DEAR SIR: We herewith inclose a plan [a] of proposed Charles River embankment, to be substituted for the plan [a] sent to the Secretary of War for approval December 1, 1903.

Yours, very respectfully,

CHARLES E. STRATTON, *Chairman.*

Hon. WILLIAM H. TAFT,
Secretary of War.

---

[a] Not printed.

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[Second indorsement.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS, U. S. ARMY,
Washington, April 12, 1904.

Respectfully referred to Lieut. Col. W. S. Stanton, Corps of Engineers, in connection with previous papers referred to him by indorsement of December 9, 1903.

To be returned.

By command of Brig. Gen. Mackenzie:

H. F. HODGES,
Major, Corps of Engineers

Third indorsement.]

U. S. ENGINEER OFFICE,
Boston, Mass., May 28, 1904.

Respectfully returned to the Chief of Engineers.

The within application, referring to the blueprint [a] accompanying it, is for authority to build in the Charles River along the southerly (right) or Boston and Brookline bank a wall on the red line A, B, C, D, E, F, G, H, I, J, K, L on tracing [a] herewith, and to fill solid behind it.

Between the plane of mean high and mean low water the wall and embankment would displace a prism of 15,524.534 cubic feet. Inasmuch as the wall and embankment will be in the Charles River Basin, wholly above the dam which the War Department has authorized the Charles River Basin Commission to build in the Charles River, there can be no objection to the construction of the wall and the solid filling behind it, as shown on blueprint [a] accompanying the within application and on tracing [a] above referred to, upon the following condition, viz: That should the wall reduce the width of the channel to less than 200 feet in the bend extending about 1,500 feet below the Essex Street Bridge at A B (see "Boston harbor line sheet B" [a] herewith), the board of park commissioners shall, at the time of building the wall, restore the channel to the full width of 200 feet by dredging the channel to the depth of 7 feet at mean low water on its opposite (northerly) side.

If the authority to build the wall and fill solid behind it be granted, I respectfully recommend that the United States pier and bulkhead line, shown in black on the accompanying tracing [a] and approved by the Secretary of War July 27, 1889, March 17, 1890, and July 19, 1899, be changed to the position shown on the accompanying tracing [a] by the full red line A, B, C, D, E, F, G, H, I, K, L, and as described in full in the inclosure herewith.

This report would have been submitted with my report of April 14, 1904, upon the dam aforesaid, but the obliteration by the building of the Cambridge (West Boston) Bridge of the point A in the pier and bulkhead line approved by the Secretary of War July 27, 1889, and the impossibility of sparing a junior engineer from other

[a] Not printed.

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work for surveying the new pier and bulkhead line from the Cambridge Bridge to the Essex Street Bridge have delayed its transmission until this time.

W. S. STANTON,
Lieut. Col., Corps of Engineers.

[Sixth indorsement.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS, U. S. ARMY,
Washington, July 20, 1904.

Respectfully returned to the Secretary of War.

The board of commissioners of the department of parks of the city of Boston presents for approval a substitute plan [a] for an embankment and sea wall in the Charles River Basin, to take the place of a plan [a] originally presented December 1, 1903.

The matter has been referred to the local engineer officer, Lieut. Col. W. S. Stanton, Corps of Engineers, from whose report of May 28, 1904, in third indorsement hereon, it appears that, in view of the Department's action of May 18, 1904, in authorizing the construction of a dam across Charles River by the Charles River Basin Commission, there can be no objection to the construction of the wall and the solid filling behind it, as contemplated in this application, upon condition of maintaining a width and depth of channel at a certain point, as specifically indicated by him.

Concurring in the views of the local officer, I recommend that the applicant in this case be informed that no objection will be made by the War Department to the proposed construction as shown on the blueprint plan [a] herewith, subject to the condition named by Lieutenant-Colonel Stanton.

Should this action meet with the approval of the Secretary of War, I concur in the further recommendation of the local officer that the existing harbor line at the locality in question be modified as shown on the accompanying tracing [a] and described in a separate paper herewith, and recommend further that the Secretary place his approval upon said tracing and description, both of which have been prepared for his signature.

A. MACKENZIE,
Brig. Gen., Chief of Engineers, U. S. Army.

DESCRIPTION OF PROPOSED NEW PIER AND BULKHEAD LINE ON THE SOUTH SIDE OF CHARLES RIVER, MASSACHUSETTS, EXTENDING FROM THE CAMBRIDGE (WEST BOSTON) BRIDGE, BOSTON, TO ESSEX STREET BRIDGE, BROOKLINE.

Beginning in the Charles River at the point A (tracing [a] herewith) in the pier and bulkhead line along the southerly bank of Charles River approved by the Secretary of War July 19, 1899, and 8.56 feet westerly from the southwesterly corner of the coping of the easterly (Boston) abutment of the Cambridge Bridge measured in the westerly prolongation of the plane of the southerly end of the coping of said abutment and at right angles to its westerly face; and running thence southwesterly in a straight line to the point B in the Charles River in

[a] Not printed.

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a line forming an angle of 151° 41′ to the south side of Mount Vernon street, Boston, turned through north and west at the point B′ in the said south side of Mount Vernon street 64.62 feet westerly from its junction with the west side of Otis Place, the distance from B′ to B being 300 feet; thence from the point B running southerly and westerly by an arc of a circle with a radius of 1,175 feet and tangent at B with the line A–B, to a point C in the river at the point of tengency of said arc with the straight line C–H, two points of which, C′ and D′, are located as follows: C′ in the Charles River being in the northerly prolongation of the westerly side of Clarendon street, Boston, and distant 280.36 feet from the north side of Beacon street; and D′ being in the easterly sidewalk of Harvard Bridge marked by a copper bolt distant 279.9 feet northerly of the north side of Beacon street measured in prolongation of the easterly curb line of Massachusetts avenue. From the said point C running westerly in the line C–H aforesaid 3,550 feet more or less to a point D in the Charles River 330.52 feet easterly from the point D′ above described, and measured in the said line C–H; from the point D running northerly and westerly following the arc of a circle through an angle of 90° with a radius of 75 feet and whose center is on the said line C–H, to a point E in the Charles River; from the point E running westerly in a line tangent to said arc 570 feet to a point F in the Charles River; thence westerly and southerly following the arc of a circle through an angle of 90° with a radius of 75 feet to a point G in the Charles River and in the line C–H aforesaid, the point G being 720 feet westerly from the point D aforesaid; from the said point G running westerly in the said line C–H 417 feet more or less to the point H in the Charles River; thence westerly in the arc of a circle with a radius of 1,500 feet through an angle of 25° 14′ to a point I in the Charles River at the point of tangency with a straight line I–K; thence westerly 4,240 feet more or less to the point K 0.4 foot west from the east side of the platform of Essex Street Bridge; thence south in a line 0.4 foot west of and parallel with the said east side of Essex Street Bridge 72.44 feet to the point L, in the pier and bulkhead line on the south side of Charles River approved by the Secretary of War March 17, 1890, the said point L being 124 feet westerly of the northeast corner of the solid part of Abbot's wharf measured in the said pier and bulkhead line approved March 17, 1890.

The points K and L are referred to the point K′ marked by a copper bolt set in the north curb stone which runs diagonally through the pavement of the south side of Commonwealth avenue at its junction with Essex street; point K′ is referred to point K″, also a copper bolt set in said curb stone where it passes under the most southerly of three exposed gas and water mains in the center of Commonwealth avenue; distance from K″ to K′ 63.75 feet; distance from K′ to L, 420.36 feet; distance from K′ to K, 492.8 feet, the two latter distances measured on a line from K′ at an angle of 86° 11′ through north from the spire of the Brighton Avenue Baptist Church in Brighton. The position and direction of the straight line joining points I and K is determined by the point K as above described and by a point I′ in said line distant 254.9 feet northerly from the north side of Bay State road, measured in prolongation of the west side of Raleigh street.

[First indorsement.]

WAR DEPARTMENT, *July 22, 1904.*

Approved:

ROBERT SHAW OLIVER,
Acting Secretary of war.

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APPENDIX C.

IMPROVEMENT OF RIVERS AND HARBORS IN SOUTHEASTERN MASSACHUSETTS AND IN RHODE ISLAND.

REPORT OF LIEUT. COL. J. H. WILLARD, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1905, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Harbors at Hyannis and Nantucket, Massachusetts.
2. Vineyard Haven Harbor, Massachusetts.
3. Little Harbor, Woods Hole, Massachusetts.
4. Woods Hole Channel, Massachusetts.
5. Weepecket Rock, Buzzards Bay, Massachusetts.
6. New Bedford Harbor, Massachusetts.
7. Taunton River, Massachusetts.
8. Sakonnet River, Rhode Island.
9. Pawtucket (Seekonk) River, Rhode Island.
10. Providence River and Narragansett Bay and removal of Green Jacket Shoal, Providence River, Rhode Island.
11. Fall River Harbor, Massachusetts.
12. Newport Harbor, Rhode Island.
13. Harbor at Coasters Harbor Island, Rhode Island.
14. Harbor of Refuge at Point Judith, Rhode Island.
15. Entrance to Point Judith Pond, Rhode Island.
16. Harbor of Refuge at Block Island, Rhode Island.
17. Great Salt Pond, Block Island, Rhode Island.
18. Removing sunken vessels or craft obstructing or endangering navigation.

UNITED STATES ENGINEER OFFICE,
Newport, R. I., July 19, 1905.

GENERAL: In compliance with the provisions of General Orders, No. 2, Office of the Chief of Engineers, c. s., I have the honor to inclose herewith annual report for rivers and harbors in this district for the fiscal year ending June 30, 1905.

Very respectfully, your obedient servant,

J. H. WILLARD,
Lieut. Col., Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

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C 1.

IMPROVEMENT OF HARBORS AT HYANNIS AND NANTUCKET, MASSACHUSETTS.

For history and projects see page 74 of this report.

Operations during the past fiscal year.—The river and harbor act of March 3, 1905, contained the following item:

Improving harbors of Hyannis and Nantucket, Massachusetts: Continuing improvement and for maintenance, eighty thousand dollars.

Under date of March 29, 1905, the Assistant Secretary of War approved the allotment of $10,000 of this appropriation to the improvement of Hyannis Harbor and $70,000 to Nantucket Harbor.

(A) HYANNIS HARBOR.

Work under the contract with the J. S. Packard Dredging Company, of Providence, R. I., in progress at the beginning of the fiscal year, was continued until September 3, when the contract was completed. Forty-nine thousand six hundred and fifty-four cubic yards were dredged during the fiscal year, making a total of 75,000 cubic yards under the contract. This work completed the deepening of 34.5 acres of the originally projected 36 acres of additional anchorage area.

Under date of May 3, 1905, proposals were received for completing the dredging in this harbor under the allotment of the $10,000 from the appropriation of March 3, 1905, and a contract dated May 26, 1905, was entered into with the Morris & Cumings Dredging Company, of New York, at the rate of 23.9 cents per cubic yard, in connection with the dredging to be done at Nantucket Harbor. Work to commence within fifteen days after notification of the approval of the contract by the Chief of Engineers, and be completed at Hyannis within two months after the time of commencement.

The Hyannis dredging will be commenced after the completion of that at Nantucket, and will complete all the projected work for this harbor.

Operations contemplated for the fiscal year ending June 30, 1906.—Complete the project.

Money statement.

July 1, 1904, balance unexpended	$21,353.82
Amount appropriated by river and harbor act approved March 3, 1905	10,000.00
	31,353.82
June 30, 1905, amount expended during fiscal year, for works of improvement	19,263.07
July 1, 1905, balance unexpended	12,090.75
July 1, 1905, amount covered by uncompleted contracts	8,170.00
Amount (estimated) required for completion of existing project	2,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	2,500.00

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AMOUNTS APPROPRIATED.

Previous projects.

March 2, 1827	$10,650.00	
April 30, 1830	6,517.82	
March 2, 1831	8,400.00	
July 3, 1832	7,600.00	
March 2, 1833	5,000.00	
June 28, 1834	10,000.00	
March 3, 1835	9,000.00	
March 3, 1837	5,000.00	
July 7, 1838	8,764.00	
August 30, 1852	5,000.00	
July 11, 1870	10,000.00	
March 3, 1871	10,000.00	
March 3, 1873	19,000.00	
June 23, 1874	5,000.00	
June 18, 1878	3,000.00	
March 3, 1879	2,500.00	
March 3, 1881	5,000.00	
		$123,431.82

Existing project.

August 5, 1886	$10,000.00	
August 11, 1888	10,000.00	
September 19, 1890	8,000.00	
July 13, 1892	6,000.00	
August 18, 1894	3,500.00	
June 3, 1896	6,000.00	
March 3, 1899	2,162.00	
June 13, 1902 (allotment)	20,000.00	
March 3, 1905 (allotment)	10,000.00	
		75,662.00
Received from sale of material		20.68
Total		199,114.50

CONTRACTS IN FORCE.

Contractor.	Work.		Price per cubic yard.	Date of approval.	To commence.	Date of expiration.
	Amount.	Character.				
			Cents.			
J. S. Packard Dredging Co.	$18,000	Dredging	24.0	Dec. 17, 1903	March 1, 1904, or before.	Six months after beginning.
Morris & Cumings Dredging Co.	10,000	.....do.....	23.9	June 6, 1905	Within fifteen days of approval.	In two months after beginning.

COMMERCIAL STATISTICS.

The commerce arriving at and leaving Hyannis Harbor, Massachusetts, during the calendar year ending December 31, 1904, is estimated as follows (based mainly upon report received from Mr. Theo. McMahan, Newport, R. I.):

Commerce arriving at and leaving Hyannis Harbor, calendar year 1904.

	Tons.
Grains and forage	200
Fish, oysters, etc	300
Lumber and products	2,000
Coal, minerals, etc	11,000
Sundries	100
Total	13,600
Decrease under 1903	9,080

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The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
		Feet.	
Steam:			
Freight and passenger	33	10	300
Freight, mainly	3	10	300
Fishing	3	9	80
Tugs	80	10	300
Pleasure boats	6	4	14
Sail:			
Fishing boats	25	4	4
Pleasure boats, large	10	5	14
Pleasure boats, small	50	2½	
Barges	6	11	500

(B) NANTUCKET HARBOR.

Operations during the past fiscal year.—Work under the contract with E. S. Belden & Sons, of Hartford, Conn., for placing stone in the gap in the east jetty, which was in progress at the beginning of the fiscal year, was continued until July 21, when the contract was completed. One thousand nine hundred and fifty and one-half tons of stone were placed in the jetty during the fiscal year, making a total under the contract of 4,604 tons, by which the gap in the east jetty was filled to the low-water level.

The approved project for the expenditure of the $70,000 allotted to this work from the appropriation of March 3, 1905, for the improvement of Hyannis and Nantucket harbors, provides for extending the eastern jetty about 1,200 feet, repairing portions of the jetty, and dredging a channel about 200 feet wide and about 12 feet deep at mean low water through the bar between the jetties.

Under date of May 26, 1905, a contract was entered into with E. S. Belden & Sons, of Hartford, Conn., for the stone work in the jetty, at the rate of $1.73 per ton; work to commence within fifteen days of the notification of the approval of the contract by the Chief of Engineers and be completed within five working months.

The work under this contract was commenced June 5, 1905, and up to the close of the fiscal year 2,909½ tons of stone had been placed in the jetty.

Under date of May 26, 1905, a contract was entered into with the Morris & Cumings Dredging Company, of New York, for the dredging of about 200,000 cubic yards of sand, at the rate of 23.9 cents per cubic yard; work to commence within fifteen days of the notification of approval of the contract by the Chief of Engineers and be completed within nine months. The dredge commenced work on June 23, 1905, and up to the close of the fiscal year 7,039 cubic yards had been excavated.

The breachway in the narrow beach, known as the "haulover," separating the head of the harbor from the ocean on the eastern side of the island, has afforded an outlet for a large portion of the water which would otherwise have had to flow through the jetty channel. It is believed that the blocking up of the jetty entrance to the harbor by the jetties has contributed in no small degree to keeping the breach in the haulover open. As it would be impracticable to close this breach by artificial means, save at great expense, it was recommended

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that $50,000 of the allotment for this work from the appropriation of March 3, 1905, be applied to dredging, partly with a view of increasing the waterway through the jetty channel and thereby assist in closing the breach in the haulover.

The estimate for completion of this work does not include dredging, as the amount is dependent upon the tidal scour, which could not be predetermined.

Operations contemplated for the fiscal year ending June 30, 1906.—It is proposed to apply the available funds to extending and repairing the east jetty and to dredging a channel 12 feet deep and about 200 feet wide through the bar between the jetties.

Money statement.

July 1, 1904, balance unexpended	$13,713.88
Amount appropriated by river and harbor act approved March 3, 1905	70,000.00
	83,713.88
June 30, 1905, amount expended during fiscal year, for works of improvement	14,087.61
July 1, 1905, balance unexpended	69,626.27
July 1, 1905, outstanding liabilities	241.65
July 1, 1905, balance available	69,384.62
July 1, 1905, amount covered by uncompleted contracts	65,800.00
Amount (estimated) required for completion of existing project	42,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	42,500.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

AMOUNTS APPROPRIATED.

Previous projects.

May 23, 1825, survey	$300.00	
March 2, 1829	30,000.00	
March 2, 1831	8,265.00	
July 3, 1832	6,000.00	
June 14, 1844	1,169.75	
		$45,734.75

Existing project.

July 14, 1880	$50,000.00	
March 3, 1881	25,000.00	
August 3, 1882	25,000.00	
July 5, 1884	10,000.00	
August 5, 1886	15,000.00	
August 11, 1888	20,000.00	
September 19, 1890	25,000.00	
July 13, 1892	25,000.00	
August 18, 1894	25,000.00	
June 3, 1896	20,000.00	
March 3, 1899	20,000.00	
June 13, 1902 (allotment)	15,000.00	
March 3, 1905 (allotment)	70,000.00	
		345,000.00
Total		390,734.75

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CONTRACTS IN FORCE.[a]

Contractor.	Work.		Rate per ton (2,000 pounds).	Date of approval.	To commence.	Date of expiration.
	Amount.	Character.				
E. S. Belden & Sons.	$6,800	Jetty construction.	$2.97	Feb. 28, 1903	May 1, 1903	In 2 working months after commencement.
Do	10,000	do	2.75	Nov. 23, 1903	None fixed	June 30, 1904.[b]
Do	13,000	do	2.75	Aug. 8, 1904	do	None fixed.
Do	20,000	do	1.73	June 15, 1905	Within 15 days after notification of approval by Chief of Engineers.	Within 5 working months after date of commencement.
Morris & Cummings Dredging Co.	50,000	Dredging.[c]		June 6, 1905	do	Within 7 months after commencement.

[a] Contracts approved November 23, 1903, and August 8, 1904, modify that approved February 28, 1903.
[b] Time limit for completion waived by authority of the Chief of Engineers, dated June 17, 1904.
[c] Rate per cubic yard, 23.9 cents.

COMMERCIAL STATISTICS.

The commerce arriving at and leaving Nantucket Harbor, Massachusetts, during the calendar year ending December 31, 1904, is estimated as follows, based upon the best information obtainable:

Commerce arriving at and leaving Nantucket Harbor, calendar year 1904.

	Tons.
Cotton and products	12
Tobacco	50
Rice	14
Grains and forage	5,000
Vegetables and truck	600
Live stock and products	110
Fish, oysters, etc	2,000
Naval stores	8
Lumber and products	6,000
Coal, minerals, etc	14,500
Fertilizers	200
Machinery	1,500
General merchandise	6,500
Sundries	2,100
Total	38,594
Increase over 1903	4,114

The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
		Feet.	
Steam:			
Freight and passenger	500	8	500
Freight mainly	25	7	100
Passenger mainly	48	7	200
Fishing	10	5	8
Tugs	10	6	15
Pleasure boats	85	7	14
Sail:			
Freight	60	7	250
Fishing boats	80	4	5
Oyster boats	5	4	5
Pleasure boats, large	175	5	40
Pleasure boats, small	725	4	3

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C 2.

IMPROVEMENT OF VINEYARD HAVEN HARBOR, MASSACHUSETTS.

For history and project, see page 77 of this report.

Operation during the past fiscal year.—No works of improvement were in progress during the past fiscal year.

Operations contemplated for the fiscal year ending June 30, 1906.—Further work at this harbor is dependent upon the results of the examination of the Board of Engineers convened in accordance with the river and harbor act of June 13, 1902, to consider the general subject of harbors in the waters of this locality.

Money statement.

July 1, 1904, balance unexpended	$4,612.65
July 1, 1905, balance unexpended	4,612.65

AMOUNTS APPROPRIATED.

April 11, 1888	$25,000	June 3, 1896	$7,000
September 19, 1890	10,000	March 3, 1899	3,000
July 3, 1892	7,500		
August 18, 1894	7,500	Total	60,000

COMMERCIAL STATISTICS.

The commerce arriving at and leaving Vineyard Haven, Mass., during the calendar year ending December 31, 1904, is estimated as follows (based mainly upon reports received from Mr. Lorenzo F. Luce, deputy collector of customs, Vineyard Haven, Mass.):

Commerce arriving at and leaving Vineyard Haven, calendar year 1904.

	Tons.
Fish, oysters, etc	600
Lumber and products	2,000
Coal, minerals, etc	250,000
Total	252,600
Decrease under 1903	10,400

The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
Steam:		*Feet.*	
Freight and passenger	500	7	300
Freight mainly	500	7	300
Passenger mainly	500	7	300
Fishing	60	4	10
Tugs	3,000	14	150
Sail:			
Freight	2,000	17	1,800
Pleasure boats, small	75	2½	5
Barges	7,000	18	1,000

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C 3.

IMPROVEMENT OF LITTLE HARBOR, WOODS HOLE, MASSACHUSETTS.

For history and project, see page 78 of this report.

Operations during the past fiscal year.—The river and harbor act of March 3, 1905, contained the following item:

Improving Little Harbor, Woods Hole, Massachusetts, in accordance with the report submitted in House Document Numbered One hundred and sixty-two, Fifty-eighth Congress, second session: Completing improvement, eighteen thousand dollars.

Proposals for dredging the channel and turning basin were received on May 8, 1905, after the usual public advertisement, and the contract awarded to Charles M. Cole, of Fall River, Mass., to complete the proposed dredging, at the rate of 21 cents per cubic yard. The date of this contract is June 16, 1905, work to be commenced within fifteen days after its approval and be completed within three months of the time of commencement. The amount of the contract is about 66,000 cubic yards.

The work of dredging was commenced June 26, 1905, and up to the close of the fiscal year 3,114 cubic yards of sand and gravel had been removed.

Operations contemplated for the fiscal year ending June 30, 1906.—It is proposed to expend the available funds in completing the project.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1905	$18,000.00
June 30, 1905, amount expended during fiscal year, for works of improvement	16.63
July 1, 1905, balance unexpended	17,983.37
July 1, 1905, outstanding liabilities	60.00
July 1, 1905, balance available	17,923.37
July 1, 1905, amount covered by uncompleted contracts	13,860.00

AMOUNT APPROPRIATED.

March 3, 1905 ..... $18,000

CONTRACT IN FORCE.

Contractor: Charles M. Cole.
Amount and character of work: About 66,000 cubic yards of dredging.
Rate per cubic yard, 21 cents.
Date of approval: Not approved at the close of the fiscal year.
To commence: Within fifteen days after approval.
To complete: Within three months after commencement.

COMMERCIAL STATISTICS.

For commercial statistics, see commercial statistics for improving Woods Hole Channel, Massachusetts.

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C 4.

IMPROVEMENT OF WOODS HOLE CHANNEL, MASSACHUSETTS.

For history and project, see page 78 of this report.

Operations during the past fiscal year.—A project for the expenditure of the funds appropriated by the river and harbor act of March 3, 1905, has been approved and specifications for the completion of the project have been prepared.

The main channel has been cleared of all obstructing shoals for its full width, excepting two small shoals on the northern edge of the channel near Devils Foot Island and the main shoal at its eastern end, through which a channel 225 feet wide has been dredged to the full depth of 13 feet at mean low water.

Operations contemplated for the fiscal year ending June 30, 1906.—It is proposed to expend the available funds in the completion of the project.

The prices at which the contracts for the work in Woods Hole Channel have been let and the proportion of large bowlders to the smaller material have both been much less than was estimated. It is therefore believed that the $100,000 authorized by the river and harbor act of March 3, 1905, will be sufficient to complete the project.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1905	$70,000.00
July 1, 1905, balance unexpended	70,000.00
Amount (estimated) required for completion of existing project	266,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement in addition to the balance unexpended July 1, 1905	100,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

AMOUNTS APPROPRIATED.

August 30, 1852	$2,500.00
March 3, 1879	15,000.00
August 2, 1882	52,000.00
July 5, 1884	25,000.00
August 5, 1886	14,000.00
March 2, 1895	5,000.00
June 3, 1896	20,000.00
March 3, 1899	20,000.00
June 13, 1902	20,000.00
March 3, 1905	70,000.00
Total	244,000.00
December 5, 1895, unexpended balance deposited to the credit of the Treasurer of the United States	400.08
Total	243,599.92

COMMERCIAL STATISTICS.

The commerce arriving at and leaving Woods Hole, Mass., by water during the calendar year ending December 31, 1904, is estimated as follows (based mainly upon reports received from Mr. Walter O. Luscombe, of Woods Hole, Mass.):

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Commerce arriving at and leaving Woods Hole, calendar year 1904.

	Tons.
Grains and forage	5,000
Vegetables and truck	40
Live stock and products	225
Fish, oysters, etc	350
Naval stores	500
Lumber and products	8,000
Coal, minerals, etc	9,000
Fertilizers	500
Machinery	1,700
Total	25,315
Increase over 1903	5,265

The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
Steam:		*Feet.*	
Freight and passenger	400	10	900
Freight, mainly	100	7	25
Passenger, mainly	200	10	75
Fishing	50	8	100
Tugs	150	11	300
Pleasure boats	100	10	100
Sail:			
Freight	100	8	150
Fishing boats	175	7	50
Pleasure boats, large	50	4	15
Pleasure boats, small	200	3	5

C 5.

IMPROVEMENT OF BUZZARDS BAY, MASSACHUSETTS, BY THE REMOVAL OF WEEPECKET ROCK.

For project, see page 80 of this report.

Operations during the past fiscal year.—The river and harbor act of March 3, 1905, contained the following item:

Improving Buzzards Bay, Massachusetts: By removing Weepecket Rock in accordance with the report submitted in House Document numbered one hundred and sixty-four, Fifty-eighth Congress, second session, two thousand five hundred dollars.

Proposals for the removal of Weepecket Rock were received May 23, 1905, after public advertisement in the usual way, and the contract for its removal awarded to Chas. E. Davis, of New Bedford, Mass., for the lump sum of $1,380.

The date of this contract is June 5, 1905, work to be commenced within twenty days after the notification of the approval of the contract and be completed within two months.

The work of drilling of the rock preparatory to blasting commenced June 28, 1905, and was in progress at the close of the fiscal year.

Operations contemplated for the fiscal year ending June 30, 1906.—It is proposed to expend the available funds in completing the project.

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Money statement.

Amount appropriated by river and harbor act approved March 3, 1905	$2,500.00
June 30, 1905, amount expended during fiscal year, for works of improvement	16.63
July 1, 1905, balance unexpended	2,483.37
July 1, 1905, amount covered by uncompleted contracts	1,380.00

AMOUNT APPROPRIATED.

March 3, 1905 $2,500

CONTRACT IN FORCE.

Contractor: Charles E. Davis.
Amount and character of work: Removal of Weepecket Rock, in Buzzards Bay, Massachusetts.
Date of approval: June 10, 1905.
To commence within twenty days from date of notification of approval by the Chief of Engineers.
To complete within two months after commencement.
Rate: Lump sum of $1,380 for removing the rock.

COMMERCIAL STATISTICS.

For commercial statistics, see statistics for New Bedford Harbor and Woods Hole channel, Massachusetts.

C 6.

IMPROVEMENT OF NEW BEDFORD HARBOR, MASSACHUSETTS.

For history and projects see page 80 of this report.

Operations during the past fiscal year.—The river and harbor act of March 3, 1905, contained the following item:

Improving harbor of New Bedford, Massachusetts, in accordance with the report submitted in House Document Numbered One hundred and sixty-nine, Fifty-sixth Congress, first session: Completing improvement, eleven thousand dollars.

Proposals were received for dredging under the approved project May 10, 1905, and the contract awarded to Charles M. Cole, of Fall River, Mass., for completing the work, at 19 cents per cubic yard. The date of this contract is May 31, 1905, work to be commenced within fifteen days after notification of its approval and completed within three months. The amount of the contract is about 55,000 cubic yards. The work of dredging was commenced promptly with two dredges and was completed June 21, 1905. The total amount excavated under the contract was 54,446 cubic yards of sand and mud and 9.22 cubic yards of bowlders exceeding 1 cubic yard each. The dredging disclosed a small area of ledge rock which rises about 2 feet above the required grade of the bottom.

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Operations contemplated for the fiscal year ending June 30, 1906.—An examination of the small area of rock uncovered near the close of the dredging contract will be made with a view to its removal.

Money statement.

July 1, 1904, balance unexpended	$826.18
Amount appropriated by river and harbor act approved March 3, 1905	11,000.00
	11,826.18
June 30, 1905, amount expended during fiscal year, for works of improvement	977.40
July 1, 1905, balance unexpended	10,848.78
July 1, 1905, outstanding liabilities	10,733.95
July 1, 1905, balance available	114.83

AMOUNTS APPROPRIATED.

Previous projects.

July 4, 1836	$10,000	
March 3, 1875	10,000	
August 14, 1876	10,000	
August 11, 1888	10,000	
September 19, 1890	10,000	
July 13, 1892	7,500	
August 18, 1894	7,500	
June 3, 1896	10,000	
March 3, 1899	44,000	
June 13, 1902	37,700	
Total		$156,700
Received from sale of material		9
Total		156,709

Existing project.

March 3, 1905	11,000
Total	167,709

CONTRACT IN FORCE.

Contractor: Charles M. Cole.
Amount of work: $10,000.
Character of work: Dredging.
Rate per cubic yard: 19 cents.
Date of approval: June 29, 1905.
To commence within fifteen days after date of notification of approval by the Chief of Engineers.
Date of expiration: In three months after date of beginning.

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COMMERCIAL STATISTICS.

The commerce arriving at and leaving New Bedford, Mass., by water during the calendar year ending December 31, 1904, is estimated as follows (based mainly upon reports received from Mr. Edward P. Haskell, special deputy collector of customs, New Bedford, Mass.):

Commerce arriving at and leaving New Bedford, calendar year 1904.

	Tons.
Cotton and products	16,000
Tobacco	400
Vegetables and truck	12,000
Live stock and products	600
Fish, oysters, etc	8,500
Lumber and products	31,000
Coal, minerals, etc	463,000
Fertilizers	3,500
General merchandise	212,000
Sundries	28,000
Total	775,000
Decrease under 1903	39,517

The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
Steam:		*Feet.*	
Freight and passenger	834	12	879
Freight mainly	814	15	1,816
Passenger mainly	520	8	395
Fishing	500	4	10
Tugs	610	10	75
Pleasure boats	60	10	110
Sail:			
Freight	297	13	1,100
Fishing boats	900	7	20
Pleasure boats, large	250	11	150
Pleasure boats, small	500	5	15
Barges	383	14	1,000

C 7.

IMPROVEMENT OF TAUNTON RIVER, MASSACHUSETTS.

For history and projects, see page 81 of this report.

Operations during the past fiscal year.—No work of improvement has been in progress during the past fiscal year.

The river and harbor act of March 3, 1905, appropriated $5,000 for maintenance.

Operations contemplated for the fiscal year ending June 30, 1906.—It is proposed to expend the available funds in dredging the shoals offering the greatest obstruction to navigation.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1905	$5,000.00
July 1, 1905, balance unexpended	5,000.00
Amount (estimated) required for completion of existing project	5,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	5,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

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AMOUNTS APPROPRIATED.

Previous projects.

July 11, 1870	$10,000	
March 3, 1871	10,000	
June 10, 1872	10,000	
March 3, 1873	10,000	
June 23, 1874	10,000	
March 3, 1875	10,000	
June 18, 1878	2,000	
March 3, 1879	1,000	
		$63,000

Existing projects.

July 14, 1880	$17,500	
March 3, 1881	25,000	
August 2, 1882	25,000	
July 5, 1884	26,500	
September 19, 1890	7,000	
July 3, 1892	7,000	
August 18, 1894	5,000	
June 3, 1896	5,000	
March 3, 1899	7,000	
June 13, 1902	5,000	
March 3, 1905	5,000	
		135,000
Total		198,000

COMMERCIAL STATISTICS.

The commerce arriving at and leaving Taunton River, Massachusetts, by water during the calendar year ending December 31, 1904, is estimated as follows (based mainly upon reports received from the Staples Coal Company, Taunton, Mass.):

Commerce arriving at and leaving Taunton River, calendar year 1904.

	Tons.
Cotton and products	5,000
Grains and forage	40,000
Fish, oysters, etc	100
Lumber and products	20,000
Coal, minerals, etc	510,000
General merchandise	3,000
Sundries	10,000
Total	588,100

No increase or decrease over 1903.

The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
		Feet.	
Steam:			
Tugs	800	7	50
Pleasure boats	100	4	12
Sail:			
Freight	700	9	200
Fishing boats	100	7	90
Pleasure boats, small	400	4	10
Barges	900	9	900

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C 8.

IMPROVEMENT OF SAKONNET RIVER, RHODE ISLAND.

For history and projects, see page 82 of this report.

Operations during the past fiscal year.—The necessary State legislation to enable the United States to carry out the project having been enacted, specifications were prepared for the work of enlarging the draw opening in the State bridge at Tiverton, R. I., to a clear width of 100 feet and a depth of 25 feet at mean low tide. Proposals for the work were received June 28, 1905, and the contract awarded to Charles M. Cole, of Fall River, Mass., at the rate of $1.87 per cubic yard. Work to be commenced within fifteen days of receipt of notice of the approval of the contract and completed within three months.

Operations contemplated for the fiscal year ending June 30, 1906.—It is proposed to complete the work.

Money statement.

July 1, 1904, balance unexpended	$40,000.00
June 30, 1905, amount expended during fiscal year, for works of improvement	1.44
July 1, 1905, balance unexpended	39,998.56
July 1, 1905, outstanding liabilities	31.65
July 1, 1905, balance available	39,966.91

AMOUNTS APPROPRIATED.

June 3, 1896	$20,000
March 3, 1899	20,000
Total	40,000

COMMERCIAL STATISTICS.

This office has made diligent effort to obtain reliable statistics for Sakonnet River, but has been unsuccessful.

C 9.

IMPROVEMENT OF PAWTUCKET (SEEKONK) RIVER, RHODE ISLAND.

For history and project, see page 83 of this report.

Operations during the past fiscal year.—The river and harbor act of March 3, 1905, contained the following item:

Improving Pawtucket River, Rhode Island, in accordance with the plan contained in House Document Numbered One hundred and thirteen, Fifty-sixth Congress, first session, thirty thousand dollars.

The plan referred to provides for a channel depth of 16 feet at mean low water and a width of 100 feet from Providence to Paw-

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tucket, and a channel of the same depth and a width of 50 feet through the ledge rock at Pawtucket.

A conference was had with those interested in the improvement with a view to determining the points at which the funds could be expended most advantageously. The opinions expressed at this conference favored the expenditure of the greater part of the funds on the rock work at Pawtucket.

Operations contemplated for the fiscal year ending June 30, 1906.—A project for the expenditure of the appropriation will be submitted and the work performed.

Money statement.

July 1, 1904, balance unexpended	$1,574.68
Amount appropriated by river and harbor act approved March 3, 1905	30,000.00
July 1, 1905, balance unexpended	31,574.68
Amount (estimated) required for completion of existing project	207,875.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	100,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

AMOUNTS APPROPRIATED.

March 2, 1867	$17,000.00	June 3, 1896	$20,500.00
July 11, 1870	8,000.00	March 3, 1899	30,000.00
March 3, 1871	7,000.00	June 13, 1902	28,500.00
June 10, 1872	10,000.00	March 3, 1905	30,000.00
March 3, 1873	10,000.00		
July 5, 1884	50,000.00	Total	366,000.00
August 5, 1886	30,000.00	Received from sale of material	19.59
August 11, 1888	35,000.00		
September 19, 1890	30,000.00	Total	366,019.59
July 13, 1892	35,000.00		
August 18, 1894	25,000.00		

COMMERCIAL STATISTICS.

The commerce arriving at and leaving Pawtucket River, Rhode Island, during the calendar year ending December 31, 1904, is estimated as follows (based mainly upon reports received from the Newell Coal and Lumber Company, of Pawtucket, R. I.):

Commerce arriving at and leaving Pawtucket River, calendar year 1904.

	Tons.
Lumber and products	5,367
Coal, minerals, etc	203,530
Fertilizers	200
General merchandise	14,524
Sundries	6,214
Total	229,835
Decrease under last year	556

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The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
		Feet.	
Steam:			
Freight, mainly	300	10	500
Passenger, mainly	350	8	100
Tugs	700	5	50
Sail:			
Freight	300	10	300
Pleasure boats, large	30	7	100
Pleasure boats, small	400	3	4
Barges	150	10	500

C 10.

IMPROVEMENT OF PROVIDENCE RIVER AND HARBOR, NARRAGANSETT BAY, AND GREEN JACKET SHOAL, RHODE ISLAND.

For history and projects see page 84 of this report.

Operations during the past fiscal year.—The river and harbor act of March 3, 1905, placed this work under the continuing-contract system.

A contract was entered into with the Columbia Dredging Company, of New York, under date of June 5, 1905, for dredging the remaining soft material in the projected harbor at the rate of 8.45 cents per cubic yard. The removal of the hard material underlying the mud in a small area of the harbor was reserved for a future contract. The amount of the contract with the Columbia Dredging Company is $400,000, more or less, of which $100,000 was appropriated by the act of March 3, 1905. Time of commencement, within fifteen days of the notification of the approval of the contract by the Chief of Engineers, and to be completed not later than November 30, 1907.

Operations contemplated for the fiscal year ending June 30, 1906.—Work will be commenced early in the year and continued as long as funds are available.

Money statement.

July 1, 1904, balance unexpended	$12,248.96
Amount appropriated by river and harbor act approved March 3, 1905	100,000.00
Reimbursement	8.48
	112,257.44
June 30, 1905, amount expended during fiscal year, for works of improvement	4,875.26
July 1, 1905, balance unexpended	107,382.18
July 1, 1905, outstanding liabilities	53.74
July 1, 1905, balance available	107,328.44
July 1, 1905, amount covered by uncompleted contracts	400,000.00
Amount (estimated) required for completion of existing project	407,778.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	407,778.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

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AMOUNTS APPROPRIATED FOR PROVIDENCE.

Previous projects.

August 30, 1852	$5,000.00	
August 30, 1852, survey	1,500.00	
May 2, 1867	25,000.00	
July 11, 1870	5,000.00	
July 15, 1870	2,500.00	
June 10, 1872	10,000.00	
March 3, 1873	10,000.00	
March 18, 1876	5,000.00	
June 18, 1878	50,000.00	
July 14, 1880	60,000.00	
March 3, 1881	60,000.00	
August 2, 1882	60,000.00	
July 5, 1884	125,000.00	
August 5, 1886	85,000.00	
August 11, 1888	40,000.00	
September 19, 1890	50,000.00	
July 13, 1892	50,000.00	
August 18, 1894	17,500.00	
June 3, 1896	25,000.00	
June 4, 1897	125,000.00	
July 1, 1898	125,000.00	
March 3, 1899	10,000.00	
June 6, 1900	54,489.00	
March 3, 1901	59,000.00	
June 28, 1902	84,560.00	
		$1,174,549.00
Received from sale of material		143.39
Received by reimbursement from Col. W. R. Livermore		8.48
		1,174,700.87

Existing project.

June 13, 1902	$100,000.00	
March 3, 1905	100,000.00	
		200,000.00
Total		1,374,700.87

FOR GREEN JACKET SHOAL.

Present project.

August 5, 1886	$26,250	August 18, 1894	$7,500
August 11, 1888	28,000	June 3, 1896	7,500
September 19, 1890	25,000		
July 13, 1892	10,000	Total	104,250

CONTRACT IN FORCE.[a]

Contractor.	Work.		Price per cubic yard.	Date of approval.	To commence.	Date of expiration.
	Amount.	Character.				
Columbia Dredging Co.	$100,000	Dredging.	Cents. 8.45	June 24, 1905	Within 15 days after notification of approval.	Not later than Nov. 30, 1907.

[a] This is a continuing contract.

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COMMERCIAL STATISTICS.

The commerce arriving at and leaving Providence River, Rhode Island, by water during the calendar year ending December 31, 1904, is estimated as follows (based mainly upon reports received from the harbor master of Providence, R. I., Mr. John H. Maguire):

Commerce arriving at and leaving Providence River, calendar year 1904.

	Tons.
Coal, minerals, etc., and products	2,128,418
Lumber and products	42,856
Brick, sand, cement, gravel, stone, etc	43,834
Corn and potatoes	2,427
Oyster shells	1,500
Boneblack	800
Canned goods	5
Oil	39,333
Total	2,259,173
Decrease under 1903	380,833

The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
		Feet.	
Steam:			
Freight and passenger	700	12	600
Freight mainly	400	18	1,450
Passenger mainly	1,785	7	519
Fishing	1,500	3	30
Tugs	882	13	100
Pleasure boats	1,550	5	30
Sail:			
Freight	871	18	1,500
Pleasure boats, large	450	7	40
Pleasure boats, small	1,600	3	7
Barges	1,522	16	1,200

C 11.

IMPROVEMENT OF FALL RIVER HARBOR, MASSACHUSETTS.

For history and project see page 86 of this report.

Operations during the past fiscal year.—The work in progress at the beginning of the fiscal year under the continuing contract with the J. S. Packard Dredging Company, of Providence, R. I., for dredging a channel 300 feet wide and 25 feet deep at mean low tide in front of the city and across the flats in Mount Hope Bay to the deep water of Narragansett Bay was continued until September 6, 1904, when the work was completed. During the fiscal year 143,229 cubic yards of mud were dredged, making a total of 1,091,462 cubic yards under the contract.

Operations contemplated for the fiscal year ending June 30, 1906.—All approved projects for this harbor were completed under the above project. No further work is contemplated.

Money statement.

July 1, 1904, balance unexpended	$44,163.95
June 30, 1905, amount expended during fiscal year, for works of improvement	42,148.45
July 1, 1905, balance unexpended	2,015.50

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AMOUNTS APPROPRIATED.

Previous projects.

June 23, 1874	$10,000	
March 3, 1875	10,000	
August 14, 1876	10,000	
		$30,000

Existing project.

March 3, 1899	$20,000	
June 3, 1902	38,000	
March 3, 1903	117,412	
		175,412
Total		205,412

CONTRACT IN FORCE.

Contractor: J. S. Packard Dredging Company.
Date of approval: December 11, 1902.
To commence in fifteen days after notification of approval by the Chief of Engineers.
To complete in eighteen months after commencement.
Rate: 13.1 cents per cubic yard.
Amount of work: About 1,081,000 cubic yards material to be removed.
Character of work: Dredging.

COMMERCIAL STATISTICS.

This office has made diligent effort to obtain reliable statistics for Fall River Harbor, Massachusetts, but has been unsuccessful.

C 12.

IMPROVEMENT OF NEWPORT HARBOR, RHODE ISLAND.

For history and project see page 87 of this report.

Operations during the past fiscal year.—The work of removing a small area of ledge rock in the channel through the harbor in front of the New York, New Haven and Hartford Railroad Company's wharf, in progress at the beginning of the fiscal year, was completed early in July.

No other works of improvement have been in progress.

Operations contemplated for the fiscal year ending June 30, 1906.—Further work awaits the action of Congress. The report and estimate for a channel 18 feet deep through the harbor was printed as Document No. 121, House of Representatives, Fifty-eighth Congress, and at page 939, Annual Report of 1904.

Money statement.

July 1, 1904, balance unexpended	$1,438.81
June 30, 1905, amount expended during fiscal year, for works of improvement	730.33
July 1, 1905, balance unexpended	708.48

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AMOUNTS APPROPRIATED.

March 3, 1873	$8,500.00	August 29, 1901 (allotment)	$50.00
June 23, 1874	10,000.00	June 6, 1902 (allotment)	750.00
March 3, 1875	10,000.00	June 13, 1902	39,000.00
March 3, 1881	25,000.00	Received from sale of material	8.52
August 2, 1882	20,000.00	Total	235,308.52
July 5, 1884	20,000.00	Amount returned to Treasury of the United States	420.46
August 5, 1886	15,000.00	Total	234,888.06
August 11, 1888	12,000.00		
September 19, 1890	12,500.00		
July 13, 1892	25,000.00		
August 18, 1894	7,500.00		
June 3, 1896	15,000.00		
March 3, 1899	15,000.00		

COMMERCIAL STATISTICS.

The commerce arriving at and leaving Newport Harbor, Rhode Island, during the calendar year ending December 31, 1904, is estimated as follows (based on report received from Mr. Clarence A. Hammett, collector of customs, Newport, R. I.):

Commerce arriving at and leaving Newport Harbor, calendar year 1904.

	Tons.
Tobacco	55
Grains and forage	2,570
Vegetables and truck	1,350
Fish, oysters, etc	149,000
Naval stores	1,700
Lumber and products	148,000
Coal, minerals, etc	1,122,250
Fertilizers	1,650
Machinery	1,500
General merchandise	91,300
Sundries	42,000
Total	[a] 1,561,375
Increase over 1903	[a] 1,146,400

The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
		Feet.	
Steam:			
Freight and passenger	1,500	12	2,050
Freight mainly	480	10	1,200
Passenger mainly	4,200	9	600
Fishing	210	9	200
Tugs	800	9	97
Pleasure boats	1,500	7	125
Sail:			
Freight	1,500	10	160
Fishing boats	5,400	6	30
Pleasure boats, large	1,900	6	15
Pleasure boats, small	3,500	3	4
Barges	600	12	650

[a] Includes about 999,000 tons of coal and about 100,000 tons of lumber carried to other ports, but using Newport Harbor in stress of weather.

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C 13.

IMPROVEMENT OF HARBOR AT COASTERS HARBOR ISLAND, RHODE ISLAND.

For history and project see page 88 of this report.

Operations during the past fiscal year.—Work under the contract with the J. S. Packard Dredging Company, of Providence, R. I., dated May 31, 1904, for dredging the channel on the east and north sides of Coasters Harbor Island, was commenced July 5 and completed September 30, 1904. Under this contract 56,658 cubic yards of mud and sand and 17.78 cubic yards of bowlders exceeding 1 cubic yard were excavated, making a channel 7 feet deep and 80 feet wide, excepting where an outcropping of ledge rock near the bridge reduced the depth to about 6 feet for the greater portion of the width. There was also dredged a turning basin opposite the boathouse used by the United States Navy Department for the storage of launches. This work completed all that was contemplated.

Money statement.

July 1, 1904, balance unexpended		$12,949.33
June 30, 1905, amount expended during fiscal year:		
Returned to Treasury	$15.51	
For maintenance of improvement	12,933.82	
		12,949.33

AMOUNTS APPROPRIATED.

June 6, 1900 (allotment)	$4,661.87
June 13, 1902 (allotment)	8,338.13
Total	13,000.00

CONTRACT IN FORCE.

Contractor: J. S. Packard Dredging Company.
Amount and character of work: About 60,000 cubic yards of dredging.
Price per cubic yard: Twenty-one cents.
Date of approval: June 15, 1904.
To commence within fifteen days after approval.
Date of expiration: September 15, 1904.

COMMERCIAL STATISTICS.

For commercial statistics see report for improving harbor at Newport, R. I.

C 14.

HARBOR OF REFUGE AT POINT JUDITH, RHODE ISLAND.

For history and project, see page 88 of this report.

Operations during the past fiscal year.—The river and harbor act of March 3, 1905, required the construction of extensions to the shore arm of the breakwater and placed the work under the continuing con-

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tract system, appropriating $100,000 therefor, and authorizing an additional $100,000.

Investigations were made with a view to the preparation of a project for the expenditure of the funds, and specifications were prepared for the work.

Three small lights were maintained on the main breakwater by the Engineer Department.

During the year the following vessels made use of the harbor: 173 schooners, 56 sloops, 52 steamers, 11 barges, 8 catboats, 2 tugs, 1 collier, 1 torpedo boat, and 1 submarine boat.

Operations contemplated for the fiscal year ending June 30, 1906.—A contract will be let for the proposed work, and the seaward extension of the breakwater will be constructed as far as the funds will permit. Proceedings will be instituted for the condemnation of the land necessary for the shore end of the breakwater. After the title to this land is secured by the United States the shore end of the breakwater will be constructed.

Money statement.

July 1, 1904, balance unexpended	$8,040.96
Amount appropriated by river and harbor act approved March 3, 1905	100,000.00
	108,040.96
June 30, 1905, amount expended during fiscal year, for works of improvement	1,423.75
July 1, 1905, balance unexpended	106,617.21
July 1, 1905, outstanding liabilities	80.00
July 1, 1905, balance available	106,537.21
Amount (estimated) required for completion of existing project	628,062.78
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	300,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

AMOUNTS APPROPRIATED.

September 19, 1890	$75,000.00	March 3, 1905	$100,000.00
July 13, 1892	75,000.00		
March 3, 1893	100,000.00	Total	1,450,000.00
August 18, 1894	100,000.00	Received from sale of material	38.61
March 2, 1895	300,000.00		
June 11, 1896	300,000.00	Total	1,450,038.61
June 4, 1897	300,000.00		
June 13, 1902	100,000.00		

COMMERCIAL STATISTICS.

The tonnage of vessels passing Point Judith, R. I., during the calendar year ending December 31, 1904, is estimated as follows (based mainly upon reports received from Mr. Asa Church, keeper Point Judith life-saving station, Rhode Island):

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Tonnage of vessels passing Point Judith, calendar year 1904.

	Gross tons.
Steamers (freight, fish, and passenger)	9,000,000
Yachts (steam and sail)	1,500,000
Schooners (two to six masts)	32,100,000
Ships, barks, brigs, barkentines, etc	200,000
Sloops	50,000
Barges	7,700,000
Total	50,550,000
Increase over 1903	50,000

C 15.

IMPROVEMENT OF ENTRANCE TO POINT JUDITH POND, RHODE ISLAND.

For history see page 89 of this report.

Operations during the past fiscal year.—The river and harbor act of March 3, 1905, appropriated $2,000 for this improvement, which, with the unexpended balances of previous appropriations, shall be applied to the extension of jetties or in dredging, as the Secretary of War may deem most beneficial.

Such work as has been done toward the construction of an entrance to this pond has been done by the State of Rhode Island and the town of South Kingstown.

With a view to forming a project for the expenditure of the available funds, a survey of the locality has been made and several conferences had with the State commissioners in order that there may be united action in the prosecution of the improvement.

Operations contemplated for the fiscal year ending June 30, 1906.—A project will be submitted and the work carried out as far as funds will permit.

Money statement.

July 1, 1904, balance unexpended	$8,730.56	
Amount appropriated by river and harbor act approved March 3, 1905	2,000.00	
		10,730.56
June 30, 1905, amount expended during fiscal year, for works of improvement		193.95
July 1, 1905, balance unexpended		10,536.61

AMOUNTS APPROPRIATED.

July 13, 1892	$7,500
August 18, 1894	2,500
March 3, 1905	2,000
Total	12,000

COMMERCIAL STATISTICS.

For commercial statistics see report for harbor of refuge at Point Judith, R. I.

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C 16.

HARBOR OF REFUGE AT BLOCK ISLAND, RHODE ISLAND.

For history and project, see page 90 of this report.

Operations during the past fiscal year.—Lights were maintained at the entrance to the harbor during the year by the Engineer Department.

Under the appropriation of $50,000 made by the river and harbor act of March 3, 1905, for the completion of this improvement, the following contracts were let:

With E. S. Belden & Sons, of Hartford, Conn., under date of June 12, 1905, for about 10,000 tons of stone to complete the repairs to the breakwater, at the rate of $2.13 per ton in place; work to commence within fifteen days of the notification of approval of the contract and be completed within four working months.

With the J. S. Packard Dredging Company, of Providence, R. I., under date of June 12, 1905, for about 100,000 cubic yards of dredging from the enlarged inner harbor, at the rate of 24 cents per cubic yard; work to commence within twenty days of notification of the approval of the contract and be completed within six months.

Work under the Belden contract was commenced on June 15, and up to the close of the fiscal year 1,571 tons of stone had been placed.

Work under the Packard contract had not been commenced at the close of the fiscal year.

Operations contemplated for the fiscal year ending June 30, 1906.—The project will be completed.

Money statement.

July 1, 1904, balance unexpended	$3,945.00
Amount appropriated by river and harbor act approved March 3, 1905	50,000.00
	53,945.00
June 30, 1905, amount expended during fiscal year, for works of improvement	1,896.10
July 1, 1905, balance unexpended	52,048.90
July 1, 1905, outstanding liabilities	30.00
July 1, 1905, balance available	52,018.90
July 1, 1905, amount covered by uncompleted contracts	45,300.60

AMOUNTS APPROPRIATED.

July 11, 1870	$30,000.00	July 13, 1892	$24,000.00
March 3, 1871	75,000.00	August 18, 1894	2,500.00
June 10, 1872	50,000.00	June 3, 1896	5,000.00
March 3, 1873	50,000.00	March 3, 1899	10,000.00
June 23, 1874	20,000.00	April 15, 1902 (allotment)	4,500.00
March 8, 1875	20,000.00	June 13, 1902	30,000.00
August 14, 1876	40,000.00	March 3, 1905	50,000.00
July 14, 1880	6,000.00		
August 2, 1882	19,000.00	Total	501,000.00
July 4, 1884	15,000.00	Amount returned to United States Treasury	2,108.83
August 5, 1886	20,000.00		
August 11, 1888	15,000.00		
September 19, 1890	15,000.00	Total	498,891.17

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CONTRACTS IN FORCE.

Contractor.	Work.		Rate—		Date of approval.	To commence—	Date of expiration.
	Amount.	Character.	Per cubic yard.	Per ton of 2,000 pounds stone.			
			Cents.				
J. S. Packard Dredging Co.	$80,000	Dredging	24	.....	July 8, 1905.	In 20 days after notification of approval.	In 6 months after beginning.
E. S. Belden & Sons.	20,000	Repairing breakwater.	.....	$2.18	....do...	In 15 days after notification of approval.	In 4 working months after beginning.

COMMERCIAL STATISTICS.

The commerce arriving at and leaving Block Island, Rhode Island, by water during the calendar year ending December 31, 1904, is based as follows (based mainly upon reports received from Mr. C. C. Ball, Block Island, Rhode Island):

Commerce arriving at and leaving Block Island, calendar year 1904.

	Tons.
Cotton and products	200
Tobacco	65
Rice	20
Grains and forage	9,000
Vegetables and truck	3,500
Live stock and products	6,500
Fish, oysters, etc	45,000
Naval stores	30
Lumber and products	10,000
Coal, minerals, etc	25,000
Fertilizers	3,000
Machinery	600
General merchandise	30,000
Sundries	30,000
Total	162,915
Increase over 1903	59,690

The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
		Feet.	
Steam:			
Freight and passenger	3,500	9½	600
Freight mainly	800	8½	300
Passenger mainly	600	9	400
Fishing	4,000	10	200
Tugs	1,000	10½	200
Pleasure boats	5,000	9½	200
Sail:			
Freight	3,500	10½	225
Fishing boats	18,500	9½	100
Oyster boats	300	7½	35
Pleasure boats, large	4,500	9	150
Pleasure boats, small	16,000	7½	15
Barges	200	12	450

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C 17.

IMPROVEMENT OF GREAT SALT POND, BLOCK ISLAND, RHODE ISLAND.

For history and project, see page 92 of this report.

Operations during the past fiscal year.—Under the appropriation of $30,000 for this improvement, it is proposed to extend the south jetty about 150 feet, which will carry the outer end into 25 feet depth of water, and to dredge the central portion of the entrance channel to a depth of 25 feet at mean low tide and of as great a width with this depth as the funds will allow.

Proposals for this work will be received on July 8, 1905.

Operations contemplated for the fiscal year ending June 30, 1906.—Contracts will be let and the work carried out as far as funds will allow.

Money statement.

July 1, 1904, balance unexpended	$18,318.46
Amount appropriated by river and harbor act approved March 3, 1905	30,000.00
	48,318.46
June 30, 1905, amount expended during fiscal year, for works of improvement	1,054.87
July 1, 1905, balance unexpended	47,263.59
July 1, 1905, outstanding liabilities	44.46
July 1, 1905, balance available	47,219.13
Amount (estimated) required for completion of existing project	135,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	135,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

AMOUNTS APPROPRIATED.

June 3, 1896	$40,000
March 3, 1899	50,000
June 13, 1902	50,000
March 3, 1905	30,000
Total	170,000

CONTRACT IN FORCE.

Contractor: Charles H. Latham.
Amount of work: $12,000 worth, less expenses of supervision and contingencies.
Character of work: Dredging.
Rate per cubic yard: 26.7 cents.
Date of approval: January 12, 1903.
To commence not later than May 1, 1903.
Date of expiration: In five working months after commencement, later extended until September 1, 1904.

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COMMERCIAL STATISTICS.

The commerce arriving and leaving the Great Salt Pond, Block Island, Rhode Island, by water during the calendar year ending December 31, 1904, is estimated as follows, based mainly upon reports received from Mr. Christopher E. Champlin, Block Island, Rhode Island.

Commerce arriving at and leaving Great Salt Pond, Block Island, Rhode Island, calendar year 1904.

	Tons.
Grains and forage	5,000
Vegetables and truck	6,000
Live stock and products	2,500
Fish, oysters, etc	5,000
Lumber and products	4,000
Coal, minerals, etc	5,000
Fertilizers	500
Machinery	2,000
General merchandise	10,000
Sundries	5,000
Total	45,000
Increase over 1903	4,650

New transportation companies established during the year: Line of steamers belonging to the Pennsylvania Railroad from Montauk Point to Great Salt Pond, four and one-half hours from New York City to Block Island.

The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
		Feet.	
Steam:			
Freight and passenger	2,000	10	600
Freight mainly	1,500	12	500
Passenger mainly	500	11	100
Fishing	3,000	12	400
Tugs	600	9	75
Pleasure boats	7,000	11	200
Sail:			
Freight	500	11	200
Fishing boats	10,000	10	200
Pleasure boats, large	6,000	6	10
Pleasure boats, small	3,000	3	5
Barges	500	11	800

C 18.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

Schooner Levi Hart and unknown wreck.—Sunk in Pollock Rip Slough about 300 feet apart. Removal authorized April 29, 1904, commenced in May, 1904, and was completed in June, 1904. One thousand and fifty pounds of dynamite in 68 charges were used in destroying the *Levi Hart*, and 650 pounds of dynamite in 30 charges were used in destroying the unknown wreck.

The cost of removal was $1,094.87 for the two wrecks.

Barkentine Albertina and Schooner Viola May.—The former sunk on Chatham bar and the latter on Shovelful shoal, near south end of Monomoy Point, Massachusetts. Removal authorized August 4, begun September 22, and finished in November, 1904. Eleven hundred pounds

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of dynamite in 200 charges were used to destroy the wreck of the *Albertina* and 800 pounds in 150 charges to destroy the wreck of the *Viola May*.

The cost of removal of the two wrecks was $1,983.30.

Schooner Frauline.—Sunk northeast from northwest buoy on Common Flat, Chatham, Mass. Removal authorized October 8 and finished in December, 1904, 500 pounds of dynamite in 75 charges being used in destroying the wreck.

The cost of removal was $473.70.

Schooner Richard S. Leaming.—Sunk off Cross Rip light-ship; 487 tons. Removal authorized December 30, 1904; work begun February 25, 1905, and was completed in April, 1905. Seven hundred pounds of dynamite in 60 charges were used in the work.

The cost of removal was $1,710.

Schooner at Nantucket Harbor, Massachusetts.—Reported as a wreck which had drifted into the entrance to Nantucket channel, and subsequently believed to be the *Frank Palmer*. Removal authorized December 31, 1904. Upon the arrival of the wrecking party the wreck could not be located, and diligent search failed to locate it, it evidently having been carried out to sea.

Cost of the work was $381.20.

Schooner Anna Laura.—Sunk 1¼ miles from Hardings Beach, Massachusetts. Removal authorized March 28, 1905; work commenced April 13 and finished April 25, 1905, 450 pounds of dynamite in 53 charges being used in the work of removal.

Cost of removal was $427.

Steamship Aransas.—This steamer of the Joy Line was wrecked on the night of May 7–8, 1905, in Pollock Rip channel, Massachusetts; 1,156 tons. Removal authorized May 13, 1905, and work commenced May 15, 1905. This work was in progress at the close of the fiscal year.

Barge Moonbeam.—Sunk off Point Judith, Rhode Island, in a gale on the night of May 3, 1905. Removal authorized June 24, 1905. Work had not commenced at the close of the fiscal year.

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APPENDIX D.

IMPROVEMENT OF RIVERS AND HARBORS IN CONNECTICUT, AND OF PAWCATUCK RIVER, RHODE ISLAND AND CONNECTICUT.

REPORT OF LIEUT. COL. CHAS. F. POWELL, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1905, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Pawcatuck River, Rhode Island and Connecticut.
2. New London Harbor, Connecticut.
3. Thames River, Connecticut.
4. Connecticut River below Hartford, Connecticut.
5. Harbor of Refuge, Duck Island, Connecticut.
6. Branford Harbor, Connecticut.
7. New Haven Harbor, Connecticut.
8. Construction of breakwaters at New Haven, Connecticut.
9. West River, Connecticut.
10. Milford Harbor, Connecticut.
11. Housatonic River, Connecticut.
12. Bridgeport Harbor, Connecticut.
13. Saugatuck River and Westport Harbor, Connecticut.
14. Harbors at Norwalk, Fivemile River, Stamford, Southport, and Greenwich, Connecticut.

SURVEY.

15. Connecticut River between Hartford, Connecticut, and Holyoke, Massachusetts.

UNITED STATES ENGINEER OFFICE,
New London, Conn., July 31, 1905.

GENERAL: I have the honor to transmit herewith annual report of the works of river and harbor improvements in my charge for the year ending June 30, 1905.

Very respectfully, your obedient servant,

CHAS. F. POWELL,
Lieut. Col., Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

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D 1.

IMPROVEMENT OF PAWCATUCK RIVER, RHODE ISLAND AND CONNECTICUT.

No work of improvement was done from want of sufficient funds. Surveys were made of the channels across Little Narragansett Bay and at Pawcatuck Point and near Watch Hill, and examinations made of the river channel. About 15 per cent of the approved project was accomplished up to June 30, 1905.

It is proposed to apply the available balance and additional appropriation recommended to restoring the dredged channels in Little Narragansett Bay and in the river; extending and widening the channel in the bay, including removal of bowlders off Pawcatuck Point and removing obstructions in the channel at Watch Hill.

Money statement.

July 1, 1904, balance unexpended		$3,361.11
Amount appropriated by river and harbor act approved March 3, 1905		1,000.00
Amount allotted from appropriation for maintenance of river and harbor improvements, act of April 28, 1904		4,100.00
		8,461.11
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$363.53	
For maintenance of improvement	264.43	
		627.96
July 1, 1905, balance unexpended		7,833.15
Amount (estimated) required for completion of existing project		161,361.60
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$12,000.00	
For maintenance of improvement	3,000.00	
		15,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

APPROPRIATIONS.

March 3, 1871	$10,000	August 18, 1894	$6,000
June 10, 1872	10,000	June 3, 1896	15,000
March 3, 1873	10,000	March 3, 1899	15,000
June 23, 1874	10,000	June 13, 1902	9,000
March 3, 1875	10,000	April 28, 1904 (allotted)	4,100
August 5, 1886	12,000	March 3, 1905 (near Watch Hill)	1,000
August 11, 1888	10,000		
September 19, 1890	16,600		
July 13, 1892	3,800	Total	142,500

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COMMERCIAL STATISTICS FOR CALENDAR YEAR 1904.

[Compiled from reports furnished by shippers and receivers at Westerly, R. I.]

Receipts and shipments by water.

Articles.	Quantity.
	Tons.
Coal	108,149
Stone	16,084
Lumber	14,069
Brick	8,510
Total (being increase of about 31 per cent)	141,888

Summer steamboat line to Watch Hill, R. I., from Norwich and New London, Conn., abandoned.

Number of passengers not reported, but some 15,000.

D 2.

IMPROVEMENT OF NEW LONDON HARBOR, CONNECTICUT.

The dredging of the channel, under continuous contract, along the harbor front, including Winthrop Cove, was completed October 13, 1904; 1,273,229 yards were removed. This work gives a 23-foot channel of a ruling width of 400 feet, except at two small areas of ledge rock in the Fort Trumbull-Shaws Cove arm of the channel, where depths remain of about 18 feet, and at a large pipe sewer crossing the channel, where the least depth is 21.6 feet. The material removed was mud, clay, compacted sand and gravel, and bowlders.

It is proposed to apply the available balance and additional appropriation recommended in removing the ledge rock and maintaining the dredged channel.

Money statement.

July 1, 1904, balance unexpended		$41,502.04
Amount appropriated by river and harbor act approved March 3, 1905		2,000.00
		43,502.84
June 30, 1905, amount expended during fiscal year, for works of improvement		26,043.86
July 1, 1905, balance unexpended		17,458.98
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905		2,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

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APPROPRIATIONS.

June 13, 1902	$25,000
March 3, 1903	60,000
April 28, 1904	60,000
March 3, 1905	2,000
Total	147,000

CONTRACT IN FORCE.

Name of contractor: Morris & Cumings Dredging Company.
Date of contract: May 28, 1903.
Date of approval: June 19, 1903.
Date of beginning work: June 30, 1903.
Date of expiration: January 1, 1905.
Rate: $9\frac{4}{11}$ cents per cubic yard.

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1904.

[Compiled from reports furnished by shippers and receivers.]

Receipts and shipments.

Articles.	Quantity.	Articles.	Quantity.
	Tons.		*Tons.*
Coal	248,435	Iron and steel	3,350
Lumber and timber	19,907	Miscellaneous	4,266
Brick, cement, and sand	17,140	Steamboat freight	433,533
Stone	7,215		
Oil	12,010	Total	745,856

Number of passengers, 606,060.
A decrease of about 18 per cent, due to including Shaws Cove traffic in 1903 report and to erroneous statements received for 1903.

[Furnished by collector of customs, port of New London, for fiscal year 1905.]

Value of imports	$58,780.60
Value of exports	52,888.39
Duty on imports	10,127.58
Foreign vessels entered	19
Foreign vessels cleared	34
Total	53
Domestic vessels entered	27
Domestic vessels cleared	6
Total	33

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D 3.

IMPROVEMENT OF THAMES RIVER, CONNECTICUT.

Surveys were made at Bartletts Cross-over, below Allyns Point, at the opposite side of river from same and from above Allyns Point to Norwich. Ledge rock obstructions in Shetucket River channel near its mouth at Norwich were mapped. Range targets for Bartletts Cross-over were maintained. The last survey shows the dredged 16-foot channel here to be in good shape.

It is proposed to apply the available balance and appropriation recommended in completing the project by deepening and widening the channel at and above the long reach, completing the system of training dikes, and maintaining the channel and works.

Money statement.

July 1, 1904, balance unexpended	$9,251.17
Amount appropriated by river and harbor act approved March 3, 1905	34,100.00
	43,351.17
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	2,857.63
July 1, 1905, balance unexpended	40,493.54
July 1, 1905, outstanding liabilities	230.58
July 1, 1905, balance available	40,262.96
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	8,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

March 3, 1821	$150	August 2, 1882	$35,000
March 2, 1829	150	July 5, 1885	25,000
July 4, 1836	10,000	August 5, 1886	22,500
March 3, 1837	20,000	August 11, 1888	50,000
July 7, 1838	10,000	September 19, 1890	20,000
June 23, 1866	10,000	July 13, 1892	30,000
March 3, 1867	72,000	August 18, 1894	12,500
March 3, 1871	15,000	June 3, 1896	12,000
June 10, 1872	10,000	March 3, 1899	20,000
June 18, 1878	10,000	June 13, 1902	15,000
March 3, 1879	12,000	March 3, 1905	34,100
June 14, 1880	22,500		
March 3, 1881	30,000	Total	497,900

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COMMERCIAL STATISTICS FOR CALENDAR YEAR 1904.

[Compiled from reports furnished by shippers and receivers.]

Receipts and shipments by water.

Articles.	Quantity.	Articles.	Quantity.
	Tons.		*Tons.*
Coal	[a]281,554	Building material	990
Cotton and wool	7,355	Miscellaneous	[a]1,126
Lumber	26,720	Steamboat freight	24,691
Iron and steel	1,990		
Wood pulp	2,375	Total	346,791

[a] Includes 24,400 tons coal and 150 tons miscellaneous freight due to Shaws Cove traffic.

Number of passengers, 33,571.

Decrease of about 15 per cent from amount of previous year; decrease in coal receipts more than covers net decrease.

Summer steamboat running to Watch Hill, R. I., from Norwich abandoned and freight steamboat added to the New York-Norwich line.

D 4.

IMPROVEMENT OF CONNECTICUT RIVER BELOW HARTFORD, CONNECTICUT.

Dredging at the river bar channels under existing contract was continued until September 7, 1904, when the work was closed. A channel of good project depth and of partial but navigable width had been then completed and available funds exhausted. Later, during the same season, an obstructive fill formed at the lower Hartford bar. This channel was reopened in November, 1904, by dredging to 12 feet depth at zero of Hartford gauge and width of 50 feet by means of an allotment of funds from the emergency river and harbor appropriation of 1904 and at a cost of 9 cents per cubic yard.

In 1905 the river bar channels were found upon the subsidence of spring freshets, as usual, to have been filled more or less. Dredging for restoration of the channels was undertaken May 4 at 9 cents per cubic yard and was in progress at end of the year. After opening a narrow channel at the shoalest places the dredging was directed toward an enlargement of the channels to 100 feet width.

Details of the dredging, July to November, 1904.

[Classification: Maintenance.]

Locality.	Channel.			Cubic yards dredged.	Material.
	Length.	Width.	Depth.		
	Feet.	*Feet.*	*Feet.*		
Hartford lower bar	1,750	50	12.0	11,444	Sand.
Clay Banks bar	450	50	11.0	3,388	Loamy sand.
Press Barn bar	1,200	50	11.0	2,474	Sand and gravel.
Dividend bar	1,800	50	11.0	8,378	Sand.
Pistol Point bar	600	50	11.5	5,996	Do.
Sears shoal	2,020	50	12.0	24,513	Do.
Total				56,187	

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Details of the dredging, May and June, 1905.

[Classification: Maintenance.]

Locality.	Channel.			Cubic yards dredged.	Material.
	Length.	Width.	Depth.		
	Feet.	*Feet.*	*Feet.*		
Hartford upper bar	600	50	11	4,948	Fine gravel.
Hartford lower bar	900	50	12	16,076	Sand.
	600	75	12		
Clay Banks upper bar	240	50	11	914	Do.
Clay Banks lower bar	260	50	11	914	Do.
Press Barn bar	1,200	50	12	8,998	Gravel and sand.
Two Piers bar	400	50 to 75	12	4,551	Sand.
Dividend bar	1,500	50	12	10,097	Do.
May and June, 1905				46,498	
July to November, 1904				56,187	
Total				102,685	

Under the allotment from the river and harbor emergency act of 1904, contract work of repairs to the Saybrook jetties was begun November 8, 1904, suspended for about three months during the winter on account of severe weather and ice, and completed June 10, 1905; 7,646.88 tons of stone were delivered and placed, at $1.23 per ton, of which 4,283 tons were placed at the west and the remainder at the east jetty. Both jetties were put in a fair state of repair, being restored to height of from 5 to 6 feet above low water and about 6 feet wide on top, but with side slopes in many places steeper than permanent stability demands. These jetties have not been built to full cross section; they are exposed to heavy southeasterly and southwesterly storms, and the reduced cross section renders them subject to much damage from wave attack.

It is proposed to apply the available balance and appropriation recommended in maintaining the dredged bar channels, completing the Saybrook jetties, and enlarging the Hartford dike.

Money statement.

July 1, 1904, balance unexpended	$7,407.08
Amount appropriated by river and harbor act approved March 3, 1905	40,000.00
Amount allotted from appropriation for maintenance of river and harbor improvements, act of April 28, 1904	12,000.00
	59,407.08
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	16,547.27
July 1, 1905, balance unexpended	42,859.81
July 1, 1905, outstanding liabilities	7,461.90
July 1, 1905, balance available	35,397.91
Amount (estimated) required for completion of existing project	100,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:	
For works of improvement	$40,000.00
For maintenance of improvement	10,000.00
	50,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

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APPROPRIATIONS.

July 4, 1836	$20,000.00	July 5, 1884	$35,000.00
March 1, 1843	3,471.57	March 3, 1885	4,745.43
July 11, 1870	20,000.00	August 5, 1886	26,250.00
March 3, 1871	35,000.00	August 12, 1888	10,000.00
June 10, 1872	40,000.00	September 19, 1890	12,500.00
March 3, 1873	20,000.00	July 13, 1892	20,000.00
June 23, 1874	20,000.00	August 18, 1894	20,000.00
March 3, 1875	20,000.00	June 3, 1896	20,000.00
August 14, 1876	20,000.00	March 3, 1899	20,000.00
June 20, 1878	4,203.00	May 24, 1902 (allotted)	2,000.00
June 18, 1878	30,000.00	June 13, 1902	30,000.00
March 3, 1879	10,000.00	April 28, 1904 (allotted)	12,000.00
June 14, 1880	10,000.00	March 3, 1905	40,000.00
March 3, 1881	30,000.00		
August 2, 1882	45,000.00	Total	580,170.00

CONTRACTS IN FORCE.

Contractor: Hartford and New York Transportation Company.
Dredging: Yardage, approximate, 60,000.
Date of contract (emergency): June 20, 1904.
Date of beginning work: June 23, 1904.
Date of expiration: September 7, 1904.
Rate: 9 cents per cubic yard.

Contractor: E. S. Belden & Sons.
Stone work: 8,000 tons.
Date of contract: October 15, 1904.
Date of approval: October 28, 1904.
Date of beginning work: November 8, 1904.
Date of expiration: June 10, 1905.
Rate: $1.23 per ton of stone in place.

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1904.

[Compiled by C. C. Goodrich, general manager Hartford and New York Transportation Company.]

Receipts and shipments by water.

Articles.	Quantity.
	Tons.
Coal	330,000
Lumber, piles, ties, poles, and wood	35,000
Lime, cement, brick, tile, and pipe	20,000
Stone	40,000
Steamboat freight	250,000
Total	675,000

Tonnage about the same as for previous year.
Number of passengers, 70,307.

REPORT OF MR. WILLIAM C. LYNCH, JUNIOR ENGINEER.

For the year beginning July 1, 1904, Press Barn bar, which is about 2 miles south of Naubuc, was dredged 815 feet long, 25 feet wide, and to 11 feet depth. This bar, next to the Hartford lower bar, gives more trouble than any other

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bar on the river. The whole area around it is shoal, and vessels must be on the range to pass over it. The material is composed of fine gravel and coarse sand, and it and that of Hartford upper bar are the heaviest that has been encountered on the river. Two thousand four hundred and seventy-four cubic yards of it were dredged and deposited on the sand flats under the west bank of the river, distance about 0.75 mile southwest of the dredged cut.

At Hartford lower bar, a distance of 735 feet, 25 feet wide and 12 feet deep was dredged and the existing cut redredged for a linear distance of 350 feet, also making a depth of 12 feet. There is heavy cross current at this bar, the material being a lively coarse sand, easily kept in suspension, and fills in rapidly. The cut being also narrow, the tendency to fill is helped very materially. Should a vessel get off the range and ground on the edge of the cut, if there is a strong current at the time, it will cut out the sand from one side of the obstruction and deposit it on the other, according to its position. If there should not be much current the sand is dragged into the cut in the endeavor to release the vessel by pulling on her with tugs. I have observed that to lighter a vessel aground under such circumstances is a last resort of her manager. The amount of material dredged was 3,908 cubic yards, which was deposited in a small cove at the southwest end of the Hartford dike, distant about 0.5 mile from the dredged cut.

Clay Bank bar required but little this year, and a cut 350 feet long by 50 feet wide and having a depth at 0 of 11 feet, was found to answer all requirements. The cut was dredged to these dimensions through a loamy sand. Sticky and very fine, it is slow-handling stuff, as its adhesive qualities cause it to stick in the bucket more or less, and it is slow in falling out of the scows. Three thousand three hundred and eighty-eight cubic yards of this material were removed from Clay Bank and deposited in a bight off Miner's grove, on the east bank of the river, distant south from the dredged cut about 0.75 mile.

At Dividend bar 1,100 feet were dredged to a width of 50 feet and 11 feet depth at 0, and a cut of 200 feet at 25 feet in width extends farther downstream; 8,373 cubic yards of sand were removed from here and dumped close into shore on the east bank of the river north-northeast from the dredged cut, about 0.25 mile distant. This bar, while requiring some attention annually, is not so rank a filling place as some others.

Pistol Point bar, located about 3 miles above Portland, near Gildersleeve Island, had 5,996 cubic yards of material removed, making a cut 50 feet wide and 11.5 feet in depth at 0 for a linear distance of 635 feet, and a cut 25 feet in width, 365 feet long, of same depth, extending downstream. This is the finest-grained sand of any found on the river. Scows are obliged to be tight; in fact, canvas is tacked all around the spaces between the doors and around bottom of the slopes of the pockets in order to prevent the sand from leaking out, for when mixed with water it will go wherever water will. This material was all dumped in deep water about 0.25 mile northeast of the dredged cut under west bank of the river, the scows being run on the bank before dumping them.

The linear distance on Sears shoal being so great, and the available funds being limited, it was decided that instead of making a cut clear through the whole shoal the shoalest portion of it would be dredged. The best method of procedure was found to be the cutting away of four reefs in different parts of the shoal. Reef No. 1, commencing upstream, was about 175 feet long; reef No. 2 was about 400 feet in length; reef No. 3, about 675, and reef No. 4 about 350 feet. These four reefs were then laid out for a cut 100 feet wide and were dredged to a depth of 12 feet at 0, not disturbing the existing bottom from one reef to the other except in the case of reefs 1 and 2, where two cuts of 25 feet each were dredged, giving a cut 50 feet in width at same depth between these two reefs. The point in view was to have a channel available for vessels of 9 feet draft at all stages of the tide and one that will be likely to maintain for two years. The material removed was all sand and was dumped under west bank of river northwest from dredged channel about 0.25 mile; yardage removed, 24,512.

Had enough funds been at the disposal of this office, the channel leading through the Potash channel or Hadlyme reach would have been put into navigable condition. This shoal has had nothing done to it since 1902. It is the straightway channel down that reach and is very desirable when ice is running, as the current makes down it nearly straight, keeping the ice on the move; while it backs over in the broad bay on the west or Deep River channel, greatly impeding vessels which perforce use it. The New York line boats use the Deep River channel exclusively, as they stop at Deep River, but sailing vessels, barges,

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and all other steamers use the Potash when it is in shape. The Light-House Board maintains range lights set on poles ashore for this locality.

Chester Creek bar is situated at the mouth of Chester Creek, directly opposite the railroad station at Chester; it is formed mainly of the scourings of the watershed drained by Chester Creek; hence it is in a worse condition after a season of copious rains. Not having heard any complaints from vessel men in regard to it and on examination finding it fairly good, I decided to do nothing there this season, but think it will have to be attended to in 1905.

Owing to a comparatively light freshet in the spring of 1904 the various bars were not in as bad a condition as usual; they were relatively in the same locality and were about as shoal, but were shorter in most cases. It was found unnecessary to do any dredging at Two Piers upper range, neither was anything done on the lower or Roaring Brook range. Potash channel, Chester Creek bar, or Calves Island were not disturbed.

With the exception of two or three days the river level remained normal, about 2.5 on the Hartford gauge on the flood tide and about 1.5 on the last of the ebb, except when the river was under the influence of a stiff northwest gale or dammed above Hartford.

The work at Hartford lower bar in November, 1904, consisted of redredging two cuts through this bar where it had shoaled to such an extent that vessels drawing as much as 9 feet were unable to pass. Two cuts each of 25 feet width were dredged through this part of the bar, one cut on each side of the center range of the dredged channel through the shoal, making a channel about 1,400 feet long, 50 feet wide and having a depth of water at 0 of the Hartford gauge of 12 feet—all for maintenance. The material was all sand, measured in scows, and was dumped inside the west line of the old dock or pier, called Colts Ferry pier, on the east side of the river, the best available dumping grounds at the present stage of the water. The amount of material removed was 7,536 cubic yards from November 10 to 19, inclusive. On November 9 there were about 690 cubic yards of sand removed on private account.

The dredging operations for the season of 1905 began on May 4 at Dividend bar, 11 miles below Hartford. Two cuts, each 25 feet wide and 12 feet deep at 0, were dredged through the bar for a distance of 1,275 feet; later it was found necessary to further extend the cut to the north, making the completed cut about 1,500 feet long, 50 feet wide, and 12 feet deep at 0. The material was all sand and was deposited on the east side of the river on the flats and as close to the bank as the scows could be placed. This bar is gradually making upstream and shortening correspondingly at the downstream end.

Hartford lower bar was next dredged to a depth of 12 feet at 0; at the close of work on June 30 we had a cut 75 feet wide, about 600 feet long, and 12 feet deep, and continuing downstream for 900 feet the same depth, with a width of 50 feet. The intention is to make the whole cut of 1,500 feet with a uniform width of 100 feet. All the dredged material was sand and was placed close ashore in a bight behind the south wall of Hartford dike.

At Two Piers, lower range, the channel runs so close to the bank that a person can almost step ashore from a boat making the turn; it is a point where close and quick work is required to round safely. For the past several years this place has had nothing done to it, and a sand spit has been making from the west gradually encroaching on the channel, forcing the vessels farther and farther toward the shore. The twin-screw boats could only use their eastern-most wheel when rounding, and tows of barges would crowd toward the east bank. To obviate this difficulty, a cut 400 feet long, 12 feet deep, 75 feet wide at the northern end and tapering to 50 feet in width at the southern end was put in, cutting off on an average of 60 feet from the end of the spit. Since then no trouble has been reported at that place. The material was sand and was taken a mile downstream and dumped on the western flats.

Hartford upper bar was dredged to 11 feet deep at 0 and 50 feet wide for a distance of 600 feet. The material is a fine gravel, which was dumped in the same place as that from Hartford lower bar. This bar does not fill as badly in recent years.

Press Barn bar was not in as bad condition as usual, being much shorter. Two cuts, each 25 feet wide, were dredged at the bar, making a cut of 1,200 feet in length, 50 feet wide, and 12 feet deep at 0. Dredged material was a gravelly sand and was dumped downstream from the cut in the deep water under west bank of the river.

There was not much dredging to do at Clay Banks, the upper shoal being the most troublesome. A cut 240 feet long, 50 feet wide, and 11 feet deep was

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put through the upper shoal, and a cut of the same width and depth, 260 feet long, through the lower shoal. The spoil was deposited off Miners grove in a deep hole made by the eddy close to the eastern bank. This bar is improving rapidly from year to year.

Respectfully submitted.

WM. C. LYNCH, *Junior Engineer.*

Lieut. Col. CHAS. F. POWELL,
Corps of Engineers.

D 5.

IMPROVEMENT OF HARBOR OF REFUGE, DUCK ISLAND, CONNECTICUT.

No operations were conducted from lack of funds. The project is about 40 per cent completed. Owing to the reduced cross section of the west breakwater as built, viz, 8 feet wide on top, 8 feet above low water, and outer slopes of only about 1 on 1½, this breakwater has suffered largely from wave attack. Its completion to full project dimensions is desirable. The appropriation of $6,000 for maintenance, act of March 3, 1905, is only sufficient for necessary repairs to the work already done.

It is proposed to apply the appropriation recommended to completing the west breakwater to project dimensions, estimated to cost $65,000, and toward construction of the middle breakwater.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1905	$6,000.00
July 1, 1905, balance unexpended	6,000.00
Amount (estimated) required for completion of existing project	349,540.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	122,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

September 19, 1890	$25,000	June 6, 1900 (allotment)	$202
July 13, 1892	35,000	March 3, 1905	6,000
August 18, 1894	30,000		
June 3, 1896	24,000	Total	120,202

D 6.

IMPROVEMENT OF BRANFORD HARBOR, CONNECTICUT.

Under authority in the emergency river and harbor act of 1904 the appropriation of $5,000, act of June 3, 1902, for completion of the improvement was applied to dredging the projected channel to full

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depth and to such width as available funds permitted in prosecution of the project. The work had been advertised and award made at the beginning of the fiscal year, but as the contractor failed to begin within the required time the work was done by open-market agreement at 15 cents per yard, September 13 to October 14, 1904, and April 26 to May 4, 1905. A total of 35,395 yards of material and one large bowlder were removed, of which 9,371 cubic yards, dumped in unauthorized and objectionable places at the instigation of State agents, were not paid for.

At the close of work the projected channel was full depth and from 75 to 100 feet wide throughout its length from the lower to the upper docks, and the project was about 80 per cent completed. Owing to a late filling in the channel of the bay or lower harbor, between the mouth of the river and the "Mermaids," the deepest draft which can be carried into the channel from Long Island Sound is 6 feet, although the improved river channel is 8½ feet deep.

It is proposed to apply the available balance and the appropriation recommended to the completion of the approved project and maintenance of the improvement.

Money statement.

July 1, 1904, balance unexpended		$4,795.89
Amount appropriated by river and harbor act approved March 3, 1905		3,000.00
		7,795.89
June 30, 1905, amount expended during fiscal year, for works of improvement		4,636.01
July 1, 1905, balance unexpended		3,159.88
Amount (estimated) required for completion of existing project		2,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$2,000.00	
For maintenance of improvement	500.00	
		2,500.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

APPROPRIATIONS.

June 13, 1902	$5,000
March 3, 1905	3,000
Total	8,000

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COMMERCIAL STATISTICS FOR CALENDAR YEAR 1904.

[Compiled from reports furnished by shippers and receivers.]

Receipts and shipments by water.

Articles.	Quantity.
	Tons.
Coal	12,988
Sand	8,348
Iron	5,104
Lumber	1,400
Fertilizer	125
Total	22,910

D 7.

IMPROVEMENT OF NEW HAVEN HARBOR, CONNECTICUT.

Obstructive rocks were removed in October, 1904, from the 8-foot channel in the Quinnipiac River above Ferry street. With the available balance and the allotment of $9,000 from the emergency river and harbor act of 1904, redredging the 20-foot channel between Long wharf and Tomlinson bridge and the 12-foot anchorage at 9.9 cents, was begun on December 3, 1904, and prosecuted until completion on March 24, 1905, with the exception of about three weeks, when work was suspended on account of severe weather and ice. The yardage removed was 70,352 from the main channel and 58,713 from the 12-foot anchorage. The main channel was restored to full project depth and practically project width, and the 12-foot anchorage basin, excepting a small area along the north side, was restored to project depth. A receiving basin 18 to 20 feet deep, 100 feet long, and averaging about 75 feet wide was dredged by the city of New Haven at the mouth of the East street sewer, which empties into the 12-foot anchorage and deposit of whose contents has heretofore shoaled the basin and adjacent channel.

It is proposed to apply the available balance and appropriation recommended to a needed survey of the harbor with special reference to the condition of the improvements and maintenance of the dredged channels and anchorages wherever impairment of project dimensions is found, and to the completion of the project as may be authorized.

Attention is called to the commercial need of greater capacity of channel in the Quinnipiac River from Tomlinson Bridge north to or near the Ferry Street Bridge. South of Tomlinson Bridge the improved channel is 20 feet deep and 400 feet wide, except for a short length next to the bridge, where the width is 300 feet. This channel, 20 feet by 300 feet, should be extended for accommodation of existing traffic to very near the Ferry Street Bridge. The estimated cost for it, additional to that of its present authorized improvement—namely, channel 12 feet by 200 feet—is $62,000. The call for the extension of the 20-foot channel is for benefit of traffic of the extensive wire works located on the Quinnipiac River, next below Ferry Street Bridge, and for other interests in prospect. The wire works receive, or try to receive, pig iron or steel billets and coal in deep vessels. Some of the cargoes are transferred to barges at New York,

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others come direct to New Haven and are partly lightered there, and the vessels, when not drawing more than 17 or 18 feet, taken up to the works after waiting for a good high tide and being hauled by tugs over the shoal bottom. It is stated that the wire works also ship products under difficulty in heavy barges and deep vessels.

Money statement.

July 1, 1904, balance unexpended	$7,216.03
Amount appropriated by river and harbor act approved March 3, 1905	9,000.00
Amount allotted from appropriation for maintenance of river and harbor improvements, act of April 28, 1904	9,000.00
	25,216.03
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	15,637.40
July 1, 1905, balance unexpended	9,578.63
July 1, 1905, outstanding liabilities	71.65
July 1, 1905, balance available	48,006.98
Amount (estimated) required for completion of existing project	57,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:	
For works of improvement	$62,000.00
For maintenance of improvement	9,000.00
	71,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

August 30, 1852	$6,000.00	September 19, 1890	$15,000.00
July 11, 1870	15,000.00	July 13, 1892	15,000.00
March 3, 1871	40,000.00	August 18, 1894	10,000.00
June 10, 1872	35,000.00	June 3, 1896	10,000.00
March 3, 1873	25,000.00	March 3, 1899	50,000.00
March 3, 1875	10,000.00	June 6, 1900	50,000.00
June 18, 1878	25,000.00	March 3, 1901	50,000.00
March 3, 1879	15,000.00	June 28, 1902	67,000.00
June 14, 1880	15,000.00	March 3, 1903	63,073.90
March 3, 1881	15,000.00	April 28, 1904 (allotted)	9,000.00
August 2, 1882	30,000.00	March 3, 1905	9,000.00
July 5, 1884	10,000.00		
August 5, 1886	20,000.00	Total	624,073.90
August 11, 1888	15,000.00		

CONTRACT IN FORCE.

Name of contractor: Henry Du Bois' Sons Company.
Dredging: Yardage, approximate, 100,000.
Date of contract: November 10, 1904.
Date of approval: December 2, 1904.
Date of beginning work: December 3, 1904.
Date of expiration: March 24, 1905.
Rate: 9.9 cents per cubic yard.

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COMMERCIAL STATISTICS FOR CALENDAR YEAR 1904.

[Compiled from reports furnished by shippers and receivers.]

Receipts and shipments.

Articles.	Main harbor.	Quinnipiac River.		Mill River.			Total.
		Below Ferry street.	Above Ferry street.	Below Chapel street.	East Branch.	West Branch.	
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Coal	817,578	57,380	39,798	.....	21,898	143,452	1,080,050
Lumber	35,242	.....	.....	13,500	.....	4,378	53,120
Steel billets, pig and scrap iron	10,499	17,845	.....	.....	4,016	.....	32,360
Iron pipe	1,000	.....	.....	.....	.....	.....	1,000
Steel rods and wire	.....	4,500	.....	.....	.....	.....	4,500
Oysters, seed oysters, and clams	680	22,288	16,009	.....	.....	.....	38,977
Oyster shells	643	7,907	12,920	.....	.....	.....	21,470
Cement	.....	.....	.....	.....	.....	3,514	3,514
Plaster	.....	.....	3,000	.....	.....	2,476	5,476
Sand	11,713	3,207	3,000	.....	880	880	19,680
Clay	100	194	.....	.....	.....	.....	294
Bluestone and cut stone	118	665	.....	.....	.....	3,611	4,394
Petroleum products	.....	9,278	.....	.....	.....	8,325	17,603
Wood pulp	.....	.....	.....	.....	.....	2,673	2,673
Powder	388	.....	.....	.....	.....	.....	388
Retorts, fire and common brick	.....	.....	.....	.....	.....	2,189	2,189
General merchandise	3,798	.....	.....	.....	.....	.....	3,798
Steamboat freight	212,496	.....	.....	.....	.....	.....	212,496
Miscellaneous	115	2,304	.....	.....	3,705	1,376	7,500
Total	1,094,315	125,518	74,727	13,500	30,498	172,874	1,511,427

Number of passengers, 81,149.

[Furnished by collector of customs at New Haven, Conn.]

Foreign:	
Value of imports	$321,749.09
Revenue receipts, duties on imports	107,001.10
Foreign vessels:	
Entered	51
Cleared	13
Total	64
Domestic vessels:	
Entered	741
Cleared	757
Total	1,498

D 8.

CONSTRUCTION OF BREAKWATERS AT NEW HAVEN, CONNECTICUT.

On account of insufficient funds, no work of improvement was conducted. A light was maintained on the unfinished end of the west breakwater.

The completion of the west breakwater is of great importance to the harbor of refuge expected to be provided by the approved project. The harbor is still most exposed to heavy southwest storms. The west breakwater is laid in a northwesterly direction, and is designed to afford shelter from southwest storms and at the deeper anchorage of the harbor, which has excellent holding bottom.

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The approved project is about two-thirds completed. The full extension of the west breakwater will secure the larger portion of the benefit expected from completion of the whole improvement.

It is proposed to apply the available balance and the appropriation recommended to maintenance and to completion of the west breakwater.

Money statement.

July 1, 1904, balance unexpended	$1,819.84
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	741.08
July 1, 1905, balance unexpended	1,078.76
July 1, 1905, outstanding liabilities	25.84
July 1, 1905, balance available	1,052.92
Amount (estimated) required for completion of existing project	1,272,134.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:	
For works of improvement	$300,000.00
For maintenance of improvement	10,000.00
	310,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

March 3, 1879	$30,000	September 19, 1890	$120,000
June 14, 1880	30,000	July 13, 1892	120,000
March 3, 1881	60,000	August 18, 1894	125,000
August 2, 1882	60,000	June 3, 1896	100,000
July 5, 1884	40,000	June 13, 1902	44,000
August 5, 1886	75,000		
August 11, 1888	75,000	Total	879,000

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1904.

[Furnished by keeper of Southwest Ledge light.]

Vessels observed passing New Haven breakwaters during the year.

Kind of vessel.	First quarter.	Second quarter.	Third quarter.	Fourth quarter.	Total.
United States naval vessels	----	2	34	8	44
United States revenue cutters	2	----	2	3	7
Light-house tenders	17	19	33	24	93
United States Quartermaster's Department vessels	----	----	----	2	2
Steamers	1,992	3,878	4,160	3,988	13,968
Ships	----	----	1	----	1
Brigs	----	1	4	2	7
Barks	1	1	4	4	10
Schooners	1,042	2,620	3,588	3,190	10,440
Sloops	95	539	839	474	1,947
Barges	2,516	3,912	3,967	3,805	14,200
Steamer yachts	1	205	1,235	58	1,499
Schooner yachts	----	189	990	37	1,216
Sloop yachts	----	440	1,182	55	1,677
Unknown	526	694	769	662	2,651
Total	6,192	12,500	16,808	12,307	47,777

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Above includes all vessels sighted from Southwest Ledge light-house, both entering the harbor or passing through the Sound, but does not include a considerable number passing during dark nights or thick weather.

D 9.

IMPROVEMENT OF WEST RIVER, CONNECTICUT.

Project for the expenditure of the appropriation for completion of this work, made in the river and harbor act of March 3, 1905, and contract specifications for executing the work were prepared. Proposals are to be opened August 26, 1905.

It is proposed to apply the available balance and the appropriation recommended in completing the improvement and maintaining it for two years.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1905	$38,500.00
July 1, 1905, balance unexpended	38,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	1,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

APPROPRIATIONS.

March 3, 1905	$38,500

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1904.

[Compiled from reports furnished by shippers and receivers.]

Receipts and shipments.

Articles.	Oyster Point.	Below Kimberly Avenue Bridge.	Above Kimberly Avenue Bridge.	Total.
	Tons.	*Tons.*	*Tons.*	*Tons.*
Coal	5,000	36,500	2,411	43,911
Lumber and laths	----------	1,750	543	2,293
Sand	----------	----------	2,296	2,296
Clay	----------	----------	4,697	4,697
Stone	----------	----------	250	250
Brick	----------	----------	200	200
Cement	----------	----------	68	68
Plaster	----------	----------	310	310
Fertilizer	----------	----------	3,150	3,150
Produce	40	----------	----------	40
Oysters	39,098	----------	----------	39,098
Oyster shells	26,048	----------	----------	26,048
Miscellaneous	----------	----------	5	5
Total	70,186	38,250	13,930	122,366

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D 10.

IMPROVEMENT OF HARBOR AT MILFORD, CONNECTICUT.

Under authority in the emergency river and harbor act of 1904, the appropriation of $15,000, act of June 13, 1902, for completion of the improvement, was applied to dredging the more important portions of the channels and basin in prosecution of the project. Work was begun October 24, 1904, at the rate of 16 cents for the 10-foot channel dredging and 14 cents for the 6-foot, and completed April 15, 1905. A total of 47,703 yards at 16 cents and 40,692 yards at 14 cents were removed. The 10-foot channel was completed to full project dimensions; the 6-foot channel to full project dimensions upstream to a point 100 feet above the town dock, and a portion of the 10-foot anchorage, about 2 acres in area, adjoining the main channel was dredged. Work under the appropriation of March 3, 1905, was begun June 12 and is in progress; the work is being applied to the development of the anchorage basin. Under this contract, 8,177 cubic yards and three large bowlders, aggregating 4.489 yards, were removed up to the close of the fiscal year. At the close of the fiscal year ledge rock was encountered in such quantities and at such depths, varying from 0.5 to 10 feet below low water, that it will be impracticable to complete the basin on the lines originally laid out within the estimate, but it is thought that an useful basin equivalent in area to the undredged portion of the originally located basin can be obtained on the opposite side of the channel within the estimate. The funds on hand will be sufficient to complete the essential part of the project.

It is proposed to apply the appropriation recommended in maintaining the improvement for two years.

Money statement.

July 1, 1904, balance unexpended	$14,720.27
Amount appropriated by river and harbor act approved March 3, 1905	10,000.00
	24,720.27
June 30, 1905, amount expended during fiscal year, for works of improvement	14,853.14
July 1, 1905, balance unexpended	9,867.13
July 1, 1905, outstanding liabilities	1,302.45
July 1, 1905, balance available	8,564.68
July 1, 1905, amount covered by uncompleted contracts	6,461.57
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	1,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

APPROPRIATIONS.

June 10, 1872	$1,500	August 11, 1888	$5,000
June 23, 1874	5,000	September 19, 1890	2,500
March 3, 1875	13,000	June 13, 1902	15,000
June 18, 1878	10,000	March 3, 1905	10,000
June 14, 1880	5,000		
March 3, 1881	100	Total	72,100
August 2, 1882	5,000		

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CONTRACTS IN FORCE.

Name of contractor: John P. Randerson.
Dredging: Yardage, approximate, 78,000.
Date of contract: October 10, 1904.
Date of approval: October 28, 1904.
Date of beginning work: October 24, 1904.
Date of expiration: April 15, 1905.
Rates: For the 10-foot channel, 16 cents, and for the 6-foot channel, 14 cents per cubic yard.

Names of contractors: John & Joseph McSpirit.
Dredging: Yardage, approximate, 55,000.
Date of contract: June 1, 1905.
Date of approval: June 20, 1905.
Date of beginning work: June 12, 1905.
Date of expiration: October 2, 1905.
Rate: 13.8 cents per cubic yard.

D 11.

IMPROVEMENT OF HOUSATONIC RIVER, CONNECTICUT.

At the close of the fiscal year a contract was in force for redredging in the lower part of the river. This work was begun July 27 and completed November 23, 1904; a total of 14,010 yards was removed and channels of project dimensions obtained. The western half of the outer bar channel was dredged from 1 to 3 feet more than project depth to provide for subsequent filling.

Following are details of the work done:

Location.	Cubic yards.	Price.
Outer bar	7,749	$0.20
Nells Island bar	a1,184	.18
Mill bar	3,319	.25
Mary Anns bar	1,758	.18
Total	14,010	

a One log.

During the past winter shoaling occurred at Mary Anns bar, and this channel was redredged by the open-market agreement May 11 to 20, 1905; 3,326 yards were removed at 30 cents per yard, and a channel made of project depth and from 50 to 75 feet wide. A permanent shore range was established to aid in navigating this bar channel.

The breakwater was repaired by open-market purchase where damaged by the ice and storms of the past two winters, and several large gaps in the inner arm, where settlement had taken place, were restored to project dimensions. A total of 1,496.26 tons of new stone, at $1.50 per ton, and 1,692.41 tons, at $1.80 per ton, were delivered and placed, of which 2,088.22 tons were applied to the inner arm and 1,100.45 tons to the outer arm; 161.29 tons of old stone which had fallen out of place on the outer portion of the breakwater were picked up and replaced at 50 cents per ton. The outer portion of this breakwater has not been built to project dimensions; the height at present

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for the most part is only about 4 feet above high water and the top width only about 5 feet less than one-half the projected width; the side slopes are steeper than called for by project. Owing to this reduced cross section, the breakwater is annually much damaged by wave attack. The approved project is about 80 per cent completed.

It is proposed to apply the available balance and appropriation recommended in redredging at the bar channels where needed, and in completing the breakwater.

Money statement.

July 1, 1904, balance unexpended	$9,882.39
November 8, 1904, sales of condemned property	.35
Amount appropriated by river and harbor act approved March 3, 1905	10,000.00
Amount allotted from appropriation for maintenance of river and harbor improvements, act of April 28, 1904	3,950.00
	23,832.74
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	11,742.90
July 1, 1905, balance unexpended	12,089.84
July 1, 1905, outstanding liabilities	73.61
July 1, 1905, balance available	12,016.23
Amount (estimated) required for completion of existing project	37,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:	
For works of improvement	$37,000.00
For maintenance of improvement	10,000.00
	47,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

APPROPRIATION.

March 3, 1871	$15,000	August 11, 1888	$35,000
June 10, 1872	15,000	September 19, 1890	35,000
March 3, 1873	10,000	July 13, 1892	20,000
June 23, 1874	10,000	August 18, 1894	25,000
March 3, 1875	5,000	June 3, 1896	25,000
June 18, 1878	5,000	March 3, 1899	15,000
June 14, 1880	2,000	June 13, 1902	10,000
March 3, 1881	2,000	April 28, 1904 (allotted)	3,950
August 2, 1882	2,000	March 3, 1905	10,000
July 5, 1884	2,500		
August 5, 1886	5,000	Total	252,450

CONTRACT IN FORCE.

Name of contractor: The T. A. Scott Company.
Dredging: Yardage, approximate, 31,250.
Date of contract (emergency): June 14, 1904.
Date of beginning work, July 27, 1904.
Date of expiration: November 23, 1904.
Rates: 18, 20, and 25 cents per cubic yard.

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COMMERCIAL STATISTICS FOR CALENDAR YEAR 1904.

[Compiled by reports furnished by shippers and receivers.]

Receipts and shipments.

Articles.	Quantity.
At Stratford, Conn.	*Tons.*
Coal	3,600
Oysters	2,544
Oyster shells	1,920
Total	8,064
At Derby and Shelton, Conn.	
Coal	44,320
Pipe	2,169
Pig iron	496
Sand	1,686
Emery stone and cement	229
Cord wood and timber	167
Total	49,006
Total for the river	57,070

D 12.

IMPROVEMENT OF BRIDGEPORT HARBOR, CONNECTICUT.

Dredging under continuing contract in force at the beginning of the fiscal year was in progress from July 11 to December 16, 1904, and from June 2, 1905, to the close of the year, with the exception of two periods of about two weeks each. The work was applied to widening the Pequonnock River channel between the new railroad bridge and the highway bridge just above and to the extension of the Yellow Mill channel upstream above the Stratford Avenue Bridge. A total of 58,516 yards was removed under this contract, of which 6,206 yards were removed from the Pequonnock River channel and the remainder from the Yellow Mill channel. The Pequonnock channel was dredged from the opening in the new railroad bridge upstream to the western opening in the highway bridge. The Yellow Mill channel was extended upstream with full width and depth to a point about 750 feet above the highway bridge and with width of from 33 to 67 feet for about 250 feet farther. All dredging this year under the continuing contract was at 2½ cents per yard, the time limit for earning the second appropriation for the improvement at the base rate of 5 cents per cubic yard having expired July 28, 1901.

In addition to the continuing contract work a small amount of necessary widening in the Pequonnock River channel between the new railroad bridge and the highway bridge was done under open-market agreement at 18 cents per yard, this work being outside the limits of the contract and the contractor declining to estimate on it. The total yardage removed under this agreement was 5,850. The approved project is about 70 per cent completed.

It is proposed to apply the available balance and the recommended appropriation to completion of the main and Yellow Mill channels and to the remainder of project and in maintaining the improvement.

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Money statement.

July 1, 1904, balance unexpended	$76,926.57
Amount appropriated by river and harbor act approved March 3, 1905	10,000.00
	86,926.57
June 30, 1905, amount expended during fiscal year, for works of improvement	6,189.24
July 1, 1905, balance unexpended	80,737.33
July 1, 1905, outstanding liabilities	5,654.40
July 1, 1905, balance available	75,082.93
July 1, 1905, amount covered by uncompleted contracts	65,082.93
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	10,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

APPROPRIATIONS.

July 4, 1836	$10,000	August 5, 1886	$20,000
July 4, 1836 [a]	10,000	August 5, 1886 [a]	5,000
July 7, 1838 [a]	11,550	August 11, 1888	10,000
August 30, 1852	10,000	August 11, 1888 [a]	10,000
March 3, 1871	20,000	September 19, 1890	20,000
June 20, 1872	40,000	September 19, 1890 [a]	5,000
March 3, 1873	30,000	July 13, 1892	20,000
June 23, 1874	20,000	July 13, 1892 [a]	5,000
March 3, 1875	15,000	August 18, 1894	10,000
August 14, 1876	10,000	August 18, 1894 (allotted) [a]	3,500
June 18, 1878	10,000	August 18, 1894 [a]	2,500
March 3, 1879	10,000	June 3, 1896	28,000
June 14, 1880	10,000	March 3, 1899	50,000
March 3, 1881	10,000	June 6, 1900	50,000
August 2, 1882	10,000	March 3, 1901	50,000
August 2, 1882 [a]	350	March 3, 1905	10,000
July 5, 1884	5,000		
July 5, 1884 [a]	20,000	Total	550,900

CONTRACT IN FORCE.

Name of contractor: Hughes Bros. & Bangs.
Dredging, about 2,226,500 cubic yards; and placing riprap, about 20,000 tons.
Date of contract: July 31, 1899.
Date of approval: August 25, 1899.
Date of beginning work: July 9, 1900.
Date of expiration: Indefinite.
Rates: For dredging, base rate 5 cents per cubic yard; for riprap stone in place, $2 per ton.

[a] For Black Rock Harbor, Connecticut.

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COMMERCIAL STATISTICS FOR CALENDAR YEAR 1904.

[Compiled from reports furnished by shippers and receivers.]

Receipts and shipments.

Articles.	Quantity.	Articles.	Quantity.
	Tons.		*Tons.*
Coal	539,198	Acid	3,450
Lumber	67,242	Plumbago	400
Iron	68,039	Sulphur	1,196
Steel billets	2,500	Gunpowder	566
Cast-iron pipe and pipe fittings	4,349	Copper	2,500
Sand	23,413	Fireproofing	440
Oysters	17,571	Fertilizer	575
Oyster shells	12,134	Miscellaneous	3,378
Clay	1,810	General merchandise via regular steamboats	96,988
Brick	4,506		
Cement	2,440		
Building, flag, and broken stone	5,609	Total (of which 70,472 tons were shipments)	864,800
Petroleum products	6,501		

Passengers, 120,398.

Increase of about 8 per cent in tonnage over amount of previous year, principally in iron and lumber.

[Furnished by collector of customs.]

Foreign:	
Value of imports	$487,367.60
Duties on imports	145,683.97
Foreign vessels:	
Entered	61
Cleared	44
Total	105

D 13.

IMPROVEMENT OF SAUGATUCK RIVER AND WESTPORT HARBOR, CONNECTICUT.

No improvement operations were conducted during the year, from lack of funds. The approved project is about 60 per cent completed. Completion of the project requires further removal of bowlders and dredging to project dimensions at the channel opposite Westport.

Money statement.

July 1, 1904, balance unexpended	$96.92
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	18.36
July 1, 1905, balance unexpended	78.56
Amount (estimated) required for completion of existing project	5,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	5,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

APPROPRIATIONS.

May 20, 1826	$400	March 2, 1867	$2,500
March 2, 1827	1,500	July 11, 1870	2,500
April 30, 1830	28	July 13, 1892	7,000
July 4, 1834	1,000	August 17, 1894	3,000
July 4, 1836	3,000	June 3, 1896	3,000
May 3, 1837	3,734		
July 7, 1838	4,782	Total	32,444

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COMMERCIAL STATISTICS FOR CALENDAR YEAR 1904.

[Compiled from reports furnished by shippers and receivers.]

Receipts and shipments.

Articles.	Quantity.	Articles.	Quantity.
	Tons.		*Tons.*
Coal	12,270	Via Soley & Parsell's Line to and from New York—Continued.	
Sand	3,440	Receipts—Continued.	
Lumber	1,260	Feed	900
Cement	100	Cement	446
Granite	1,505	Flour	60
Flagstone	150	Shipments—	
Hay and grain	500	Farm produce	2,277
Fertilizer	100	Embalming fluid	136
Via Soley & Parsell's Line to and from New York:		Manufactured leather goods	67
Receipts—			
General freight	2,250	Total	25,461

The receipts include 6,155 tons of material for construction of the new railroad bridge at Saugatuck. Omitting this amount, the tonnage increase over tonnage of 1903 is 18 per cent.

D 14.

IMPROVEMENT OF HARBORS AT NORWALK, FIVE-MILE RIVER, STAMFORD, SOUTHPORT, AND GREENWICH, CONNECTICUT.

(A) NORWALK HARBOR.

Under the allotment of $7,000 from the emergency river and harbor act of 1904, contract dredging for maintenance was begun November 18, 1904, and completed January 17, 1905; 35,234 cubic yards of material, at 17½ cents, and 4.644 yards of rock, at $10, were removed; the channel between South Norwalk and the lower dock at Norwalk was restored to former dimensions. The project is about 85 per cent completed. Completion requires widening to 150 feet the present 50-foot channel between the railroad bridge and the highway bridge at South Norwalk and a small widening immediately below the latter-named bridge.

It is proposed to apply the available balance and the appropriation recommended in completing the project and maintaining the channels. Estimate is made of $2,000 for the completion and $5,000 for maintenance.

Money statement.

July 1, 1904, balance unexpended	$369.32
August 1, 1904, amount allotted from emergency act of April 28, 1904	7,000.00
Amount appropriated by act of March 3, 1905	4,000.00
	11,369.32
June 30, 1905, amount expended during fiscal year	7,369.32
July 1, 1905, balance unexpended	4,000.00
July 1, 1905, outstanding liabilities	11.62
July 1, 1905, balance available	3,988.38

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(B) FIVE-MILE RIVER.

No work of improvement was conducted during the year from lack of funds. The project is about 65 per cent done. Completion requires the widening to 100 feet of the upper 1,500 feet of dredged channel and extending it about 1,300 feet upstream.

It is proposed to apply the available balance in widening to 100 feet the dredged channel where now less than project width and maintaining the dredged channel. Estimate is made of $600 for maintenance.

Money statement.

Amount appropriated by act of March 3, 1905	$6,000
July 1, 1905, balance unexpended	6,000

(C) STAMFORD HARBOR.

No work of improvement was conducted during the year from lack of sufficient funds. It is proposed to apply the available balance to maintaining dredged channels and extending channels of project depth and about 60 feet wide along the sides of the projected turning basin at the head of the west branch. The project is about half done. Completion requires widening to 100 feet portions of the channel in the east branch now about 65 feet wide and dredging the turning basin at the head of the west branch. Estimate is made of $57,000 for completion of project, including $3,000 for maintenance of channels already dredged.

Money statement.

July 1, 1904, balance unexpended	$540.34
Amount appropriated by act of March 3, 1905	18,000.00
	18,540.34
June 30, 1905, amount expended during fiscal year	353.71
July 1, 1905, balance unexpended	18,186.63
July 1, 1905, outstanding liabilities	48.00
July 1, 1905, balance available	18,138.63

(D) SOUTHPORT HARBOR.

Under an open-market agreement the breakwater was repaired in July, 1904, where damaged by storms, at cost of $175. Other work of improvement was not conducted during the fiscal year from lack of sufficient funds. The project is about 40 per cent completed. It is proposed to apply the balance now available to maintenance of the main channel already dredged; extending same with width of about 75 feet upstream to the junction of the branches, including removal of two points of obstructive ledge rock; to dredging east branch channel and as much of west branch channel as available funds will permit. Estimate is made of $3,000 for completion of the improvement by widening the channel of 75 feet width and

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extending the west branch channel, and of $600 for maintenance of the breakwater.

Money statement.

July 1, 1904, balance unexpended	$650.31
Amount appropriated by act of March 3, 1905	9,000.00
	9,650.31
June 30, 1905, amount expended during fiscal year	339.47
July 1, 1905, balance unexpended	9,310.84
July 1, 1905, outstanding liabilities	52.80
July 1, 1905, balance available	9,258.04

(E) GREENWICH HARBOR.

Under an allotment of $2,100 from the emergency river and harbor act of 1904, dredging for maintenance was begun September 8 and completed October 10, 1904. Eleven thousand cubic yards were removed, at 16 cents per yard, and the dredged channel was restored to project dimensions. The project is about 75 per cent done. Completion requires widening to full width portion of the 9-foot channel 1,000 feet long and now 45 feet wide, increasing width of 6-foot channel from 80 to 90 feet and completion of turning basin at the head. It is proposed to apply the balance now available to completing the project and maintaining the channels already dredged. Estimate is made of $2,000 for maintenance of project.

Money statement.

July 1, 1904, balance unexpended	$19.47
August 1, 1904, amount allotted from emergency act of April 28, 1904	2,100.00
Amount appropriated by act of March 3, 1905	7,000.00
	9,119.47
June 30, 1905, amount expended during fiscal year	2,119.47
July 1, 1905, balance unexpended	7,000.00

Money statement (consolidated).

July 1, 1904, balance unexpended	$1,579.44
Amount appropriated by river and harbor act approved March 3, 1905	44,000.00
Amount allotted from appropriation for maintenance of river and harbor improvements, act of April 28, 1904	9,100.00
	54,679.44
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	10,181.97
July 1, 1905, balance unexpended	44,497.47
July 1, 1905, outstanding liabilities	112.42
July 1, 1905, balance available	44,385.05
Amount (estimated) required for completion of existing project	93,700.00

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Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$59,000.00	
For maintenance of improvement	11,200.00	
		70,200.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

APPROPRIATIONS.

Norwalk Harbor.

June 10, 1872	$10,000.00	August 11, 1888	$3,000.00
March 3, 1873	10,000.00	September 19, 1890	4,000.00
June 23, 1874	10,000.00	August 18, 1894	15,000.00
March 3, 1875	7,000.00	June 3, 1896	10,000.00
June 18, 1878	6,000.00	March 3, 1899	2,000.00
March 3, 1879	10,000.00	June 13, 1902 (allotted)	[a]13,833.00
June 14, 1880	5,000.00	April 28, 1904 (allotted)	7,000.00
March 3, 1881	5,000.00	March 3, 1905	[a]4,000.00
August 2, 1882	5,000.00		
July 5, 1884	5,000.00	Total	134,833.00
August 5, 1886	3,000.00		

Five-mile River.

August 11, 1888	$5,000.00	March 3, 1899	$2,500.00
September 19, 1890	5,000.00	June 13, 1902 (allotted)	[a]4,500.00
July 13, 1892	5,000.00	March 3, 1905	[a]6,000.00
August 18, 1894	2,500.00		
June 3, 1896	2,500.00	Total	33,000.00

Stamford Harbor.

August 5, 1886	$10,000.00	March 3, 1899	$6,000.00
August 11, 1888	5,000.00	June 13, 1902 (allotted)	[a]10,111.00
September 19, 1890	5,000.00	March 3, 1905	[a]18,000.00
July 13, 1892	15,000.00		
August 18, 1894	10,000.00	Total	89,111.00
June 3, 1896	10,000.00		

Southport Harbor.

March 2, 1829	$6,097.00	June 14, 1880	$2,500.00
July 3, 1832	4,490.23	March 3, 1881	2,500.00
July 4, 1836	1,500.00	August 2, 1882	3,000.00
March 3, 1837	1,000.00	June 13, 1902 (allotted)	[a]8,889.00
July 11, 1870 (allotted)	500.00	March 3, 1905	[a]9,000.00
March 3, 1875	5,000.00		
August 14, 1876	5,000.00	Total	49,476.23

Greenwich Harbor.

June 3, 1896	$6,000.00	March 3, 1905	[a]$7,000.00
June 13, 1902 (allotted)	[a]6,667.00		
April 28, 1904 (allotted)	2,100.00	Total	21,767.00

[a] From appropriations of $44,000 each for Norwalk, Fivemile River, Stamford, Southport, and Greenwich harbors.

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COMMERCIAL STATISTICS FOR CALENDAR YEAR 1904.

[Compiled from reports furnished by shippers and receivers.]

Receipts and shipments.

NORWALK HARBOR.

Articles.	South Norwalk.	Norwalk.	East Norwalk.	Total.
	Tons.	*Tons.*	*Tons.*	*Tons.*
Coal	36,789	21,853	7,300	65,942
Lumber and timber (4,474,762 feet lumber and 20,740 bundles of laths)	3,378	3,643		7,021
Oysters and clams	20,056		1,144	21,200
Oyster shells	6,620			6,620
Brick	1,000			1,000
Sand and clay	6,375	989		7,364
Stone, crushed	2,077	1,265		3,342
Iron	3,525			3,525
Cement	500			500
Ground wood pulp		3,000		3,000
Steamboat freight	51,000	29,000		80,000
Miscellaneous	85			85
Total	131,405	59,750	8,444	199,599

Passengers, 22,740.

All Norwalk freight passes through the main channel past South Norwalk. South Norwalk freight, as given, includes only that received at or shipped from South Norwalk. The traffic shows a decrease of about 10 per cent from tonnage of previous year.

FIVE-MILE RIVER.

Articles.	Quantity.
	Tons.
Oysters	4,636
Oyster shells	3,497
Clams	143
Total	8,276

Decrease of about 37 per cent from amount of previous year.

STAMFORD HARBOR.

Articles.	Quantity.	Articles.	Quantity.
East Branch.	*Tons.*	*West Branch.*	*Tons.*
Coal	53,664	Coal	13,434
Lumber	11,906	Sand	1,010
Crushed stone	2,100	Brick	800
Sand and clay	1,666	Bluestone	450
Cement	235	Various earths, ores, etc., for grinding	4,227
Cord wood	190	Ground earths, ore, etc	6,300
Iron and other metals	913	Gasoline engines and machinery	4
Pipe	577	Iron	1,678
Lincrusta Walton, manufactured	585	Total	27,903
General steamboat freight	150,000		
Miscellaneous	11,995	Total for Stamford Harbor	261,734
Total	233,831		

Passengers, 35,000.

Freight traffic shows an increase of about 21 per cent over amount for 1903.

[a] From appropriations of $44,000 each for Norwalk, Fivemile River, Stamford, Southport, and Greenwich harbors.

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[Furnished by deputy collector of customs at Stamford, Conn.]

Foreign:	
Value of imports	$77,451.37
Revenue receipts, duties on imports	1,878.74
Foreign vessels:	
Entered	17
Cleared	10
Total	27
Domestic vessels:	
Entered	372
Cleared	282
Total	654

SOUTHPORT HARBOR.

Articles.	Quantity.	Articles.	Quantity.
	Tons.		*Tons.*
Coal	4,200	Grain and hay	1,500
Cord wood	2,100	Groceries	200
Oysters	1,340	Barrels, etc	25
Oyster shells	1,340		
Fertilizer	200	Total	10,905

Decrease of about 58 per cent from tonnage of 1903.

GREENWICH HARBOR.

Articles.	Quantity.	Articles.	Quantity.
	Tons.		*Tons.*
Coal	13,266	Filling (earth, etc.)	18,000
Stone	10,340	General freight and produce via steamboat	11,400
Sand and gravel	10,125	Miscellaneous	1,000
Brick	1,320		
Cement	4,000		
Plaster	2,000	Total	78,951
Iron pipe	2,500		

Passengers, 2,000.

One local dealer failed to furnish any report of his traffic tonnage for 1904. Tonnage in his report for 1902 was 47,576 and consisted mainly of lumber, coal, and stone.

D 15.

SURVEY OF CONNECTICUT RIVER, BETWEEN HARTFORD, CONNECTICUT, AND HOLYOKE, MASSACHUSETTS.

[Printed in House Doc. No. 231, Fifty-eighth Congress, third session.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, January 13, 1905.

SIR: I have the honor to submit herewith, for transmission to Congress, a report dated August 11, 1904, by the Board of Engineers convened for the purpose stated in the following provision of the river and harbor act of June 13, 1902:

Improving Connecticut River between Hartford, Connecticut, and Holyoke, Massachusetts: For the purpose of further surveys and report upon the project for improving the Connecticut River between Hartford, Connecticut, and Hol-

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yoke Massachusetts, a board of three officers of the Engineer Corps, to be designated by the Secretary of War, shall personally make examination of the improvement proposed by the engineer in charge, and report thereon, with reference to the probable cost of said proposed improvement, the commercial advantages, if any, to be derived from such improvement, and such other information as the board may deem essential. In estimating the probable cost of said improvement said board shall take into account both direct and consequential damages and the annual cost of maintaining said improvement, and shall hear all parties interested in said improvement or who may be affected thereby, and twenty-five thousand dollars, or so much thereof as may be necessary, is hereby apropriated to pay the expenses of said board, and for any surveys ordered by it in addition to those already made.

The plan presented by the above provision of the act for consideration by this special Board is that recommended by Maj. S. S. Leach, Corps of Engineers, in a report dated November 13, 1897, printed as House Document No. 136, Fifty-fifth Congress, second session, in which the characteristics of the part of the river under consideration will be found described. The plan contemplates the construction of three locks and dams, the latter movable and of the Chanoine wicket type, to be erected, one at Hartford, one at Warehouse Point, and the third at Kings Island. By this means a depth of water of 9 feet is to be provided over the reach of river under consideration, which is about 34 miles long.

The special Board finds that this plan would cost, at prices now current, $3,700,000, with an annual maintenance charge of $50,000. It proposes three plans. The first involves three fixed dams with locks, the lowest of the series to be located somewhat farther upstream than that recommended by Major Leach; for this plan the total cost of construction is estimated at $2,725,000. The second plan involves two locks with fixed dams, the lowest one to be at Warehouse Point, and the channel from there to Hartford to be excavated mechanically; the cost of construction of this second project is estimated at $2,621,000. The third method involves a lock and fixed dam near Hartford, and makes use of the upper part of the present Windsor Locks Canal, with a second lock to overcome the difference between the canal level and that of the pool created by the lock and dam at Hartford. The cost of construction for this method is estimated at $2,393,500. The annual maintenance charge for any one of these three plans would be about $40,000. These estimates of the special Board do not include damages to the Connecticut River Company, which now owns the Windsor Locks Canal and certain water rights which may be affected by the proposed improvement; nor do they include any expenses for altering the bridges now spanning the Connecticut River, which would have to be changed were the project adopted. The expenses of these changes under the present law would probably fall upon the owners of the bridges.

The special Board expresses the opinion that the Connecticut River Company, under charter from the State of Connecticut, has created certain water powers and extensive industries partly dependent thereon, and certain facilities for navigation which are insufficient for needs of general commerce, and that the value of the company's plant at Windsor Locks must be impaired to some degree by any adequate improvement of the river. It suggests that damage to the company through taking away its right to charge tolls should be adjusted on the basis of the company's average receipts from that source for the last twenty years for boats which could pass through

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the locks. It considers that the company has a right to an equitable allowance for impairment of existing water power, but not for damage to undeveloped water power, and believes that the amount of such damages should be fixed by the courts after the improvement has been made. The Board does not attempt to estimate the amount of these damages. It may be stated, however, that in the brief filed by the Connecticut River Company the damages to this corporation are estimated at more than $1,100,000 to developed water power, and at $600,000 to that not yet developed.

The Board remarks that if the plan of Major Leach is carried out there will be no damage to the water power, and, further, that the same would hold true if one of its alternative plans be adopted, modified by replacing the fixed dam near Hartford by a movable dam, with corresponding increase in the estimates.

As to the probable commercial benefits to be derived from the improvement of this stretch of the Connecticut River, the special Board remarks that any estimate must be based upon the prospective commerce of the river, there being no present navigation except by small pleasure craft running mainly between Holyoke and Enfield. The Board gives a statement of the population of the towns affected by the proposed improvement and of the traffic of these towns, but expresses no opinion as to the desirability of undertaking the improvement, such opinion not being called for by its precept.

The report of this special Board was submitted to the Board of Engineers for Rivers and Harbors, created by section 3 of the river and harbor act of June 13, 1902, and its report[a] is also herewith. It states that an analysis of the information obtained at the public hearings leads to the conclusion that the principal objects desired by those in favor of the improvement are, first, to create competition between rail and water with a view to securing lower freight rates, and, second, to obtain quicker deliveries of freight to New York City. The towns on the river above Hartford are now practically dependent upon a single system of railroads, without competition, while at Hartford and points below the rail transportation has to compete with water transportation, via Long Island Sound and the Connecticut River, the available depth in the latter being at present about 7 feet. The Board finds that an assumed first cost of $3,000,000 would cause fixed charges, including $90,000 for interest and $50,000 for maintenance, which would be so great that it would cost the Government 28 cents per ton yearly to move the amount of freight which would probably take the river channel, this amount being assumed by the Board to be about 500,000 tons. In this estimate no account is taken of the amount to be paid for damages to existing water power, nor of the cost to some one for the modification of the existing bridges.

Owing to the large cost as compared with the probable benefits, and to the insufficient depth of water below Hartford, the Board of Engineers for Rivers and Harbors concludes that the proposed improvement of the Connecticut River is not worthy of being undertaken by the General Government.

The calculation upon which the adverse conclusion of the Board of Engineers for Rivers and Harbors is in part based considers only the

[a] See page 950.

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amount of traffic which may be carried by the river, if improved. There is, in addition to this amount, a further and greater amount which may be indirectly affected, through the influence of a competing and cheap means of transportation upon the present freight rates by rail. Neither of these amounts is susceptible of determination with accuracy. The four towns above Hartford now move about 2,200,000 tons of freight annually, of which perhaps 1,500,000 tons is inward bound, and about 550,000 tons coal. The special Board which investigated this matter had no power to compel testimony as to the actual freight rates charged by the railroads and paid by the merchants, and the statements made before it are at variance. From the best information available, however, it appears that the present rates paid for rail freights by merchants in these towns, as compared with similar rates to Hartford, which is only, say, 25 miles from Springfield, indicate a difference in favor of Hartford, which is considerably more than can be accounted for by the difference in length of haul. On such items as coal, for instance, it is stated that there is a difference as great as 50 cents per ton in favor of Hartford in shipments from Perth Amboy.

The indirect effect of the existence of the water route would extend probably to a much greater volume of freight than that actually carried on the river, and perhaps to three times that amount, in which case the saving to the people of these four towns would probably be a good return to them for an investment of $3,000,000, even with the maintenance charges stated by the Board.

I do not know that the hope of lowering noncompetitive freight rates by improving a waterway and thereby introducing a competing element for a special locality has been generally accepted as good ground for undertaking an improvement on the part of the General Government, but it is certainly frequently urged as such a ground, and in this case appears to be the principal one. It appears very questionable whether the expectation of benefiting the towns above Hartford in this manner warrants the General Government in undertaking the improvement and thus spending a large sum for the purposes named, especially as it may be possible to accomplish the ends sought at less expense by more direct methods.

Any calculation based on the amount of freight which the waterway will probably actually carry must lead to the conclusion reached by the Board of Engineers for Rivers and Harbors, that it is not advisable to undertake the improvement.

Very respectfully,

A. MACKENZIE,
Brig. Gen., Chief of Engineers, U. S. Army.

Hon. WM. H. TAFT,
Secretary of War.

REPORT OF A BOARD OF ENGINEERS UPON SURVEY OF CONNECTICUT RIVER BETWEEN HARTFORD, CONN., AND HOLYOKE, MASS.

NEWPORT, R. I., *August 11, 1904.*

GENERAL: The river and harbor act of June 13, 1902, contains the following provision:

Improving Connecticut River between Hartford Connecticut and Holyoke, Massachusetts: For the purpose of further surveys and report upon the project

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for improving the Connecticut River between Hartford, Connecticut, and Holyoke, Massachusetts, a board of three officers of the Engineer Corps, to be designated by the Secretary of War, shall personally make examination of the improvement proposed by the engineer in charge, and report thereon, with reference to the probable cost of said proposed improvement, the commercial advantages, if any, to be derived from such improvement, and such other information as the board may deem essential. In estimating the probable cost of said improvement said board shall take into account both direct and consequential damages and the annual cost of maintaining said improvement, and shall hear all parties interested in said improvement or who may be affected thereby. * * *

In compliance with the foregoing provision of the act, a Board of officers was appointed by the Secretary of War for the purpose of making the examination, surveys, etc., contemplated, and it has the honor to submit the following report:

Public notice was duly published in all of the daily papers in the principal towns along the Connecticut Valley, giving dates, etc., and hearings were held by the Board at Hartford and Windsor Locks, Conn., and Springfield and Holyoke, Mass. A stenographic report[a] of these public hearings, together with the papers[b] submitted, is hereto appended, marked "Exhibit A."

Elaborate surveys were undertaken between 1871 and 1874, under the direction of Gen. G. K. Warren, Corps of Engineers, by Gen. T. G. Ellis, on which a project for improvement was prepared, and it was on these surveys that Maj. Smith S. Leach, Corps of Engineers, based his report of November 13, 1897, with the plan of improvement referred to in the act.

During the hearings and an examination of the river, because of the changes that had probably taken place, the accuracy of the survey was questioned and the Board concluded that another survey of the river from Hartford to Holyoke should be undertaken on which to base the estimates of cost desired. The survey was in charge of Mr. A. J. Ober, junior engineer, whose report of the methods adopted and the variations between the survey completed by him and that of General Ellis are contained in a report[c] hereto appended, marked "Exhibit B."

Under the provisions of the act the Board is required:

First. To make an examination of the improvement proposed by the engineer in charge, together with the probable cost, this cost to include the direct and consequential damages and the annual cost of maintenance.

Second. To report the commercial advantages, if any, to be derived from the improvement.

The proposed improvement, that recommended by Major Leach in his report of November 13, 1897, contemplates the construction of three locks and dams, the latter of the Chanoine wicket type, to be erected, one below the new highway bridge at Hartford, Conn., the second at Warehouse Point, and the third at Kings Island, at a total estimated cost of $2,075,000. In this project the lift of the lower lock was to be 8 feet, of the second lock 18½ feet, and of the third 12 feet, the locks to be 260 feet working length, 45 feet wide, and a 10-foot depth on the miter sills, at a cost of $100,000 each. The Chanoine dams were estimated to cost $300 per foot.

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[a] Not printed.

[b] Only partially printed.

[c] See page 919; Tables I to XIII and Plates I to XI and XIII to XXIII, illustrating this report, are not printed.

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The Board is of the opinion that if this plan be adopted the locks should be made 60 feet wide instead of 45, as recommended, so as to take in four coal barges of the size used along the coast. Because of the foundations developed by the detailed surveys of the sites the estimated cost should be increased to $300,000 each, and the cost of the Chanoine dams, because of the nature of the foundation, should be increased to $500 per running foot; so that the cost of the proposed improvement would therefore be as follows:

8 locks, 250 feet working length, 60 feet wide, 10 feet depth on the miter sills, and lifts as noted above, at $300,000 each	$900,000
3,500 feet of Chanoine dam, at $500 per foot	1,750,000
The cost of the fixed dam at Kings Island, 500 feet, at $150 per foot	75,000
Cost of land, flowage, and contingencies	225,000
Total for locks and dams	2,950,000
To which is to be added:	
Excavation of sand and gravel for a 150-foot width of channel, 600,000 cubic yards, at 25 cents per cubic yard	150,000
Excavation of rock, 200,000 cubic yards, at $3 per cubic yard	600,000

From experience in operating and maintaining locks with fixed dams, the Board is of the opinion that the annual cost of maintenance will approximate $50,000, including necessary dredging.

During the personal examination of the Connecticut River between Hartford, Conn., and Holyoke, Mass., made by the Board, in accordance with the law, they found a company at Windsor Locks chartered by the State of Connecticut for the purpose of improving navigation around the rapids at that point, and the thought suggested itself whether the improvement of the river from Hartford to Windsor Locks and from the head of the rapids to Holyoke, Mass., with the improvement of the Connecticut River Company, chartered to improve the river through the rapids, would not accomplish the object desired. An examination of the locks and canal built by this company showed it to be of such size and character as to be wholly inadequate to the navigation expected on this stretch of river. The locks are in length 88 feet and in width 19½ feet, with a minimum depth over the miter sill of 3 feet at the lowest stage of the river and a depth of 5 to 6 feet at ordinary stages, so that, if this structure were included in the improvement, the availability for commerce of the entire improvement would be almost nothing. At the time of the Board's visit the lower lock, which had been in a disabled condition, was undergoing repairs, and it was apparent that for some time prior to this the canal had not been available for the purposes of navigation.

The principal improvements made by the company seemed rather for the purpose of availing itself of certain privileges granted in the charter than to the main object of its incorporation, the improvement of navigation, and as a consequence, any project now undertaken can no longer be confined to the stretch between Hartford and the lower lock of the canal system, but must be extended over the entire reach to Holyoke.

After a careful examination of the subject, three methods of improvement suggest themselves:

First. By the lock-and-dam system suggested by Major Leach.

Second. By continuing the dredging now undertaken below Hartford upstream to Warehouse Point, there to construct a lock and dam with a lift of 20 feet, with a lock and dam at Kings Island with a lift of 13 feet; and

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Third. By a lock and dam in the vicinity of Hartford with a lift of 10 feet, and the utilization of the upper portion of the Windsor Locks Canal by the construction of a lock of 29½ feet lift into the upper level of said canal.

The Board did not consider that its duties were confined to the preparation of estimates on Major Leach's project alone, but that it should embrace consideration of other methods that might suggest themselves, and therefore detailed surveys and estimates were prepared of the several plans outlined above.

The excessive cost of the construction of a Chanoine dam of the length required, especially in view of the character of the foundations encountered on the river, as well as the great cost of operating and maintaining them after completion, has led the Board to the rejection of the Chanoine wicket or any other type of movable dam, and to use instead the fixed dam with a suitable sluiceway.

In Major Leach's plan of improvement the lowest lock and dam is placed below the Hartford highway bridge, in a locality where the cost of the necessary land for lock sites, houses, etc., will be excessive. This, together with its proximity to the bridge and the overflowing of the City Park that would result, leads to the selection of a site somewhat farther up the river, about half a mile above the railroad bridge.

This change in the location of the lock and dam will require dredging to the extent of about 100,000 cubic yards of sand, so as to secure a channel 200 feet wide and 10 feet deep at extreme low water up to the lock. To secure a 10-foot channel at the least cost, the lower dam is fixed with its crest at reference 10, with the second and third locks at sites approximately selected by Major Leach, with lifts, respectively, 16½ feet and 13 feet. Under these assumptions the following estimate results:

Dredging 100,000 cubic yards sand, at 25 cents per cubic yard	$25,000
3 locks, 250 feet working length, 60 feet wide, 10 feet depth on the miter sill, $300,000 each	900,000
3,650 feet of dam, at $200 per foot	730,000
500 feet of dam in the west channel at Kings Island, at $150 per foot	75,000
950 acres of land damaged by overflow, at $200 per acre	190,000
Damage to Hartford and Springfield Street Railway power house	75,000
Purchase of necessary sites for locks, abutments, houses, etc	25,000
Excavation between dams and from Enfield dam to Holyoke:	
1,200,000 cubic yards sand, at 25 cents per cubic yard	300,000
135,000 cubic yards rock, at $3 per cubic yard	405,000
Total	2,725,000

The second plan of improvement contemplates the excavation of a channel from Hartford to a lock and dam at Warehouse Point, with a lift of 20 feet, and with another lock and dam, having a lift of 13 feet, at Kings Island, the estimated cost of which is as follows:

3,540,000 cubic yards sand, at 25 cents per cubic yard	$885,000
140,000 cubic yards rock, at $3 per cubic yard	420,000
2 locks, at $300,000 each	600,000
2,700 feet of fixed dam, at $200 per foot	540,000
500 feet of fixed dam in west channel at Kings Island, at $150 per foot	75,000
Damages due to overflowed land, 50 acres, at $200 per acre	10,000
Damages to Hartford and Springfield Street Railway power house	75,000
Land for lock sites, abutments, houses, etc	16,000
Total	2,621,000

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The third method of improvement contemplates the construction of a lock and dam, with a lift of 10 feet, about half a mile above the railroad bridge near Hartford and making use of the upper part of the present Windsor Locks Canal; the height of the Enfield dam remaining at its present reference above the zero of the Hartford gauge, a lock with a lift of 29½ feet will transfer boats to the canal level from the pool created by the lock and dam at Hartford. To avoid overflow the construction of a guard lock at the head will be necessary. For this plan the estimated cost is as follows:

Dredging 100,000 cubic yards sand, at 25 cents per cubic yard	$25,000
2 locks, the one above the railroad bridge, and the guard lock at the head of the canal, at $300,000 each	600,000
One 29½-foot lift lock, to pass from the lower pool to the canal level	450,000
900 feet of dam, at $200 per foot	180,000
1,250,000 cubic yards sand excavation in the lower and upper pools, at 25 cents per cubic yard	312,500
Excavation in the canal and rebuilding the bank:	
430,000 cubic yards earth, at 50 cents per cubic yard	215,000
102,000 cubic yards rock, at $3 per cubic yard	306,000
Repairs to Enfield dam (1,400 feet in length)	100,000
Damages due to overflowed land, 900 acres, at $200 per acre	180,000
Land for lock sites, abutments, houses, etc	25,000
Total	2,393,500

In connection with the estimate of the probable cost of the improvement, the Board is required to take into account both direct and consequential damages and the annual cost of maintenance. The direct damages that will result from the improvement arise from the overflow of lands. By moving the dam near Hartford, from the position recommended by Major Leach, the overflow of the lands in the vicinity of that city is avoided, and in the estimates given above the direct damages from this cause are especially noted in each case.

Any improvement of the river which will take from the Connecticut River Company the right to tolls under its charter would cause a direct damage to that company to the extent of such tolls, and the Board is of the opinion that this should be adjusted on the basis of the company's average receipts from that source for the last twenty years, for boats that could pass through their locks.

There are at present spanning the Connecticut River three railroad and four highway bridges which have no suitable arrangement for the passage of commerce, but as the river is a navigable waterway of the United States, existing laws require that they should be made with suitable draws for the passage of boats. This would impose some expense on the companies owning them, but will not exceed $25,000 each for the highway bridges and $50,000 each for the railroad bridges. In addition to the foregoing, there is one suspension bridge in the vicinity of Windsor Locks which will require an entire change, and the cost for a proper highway bridge with a draw should not exceed $100,000.

The Connecticut River Company, in their printed brief submitted at the hearing held in Windsor Locks, made an elaborate presentation of the damage that will result to their water power if the proposed improvement is made. The company not only claims damage to the power so developed at Windsor Locks, but also to that which might be developed at Kings Island. In considering this question, the following conditions present themselves:

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First. The Connecticut River Company chartered, not by the United States, but by the State of Connecticut, for the purpose of improving navigation, has in connection with such improvement created certain water powers and extensive industries partly dependent upon such power.

Second. The facilities for navigation, as provided by the company, are insufficient for the needs of the general commercial interests of the United States.

Third. The situation and arrangement of the company's plant at Windsor Locks are such that its value must, to a degree, be impaired by any adequate improvement of the river.

The Board, after most careful consideration, is of the opinion that, while the Connecticut River is a navigable waterway of the United States, and that under the Federal statutes any damages to the interests of the nature of those of the Connecticut River Company could be ignored in the light of the paramount rights of the general public, the company have a right, by virtue of its long occupation, to an equitable allowance for such impairment of existing water power as may result from the proposed improvement, but that there is no equitable claim for damage to undeveloped power.

The Board is further of the opinion that the proper determination of the exact amount of such damage is a matter to be fixed by the courts, and that this can only be done fairly and accurately after the improvement is made.

In this connection, it is to be noted that if the plan outlined by Major Leach is carried out, there can be no consequential damages incurred by reason of the improvement, as the water power will be in no case affected by it. In fact, the existing water power could be left intact by the construction of some type of movable dam in the vicinity of Hartford and using fixed dams at the other localities, in which case there would be required a length of 900 feet of movable dam, at an estimated cost of $500 per foot, and a corresponding change in the estimates can be made to provide for this.

The estimated cost of maintenance of any of the proposed systems of locks with fixed dams would approximate $40,000 per annum, including dredging, and $50,000 if movable dams be substituted.

As to the commercial advantages to be derived from the improvement of this stretch of the Connecticut River, it seems fair to state that, with the river in the condition that it now is, the only navigation upon it consists of small pleasure crafts, mainly running between Holyoke and Enfield dam, and the proposed improvement would in no wise effect the present navigation. Therefore any commercial advantages arising must be based upon prospective commerce on the river.

The following is a list of the towns and settlements, many of them with large manufacturing interests, lying upon this stretch of the river, all of which are now dependent for their supplies upon railroads without competition. Should the improvement be made, competition would exist between the railroads and water transportation, and large amounts of bulky material would undoubtedly be carried up the river at cheaper rates than they can be carried by the railroad.

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Town.	Population.	Value stock used.	Value manufactured products.	Capital invested in manufacturing.
Windsor	3,614	$508,427	$921,329	$1,016,549
Windsor Locks	3,062	631,785	1,311,768	2,117,159
Suffield	3,521			
South Windsor	2,014			
East Windsor	3,158	541,571	1,016,216	751,474
Enfield	6,699	1,139,636	2,090,609	4,022,477
Agawam	2,516			
West Springfield	7,105	561,675	1,142,105	934,945
Holyoke	45,712	13,673,969	26,283,964	26,760,061
Chicopee	19,167	5,666,713	8,704,907	6,595,802
Springfield	62,059	9,194,841	21,207,089	17,105,947
Longmeadow	811			
Total	159,458	31,918,617	62,678,437	59,304,384

Following this, we give a list of the tonnage of coal now delivered at Springfield, Holyoke, Chicopee, West Springfield, Thompsonville, and Windsor Locks for the year ending June 30, 1902. All of this material would be subject to competition between the river transportation and the railroad transportation, thereby giving great advantages to the citizens living along the borders of the river.

City or town.	Coal.	Total in and out freight.
	Tons.	*Tons.*
Springfield	150,000	2,086,447
Holyoke	300,000	
Chicopee	50,000	
West Springfield	80,000	
Total, exclusive of that used by railroads	580,000	
Thompsonville	25,000	188,553
Windsor Locks	10,000	
Total	565,000	2,275,000

Very respectfully,

WM. T. ROSSELL,
Lieut. Col., Corps of Engineers.
GEO. W. GOETHALS,
Major, Corps of Engineers.
J. G. WARREN,
Major, Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

[First indorsement.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, October 25, 1904.

Respectfully referred to the Board of Engineers for Rivers and Harbors constituted by Special Orders, No. 24, Headquarters, Corps of Engineers, series of 1902, for consideration, report, and recommendation.

To be returned.

By command of Brig. Gen. Mackenzie:

H. F. HODGES,
Major, Corps of Engineers.

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[Second indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., December 23, 1904.

Respectfully returned to the Chief of Engineers, United States Army, inviting attention to the Board's report of this date.

For the Board:

D. W. LOCKWOOD,
Lieut. Col., Corps of Engineers,
Senior Member of the Board.

APPENDIX A.

STATEMENT OF THE CONNECTICUT RIVER COMPANY AT THE HEARING OF THE BOARD OF ENGINEERS.

WINDSOR LOCKS, CONN., *October 10, 1902.*

The proposition to improve Connecticut River above Hartford is largely based on a report of Maj. Smith S. Leach, major, Corps of Engineers, dated November 13, 1897, and is found in House Document No. 136, Fifty-fifth Congress, second session. The data for this report are taken from the report of Gen. Theodore G. Ellis, civil engineer, based on surveys made by him in 1871–1874. The report of General Ellis did not recommend the plan now proposed, nor any plan similar to it. The map which accompanied this report is on file in the War Department. The action taken by the House Committee on Rivers and Harbors and by the Senate Committee on Commerce, resulting in the passage of the amendment to the act of June 13, 1902, by both Houses of Congress, was obviously for the purpose of obtaining more information as to the cost and feasibility of the plan than was contained in the report of Major Leach.

The plan is to construct a canal or channel in the middle of the river, 150 feet wide and 9 feet deep at all times, extending from Hartford, in the State of Connecticut, to Holyoke, Mass., a distance of 34 miles. The estimated cost of this improvement, according to Mr. Leach, is $2,000,000. The estimated cost of maintaining it after it is finished is $8,000 per annum.

It is proposed to construct a dam in the river opposite the city of Hartford which will be 800 feet long. This dam will flood the river back for 13 miles, and will flow onto the wheels of the lower mills at Windsor Locks, Conn. It will also overflow some of the lower portion of the city of Hartford.

The second dam is to be built just above the mills in Windsor Locks, and this dam will flood the water of the river to a point opposite Kings Island, lying between the towns of Enfield and Suffield.

The third dam is placed opposite Kings Island, and will flood the water back to Holyoke.

The fourth dam extends from the head of Kings Island to the river bank, in the edge of the town of Suffield. This is to be a fixed dam. The others are known as "beaver" dams, and are to a certain extent movable, and adjust themselves to high or low stages of water. The plan involves the destruction and removal of the costly and valuable dam across the river, now owned and maintained by the Connecticut River Company, at Enfield Falls.

The Connecticut River Company was chartered to improve navigation and with power to own and sell water power, water rights, and water lots on the west bank of the Connecticut River. This company constructed a canal under its charter six miles and a quarter in length through the village of Windsor Locks to Enfield Falls, so called. This canal is protected in part by walled embankments and riprap foundations, and is so situated with reference to the river that it would be greatly damaged by the ponding of the water, as contemplated by the so-called improvement.

At Enfield Falls the company erected a dam, and are now maintaining it across the river. Formerly the crest of this dam was 39 feet above zero mark at the steamboat dock in the city of Hartford. The company had the right to raise this dam, and did raise it so that its crest was, and now is, 40.31 feet above zero mark at Hartford.

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This right to raise the dam was questioned by the Holyoke Water Power Company, and that company brought suit in the United States circuit court at Hartford to determine this right of so raising the dam. After trial the court decided that the Connecticut River Company had the right to so raise the dam, and confirmed the action of the company in so doing by a decree passed June 16, 1884. This matter is alluded to in order to show that the Connecticut River Company has legal rights in the river which the proposed improvement interferes with, and that those rights have been confirmed and established by the court of the United States.

The crest of the dam being 40.31 feet above zero mark, the water in the pond above is from 2 to 3 feet higher, according to quantity of water that is flowing in the river. (See the report of David M. Greene, C. E., attached to this statement.)

The plan of improvement proposes to maintain a pool of 39 feet above low water at Hartford. It will be seen that this will lower the level of the present pool 1.30 feet if the water in the pool should be kept even with the crest of the dam, and from 1.30 feet to 3 feet above the crest of the dam at all seasons of the year, varying according to the quantity of water. This involves a loss of head and consequently a loss of power at the mills. (See the report of Mr. Greene, which gives the loss of power and consequent damages.)

The advocates of this plan claim that their wish is to give Springfield and Holyoke improved freight facilities, and it is supposed that with great expenditure on the part of the Government involved in this plan, and the establishment of a canal from Hartford, the present terminus of river navigation, to these two cities, this result will be obtained.

It appears that Springfield already has practically the same freight facilities and freight charges as Hartford, where river carriage now ends. For the last ten years or more the charge for hauling a ton of coal from tide water at New Haven to Hartford (36 miles) has been 75 cents per ton, and the charge to Springfield (62 miles) has been precisely the same.

It thus appears that nothing is to be gained to Springfield or Holyoke by making these cities the termination of river navigation, since it is not commercially possible that coal and other freights could be carried to Springfield and Holyoke by river or canal for less money than it could be delivered at Hartford. Hartford has river and rail carriage, but there is no difference to the dealer or consumer as to freight charges. They pay the same freight charges for their coal and lumber whether they come by river or rail; this is what would happen to Springfield if water carriage was extended as asked for.

The river has no monopoly of the coal carriage at Hartford.

The total amount of coal brought to Hartford in the year 1901 was 219,800 tons, of which 157,000 tons came by water and 62,000 tons by rail.

The cost of bringing a ton of coal by river to Hartford from New York or Perth Amboy, in barges, is 85 cents. There is a charge of 10 cents per ton for wharfage, and there are charges for unloading coal from barges, but we are unable to ascertain their amount.

The Connecticut Western Railroad Company, which is now leased and run in connection with the Philadelphia and Reading Railroad Company, is bringing coal to Hartford from Highland on the Hudson River for $1 per gross ton. The Consolidated Railroad brings coal to Hartford from Newburg on the Hudson River for the same price ($1 per gross ton). Both companies deliver direct to large consumers by branch tracks. When coal is handled by rail there is only a difference of 15 cents a ton over the price which it costs to land a ton of coal on the river bank on the east side of the city when brought here in barges. This amount is much more than balanced by the charges for unloading and wharfage and the extra expense of cartage to the place of consumption where the railroad companies land it.

This is a clear superiority on the side of the railroad over the river carriage. The Connecticut Western Railroad now has a connecting line over the East Granby and Suffield Railroad to Springfield by traffic agreement, and will deliver to that city for the same amount per ton ($1) from Highland as it is now delivered at Hartford, the distance to Springfield being substantially the same. However much the Government may improve Connecticut River, no company owning barges can ever afford to bring coal to Springfield, 26 miles above Hartford, at $1 per ton, placed on the wharves of the city, to say nothing of the additional cost of delivering it to the dealers and consumers in other parts of the city where it is used.

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A military reason is suggested for this so-called improvement, in connection with carrying coal to the arsenal at Springfield (see report of Major Leach, page 27). When it is considered that the road of the Boston and Albany runs immediately in the rear of the arsenal, and that coal brought in barges would have to be carted a long distance to the arsenal, this reason seems somewhat inadequate. The additional cost of carriage is a sufficient answer to it.

It has been claimed that with the establishment of water carriage to these two cities there would be another competitor of the railroads that now bring coal and other freight to Springfield and Holyoke, and that this would lower freights, etc. The answer to this proposition is, that such would not be the result, as shown in the case of Hartford, which has water carriage in competition with rail carriage, and yet, as we have seen, the freight charges are substantially the same, and the cost of bringing a ton of coal to Hartford and delivering it to a dealer or customer is substantially the same whether it comes by rail or water. How then would the competition of water carriage help matters at Springfield and Holyoke any more than it now does at Hartford?

Another answer to this proposition is, that Springfield has more railroad competition than Hartford. The Consolidated Railroad carries coal, lumber, and other freights to Springfield and Holyoke. The Boston and Albany, now leased to the New York Central Railroad is a competitor in the same business. So is the Boston and Maine and its leased lines; so also is the Connecticut Western Railroad (lessee of the Philadelphia and Reading Railroad) through an extension of its line by traffic agreement over the East Granby and Suffield Railroad to Springfield. These make four competing lines of railroad running into Springfield.

It is difficult to understand what further advantage is desired in the way of competition in freights at Springfield or Holyoke.

It has never been the policy of the Government to create competition by an appropriation of money from the general treasury. Even if there were no competing freight lines centering at Springfield it would not follow that this experiment should be tried. These improvements, so called, depend on a variety of condition and circumstances. The cost of the improvement; the damage to the industrial establishments located on the river; the cost of adjusting 12 bridges, now spanning the river to the new situations; the loss of power at the mills; the cost and trouble of adjusting the canal of the Connecticut River Company and the mills to the new dam proposed—all these enter into the problem and must influence the decision. The energy, size, and thrift of these cities is suggested as a reason why this great and costly enterprise should be entered upon. The projectors of this plan have never been able to show that they have any grievance whatever or that the growth of the two cities has ever been, or ever will be, retarded by high freight rates as compared with other cities. They have no abuse to complain of, but they ask the General Government to appropriate a large sum of money from the general treasury of the people for their special benefit when one of the railroads is carrying coal to them at the rate of about 1 cent per ton per mile, and probably the others are carrying it at the same rates.

Extracts from reports to the War Department on improvements in navigation of the Connecticut River between Hartford and Holyoke, covering the period from 1873 to the present time, show that this scheme is not new. This project of a canal is not new, although its location is new. The former schemes located it east of the Connecticut River, commencing at Enfield Falls, and extending through the country and towns of East Windsor, South Windsor, and East Hartford, to a point in the Connecticut River below Hartford. The Government through its committees of Congress has never approved of the expenditure for establishing water communication between Hartford and Springfield and Holyoke, except by way of the canal of the Connecticut River Company on the west bank of the river. It has never been before proposed to construct a canal in the river itself. The reason for this is manifest. The river has been used with no reference to such a project as the present. Cities, villages, and towns have been built up near it with no reference to its being used as a canal and its being dammed at several places for that purpose.

Between Hartford and Holyoke there are 12 bridges across the river connecting adjoining towns and cities. This section of the river has been occupied and built up with no reference to its navigation in the manner proposed. These bridges will have to be reconstructed in part, so as to provide them with draws which will admit of the passage of vessels, involving a large expenditure of money.

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In connection with their plant the Connecticut River Company own a valuable water power at Windsor Locks, which they rent to manufacturing corporations.

Nine large manufacturing establishments have been built on the banks of the river at Windsor Locks between the river and this canal, and they rent their power from the Connecticut River Company. Their wheels for propelling machinery are situated near the edge of the river, and the report on which these proceedings are based states that the proposed improvement will interfere with the wheels of the lower mills. The Connecticut River Company is of opinion that the proposed improvement, if carried out, will greatly damage the water power at Windsor Locks and largely diminish its value.

The amount of capital invested in these mills is not far from $2,000,000. The capital represented in the investments of the Connecticut River Company alone, consisting of its canal, mills, bridges, locks, etc., and not including Kings Island and the undeveloped water power in connection with it is about half a million of dollars. The Connecticut River Company believes that to pond the water in front of Windsor Locks by erecting a dam at Hartford, which will flow the water back up the river for 13 miles, would damage their water power to such an extent as to make the improvement cost such an enormous sum of money that there would be no such compensating benefit to the public as would warrant such an expenditure. The cost of the improvement, as suggested in the report, does not include the damage to property in the city of Hartford, nor does it include the great damage which would accrue to the Connecticut River Company by diminishing the value of its water power and by destroying its dam, as at present maintained. No consequential damages of any kind have been taken into consideration in making up the cost of this so-called improvement. When these damages are added to the estimated cost of the improvement, it will make the total cost considerably above $4,000,000. (See report of Mr. Greene attached to this statement.)

In connection with the subject of the damage to the water power of the Connecticut River Company, attention is called to the statement made in the report of Major Leach on page 8, which is as follows:

"Any plan which promotes the usefulness of the stream in one direction by destroying its value in another must be considered seriously defective."

The object of this improvement must necessarily be the lowering of the rates charged for freight through this valley.

Coal would be the principal commodity that would be carried through the proposed canal, and possibly other heavy freights would go that way, but not to any great extent. Connecticut River is navigable at the present time as far as Hartford, but it would not be navigable above Middletown, 16 miles below Hartford, if it were not for the fact that the Government is expending large sums of money annually to dredge the river and maintain a channel in it by jetties and other well-known means. The annual cost to the Government of the United States to maintain the river from Middletown to Hartford is from $15,000 to $20,000.

The engineer upon whose report the proposed improvement in the river above Hartford is based, estimates that with the channel to be maintained for 34 miles, and four dams to be also maintained, it will cost the Government only $8,000 per annum. It is suggested that this estimate, when compared to the actual cost to the Government of the United States of Connecticut River between Middletown and Hartford, a distance of 16 miles, is altogether too low. It is probable that it would cost the Government at least $20,000 per annum to maintain the river above Hartford according to the proposed scheme. (See report of Mr. Greene hereto attached.)

From the best information we are able to obtain, the following quantities of coal were carried to the following points in the year 1901:

	Tons.
Chicopee	21,000
Chicopee Falls	11,000
Holyoke	178,000
Springfield	174,000
Total	384,000

The amount charged by the Consolidated Railroad for hauling a ton of coal from tidewater at New Haven is 75 cents. We have not been able to ascertain the amount charged by the other competing roads, but it is probably about the same.

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Prof. David M. Greene, of Troy, civil engineer, whose large experience in such questions and whose familiarity with the Connecticut River along the line of the proposed canal thoroughly qualify him as an authority on this question, estimates the total expense of the project to be as follows:

Cost of construction	$2,593,939
Damage to developed power at Windsor Locks	1,118,750
Damage to undeveloped power at Kings Island	600,000
Total expense	4,312,689
Cost of maintenance annually	20,000

(See report of Mr. Greene attached to this statement.)

These estimates relate only to the cost of construction and the consequential damages to the Connecticut River Company. No estimate is made of the damages to the 12 bridges crossing the river or to any other consequential damage.

The following figures show the annual cost to the Government of this project:

Interest on sum estimated by Mr. Greene as cost of improvement, to wit, $2,593,939, at 4 per cent, $103,757.56; at 3 per cent, $77,818.17. Add to these figures the sum of $20,000 as the annual cost of maintenance and you have an annual outlay, at 4 per cent, of $123,757.56, at 3 per cent, of $97,818.17.

If to the item of Mr. Greene, $2,593,939, you also add the sum of $1,718,750, which is the damage to developed and undeveloped power, etc., you have the sum $4,312,689. Interest on this sum at 4 per cent, $172,507.56, or at 3 per cent, $129,380.67. Add to these two items the sum of $20,000 as the annual cost of maintenance and you have an annual outlay, at 4 per cent, of $192,507.56, at 3 per cent, of $149,380.67.

The expenditure of such a sum of money on such a project is in violation of the business principle on which the General Government should be conducted.

It appears that at the lowest estimate the Government is asked to contribute annually the sum of $123,757.56 in connection with this project, and that if the consequential damages be added, as provided in the act of June 13, 1902, the annual sum asked for will be $192,507.56, reckoning the interest charged at 4 per cent, and $149,380.67 if the interest charged be reckoned at 3 per cent.

No good reason can be shown in the existing freight conditions at Springfield and Holyoke for such an outlay.

To enter upon this project and establish the canal as asked for would be precisely the same in principle as it would be to construct and maintain a railroad between the same points with money drawn from the public Treasury. And it may be added that the difference in cost between the two plans would be very small.

In a recent paper upon this subject by George Y. Wisner, C. E., consulting engineer at Detroit, Mich., which appears in the proceedings of the American Society of Civil Engineers, that writer says:

"In the writer's opinion the only condition which warrants the General Government in constructing a free waterway between terminals where first-class railroad facilities already exist is where such waterway will develop new commerce, which otherwise could never be made profitable, and which will indirectly build up new freight traffic of benefit to the railroads as well as to the waterway." (See Proceedings of the American Society of Civil Engineers, September, 1902, vol. 28, No. 7.)

We think the principle which should govern the action of the General Government in such matters is here correctly stated. Tried by this test, the project under consideration should not be undertaken.

The canal of the Connecticut River Company starts at a point below the village of Windsor Locks, 11½ miles above Hartford. This canal has four locks. At comparatively small expense they can be widened so as to admit any of the ordinary barges that are used in the transportation of coal and other heavy freights in the Connecticut River below Hartford, and in other similar rivers. This canal extends northward on the edge of the river and under its west bank until it reaches the pool which is formed by the dam of the company, called the Enfield dam. Barges entering into this canal can go through it to the pool, and in the pool to Springfield, West Springfield, and Holyoke. This can be done at the present time if the river is dredged from Hartford to the foot of this canal, as it was in former times.

Up to about twenty years ago the Government used to dredge the river between Hartford and the lower end of this canal for the purpose of enabling barges and similar craft to go up the river, to and through it, into the pool above. This

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had been the practice for many years. But the business gradually fell off, and the Government, for that reason, ceased to make any improvements in that portion of the river. There is no doubt that if the Government would improve the river from Hartford to the foot of this canal, it would do away with any reason for further improvement in the river.

Mr. Greene in his report states that "an increase of 1 foot in depth over 2 miles of the northerly end of the canal would render the entire canal navigable for boats drawing 6 feet of water and carrying cargoes of 200 tons each." (See report of Mr. Greene attached to this statement.)

If that portion of the river between Hartford and the lower end of the canal of the Connecticut River Company should be dredged out so that barges could go there, and from there through the canal, and from the head of the canal through the pond to Springfield and Holyoke, it would accomplish every purpose contemplated by the advocates of this measure. This could be done with comparatively slight expense, and would involve simply the dredging of the river between Hartford and the lower end of the canal, and the widening and lengthening of its locks. It is not at all probable that if this were done any great amount of freight would avail itself of that means of carriage, although it would be ample for the purpose.

THE CONNECTICUT RIVER COMPANY,
By ARTHUR D. COFFIN, *President.*

LETTER OF MR. D. M. GREENE, ON BEHALF OF THE CONNECTICUT RIVER COMPANY.

TROY, N. Y., *October 6, 1902.*

GENTLEMEN: At the request of the Connecticut River Company, I have examined the project for the improvement of the Connecticut River between Hartford and Holyoke, as presented in the report of Maj. Smith S. Leach, Corps of Engineers, U. S. Army, dated November 13, 1897, and in other documents submitted therewith. In this examination I have also had the benefit of a somewhat critical and detailed investigation of the Connecticut River Company's canal and water power at Windsor Locks, and between that point and the present Enfield dam.

I beg to report respectfully the results of my examinations under the following heads:

1. Total cost of the project.
2. Damage to the Connecticut River Company's water power and the cost of readjusting it.
3. Loss of available water power at Kings Island.
4. Improvement of the Connecticut River Company's canal.

1. THE TOTAL COST OF THE PROJECT.

This estimate of the probable cost of executing the proposed improvement is necessarily based upon such facts as are presented in Major Leach's report, already referred to, together with such general and specific information as has been gained during the progress of the surveys and examinations of the present year.

No details, except length, width, and lift of locks, the aggregate length of dams, and width of channel, are found in the report of Major Leach. It has therefore been necessary to supply such details as were necessary.

In the estimate which follows the width of channel in sand and gravel has been taken at 150 feet, with side slopes of 2 to 1; in rock at 150 feet, with side slopes of ¼ to 1. The total length of each lock has been taken at 393 feet, and the total height of lock wall for Locks 1, 2, and 3 at 19, 28, and 30 feet, respectively.

I have no means of ascertaining the necessary height of the fixed dam across the west channel at Kings Island, but assume it to be at least 14 feet. The length of the proposed movable Dams 1, 2, and 3 I find by an examination of the maps to be approximately 1,050, 1,600, and 800 feet, respectively. The proposed improvement has been assumed to extend to a point 35¼ miles from Hartford.

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Estimate.

3 locks	$332,152
3,450 linear feet movable dam, at $200	790,000
500 linear feet fixed dam	50,000
Land, flowage, buildings, and contingencies	225,000
Total of locks and dams	1,397,152
1,002,371 cubic yards excavation sand and gravel, at 25 cents	250,593
315,398 cubic yards excavation rock, at $3	946,194
Total	2,593,939

It will be observed that Major Leach's prices per unit, so far as he has given them, have been adopted.

The above estimate includes nothing for the expensive foundations and protection works which would be required in connection with the proposed lock at Hartford. The estimate covers only the lock proper. The cost of foundations, etc., has been omitted in the absence of information in relation to the site, except such as could be drawn from the profile of the river on sheet No. 7 attached to the report of Major Leach.

Maintenance.—The annual cost of maintenance and operation of the proposed works has been put in the report referred to at $8,000. I am of the opinion that this annual charge will be nearer $20,000. The dredged channel above Enfield dam, in sand and gravel, is 5.67 miles in a total distance of 15¼ miles, or 37.16 per cent of the total distance. There will be 2.57 miles of rock excavation above, at, and below Dam No. 1. Between Dam No. 2 and Hartford, through the five bars, there is—

	Miles.
An aggregate of sand and gravel excavation amounting to	4.88
Add above Enfield dam	5.67
Add rock	2.57
Total in 33.8 miles	13.22

or over 39 per cent of the entire distance, of which over 31 per cent is in sand, or in sand and gravel.

In view of the foregoing facts, it would seem that the annual cost of operating the locks and dams, and of maintaining over 13 miles of artificial channel, principally in sand, or in sand and gravel, can not be safely estimated at less than $20,000. This annual sum capitalized at 4 per cent represents the capital sum of $500,000, which should be added to the estimated cost of executing the works embraced in the proposed improvement of the Connecticut River. The final estimate of the cost of the project per se thus becomes $3,093,939.

2. DAMAGE TO THE DEVELOPED WATER POWER OF THE CONNECTICUT RIVER COMPANY AT WINDSOR LOCKS.

The projected improvement contemplates establishing a pool level of 39 feet above Hartford zero, between Holyoke and dams to be erected across the two channels at Kings Island, and the removal of a part or the whole of the present Enfield dam. The water is to be delivered to the Connecticut River Company's canals at a point about 1½ miles below Enfield dam, and just above a fixed dam to be erected across the west channel, near the head of Kings Island, whose crest shall be 39 feet above Hartford zero.

The surface of the pool thus extended is to be maintained, normally, at an elevation of 39 feet by the manipulation of a movable dam across the east channel, near the foot of Kings Island. This is the new condition, as to water level, which it is proposed to establish in the river at the new head of the Connecticut River Company's canal. It will, of course, involve the building of a new bulkhead and gatehouse at the new entrance into the canal. It will also involve the building of a new lock at the new entrance, for the reason that the charter of the Connecticut River Company requires it to maintain its canal in a navigable condition.

The cost of rebuilding and readjusting the head works referred to will not, it is believed, be less than $25,000.

The normal level of the surface of the water in the present canal, at the point where the new inlet is to be located, is 39.63 feet above the Hartford zero.

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The normal loss of head at the entrance of the present canal is 2 feet, and during freshets it is more than 2 feet. After the execution of the project, therefore, the water in the canal, at the new head of the canal and below the head gates, would stand at an elevation 2 feet below the pool level, or at 37 feet. Thus the water at this point would be (39.63 feet — 37 feet=) 2.63 feet lower than it now is.

To maintain the present velocity of current the new surface slope should be practically the same as the present slope.

It will result from this new condition that the area of section of the present canal will be reduced in depth 2.63 feet, and the head at Windsor Locks will also be permanently reduced to the extent of 2.63 feet.

The depth of water in the present canal, when it is supplying water to the mills at Windsor Locks, averages—and is pretty uniformly—8 feet below the site of the proposed new intake. From the aqueduct to the head of the canal the depth of water may average about 6 feet.

A reduction of 2.63 feet in depth through the aqueduct would reduce the water section by 40 per cent. In 22 cross sections of the canal, taken between the aqueduct and the foot of the canal, at the head of the third lock, the reduction of 2.63 feet in depth produces a reduction of the water section ranging from 41 to 48, and averaging 45¼ per cent.

If the water section of the present canal be diminished by reason of a lower stage of water 45 per cent, the resulting effective section becomes 55 per cent only of the original.

The average head at Windsor Locks on May 21 and 22 of the present year was found to be over 28 feet, the water in the river opposite the third lock being 9.3 above Hartford zero. Deducting 1 foot for loss in reaching and leaving the wheels, we have a normal average effective head of 27 feet.

This would be reduced at a like stage of the river by 2.63 feet, or 9.74 per cent. Then the resulting effective head would be only 90.26 per cent of the existing head.

It follows, then, that the resulting power at Windsor Locks would be only (55×0.9026=) 49.64, say 50 per cent of the existing power.

The present canal is capable of delivering more than 1,522 cubic feet per second. This volume of water, with an effective head of 27 feet on wheels whose average efficiency is 0.75, will yield 3,500 net horsepower. One thousand four hundred and twenty cubic feet per second are now used habitually at Windsor Locks, representing 3,267 net horsepower.

By reason of the fact that the water element of this power can be depended upon absolutely every day in the year, the power as a whole is exceptionally valuable. I know of no other powers anywhere, except those drawing their water supply from the Great Lakes, where the water may be said to be reliable and constant every day in the year.

Value of the power.—The annual values or rental values of a net horsepower twenty-four hours in the day in Connecticut is not less than $25. This, capitalized at 4 per cent, represents an absolute value of $625.

The value of the Connecticut River Company's developed power at Windsor Locks is therefore (3,590×$625=) $2,187,500.

The damage, then, to the Connecticut River Company's developed water power at Windsor locks, due to the destruction of 50 per cent of it by the proposed Connecticut River improvement between Hartford and Holyoke, would be	$1,093,750
Add cost of new lock, bulkhead, and gatehouse at new intake	25,000
Total	1,118,750

8. LOSS OF AVAILABLE WATER POWER AT KINGS ISLAND.

The Connecticut River Company owns Kings Island and the valuable undeveloped water power at that point. Major Leach states in his report that the minimum flow of the Connecticut River is 4,000 cubic feet per second. Deducting 1,520 cubic feet per second for the supply of the present canal, there remains 2,480 cubic feet per second. If we assume that at least 2,000 cubic feet per second—which is probably nearer the truth—are at all times available at Kings Island, and that a normal effective head of 20 feet can be utilized, the available net power will be 3,407 horses, worth when developed (3,407×$625=) $2,129,375.

Can an effective head of 20 feet be made available at this point?

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From July 30 to August 15 of the present year (1902), a record kept at the head of the present canal shows that the elevation of the water in the river at that point varied from 42.59 feet to 43.58 feet above the Hartford zero, or practically 1 foot in 47 days; 43 feet may be taken as approximately the normal elevation of available head water at Kings Island. An examination of the profile of the river, which accompanies Major Leach's report, shows that tail-water, at an elevation of about 22 feet is practicable. The available head at this power is therefore (43—22=) 21 feet.

Allowing for a loss of 1 foot in putting the water on the wheel and in discharging it therefrom, there remains as effective head 20 feet, as assumed in the foregoing estimate.

The cost of developing this power so as to make it available at any point on the island includes the cost of the erection of fixed dams across both channels of the river, the crests of which would be at the elevation at which the Connecticut River Company is authorized to maintain the Enfield dam.

One of these dams would be about 500 feet and the other 1,050 feet, making an aggregate length of 1,550 feet, or within about 40 feet of the length of Enfield dam. The cost of a bulkhead and gates, together with the site for a power house and possibly excavation of tailrace, would also be included in the cost of developing this power.

The dam should cost not to exceed $175,000, and $25,000 should cover the cost of all other construction necessary to complete the development to the point of readiness to supply water for power.

The above sums aggregate $200,000. Add to this, to cover all possible contingencies, the sum of $129,375, making a total of $319,375.

The estimated value of this power developed is	$2,129,375
Estimated cost of development is	329,375
Value of undeveloped power	1,800,000

The development of this power and its use by manufacturing establishments on Kings Island would add very largely to the value of the island—how much can not readily be estimated.

While the projected improvement of the navigation of the Connecticut River, if executed, would not entirely destroy this power, it would very seriously impair its value. The available effective head would be reduced from 20 feet to the lift of lock No. 1, less 1 foot, or (39—26.5—1=) to 11½ feet.

The net power due to this head would be 1,960 horses and its value would be (1,960×$625=) $1,225,000.

The cost of this development to the Connecticut River Company would be comparatively trifling. The dams would be built as a part of the proposed improvement, and the head and tail levels established at 39 feet and 26½ feet elevation, respectively.

The bulkheads, gates, and other necessary work might cost $25,000. Deducting this sum from the estimated value of the improved power there remains $1,200,000 as the present value of the undeveloped power.

The difference between our two estimated values of the undeveloped powers of 3,307 and 1,960 horses, respectively, or (1,800,000—1,200,000=) $600,000 plus an indeterminate impairment of the value of Kings Island as a site for manufacturing enterprises, represents the damage which would accrue to the Connecticut River Company from the execution of the projected improvement at Kings Island. We thus have shown:

Damage to developed power at Windsor Locks	$1,118,750
Damage to undeveloped power at Kings Island	600,000
Total damage to water powers	1,718,750

4. IMPROVEMENT OF THE CONNECTICUT RIVER COMPANY'S CANAL.

The Connecticut River Company's canal extends from Enfield dam southerly along the west bank of the Connecticut River, a distance of about 5¼ miles to and through the village of Windsor Locks. At the head of the canal is a guard lock, bulkhead, and gates for the admission of water to the canal. At the lower end of the canal it drops to the river level through three locks, which are now being rebuilt or repaired and put in condition suitable for the passage of boats whenever such passage may be desired.

The locks are said to be 90 feet long between hollow quoins and 20 feet wide. They admit the passage of boats 80 feet long, 19 feet wide, and drawing 6 feet

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of water. Such boats have a displacement of about 260 tons and should carry 200 tons of cargo.

The depth of the canal from the head to the third lock, at the foot of the canal proper to the aqueduct, a distance of about 2¾ miles, averages about 8 feet. From the aqueduct, in which the depth of water is 6½ feet, to the guard lock, a distance of about 2½ miles, the depth averages about 6 feet. The surface width of the canal averages about 75 feet, except through Windsor Locks, where for a mile in places the width is not more than 50 feet.

An increase of 1 foot in depth over 2 miles of the northerly end of the canal would render the entire canal navigable for boats drawing 6 feet of water and carrying cargoes of 200 tons each.

The maximum velocity of the current in the canal, except perhaps at the upper end, does not reach 2 miles per hour. The grade of the bottom of the canal falls 5 feet, between the guard lock and the head of the third lock, at Windsor Locks. There is also a fall of about 2.9 feet in the surface of the canal, between the same points, when it is carrying 1,500 cubic feet of water per second. Exact figures can not be given because of small hourly fluctuations in elevations.

Such is the present canal of the Connecticut River Company, with a capacity about equal to that of the enlarged Erie Canal, connecting the Hudson River, at Albany and Troy, with Lake Erie at Buffalo, in the State of New York.

This capacity will be secured by the excavation of less than 20,000 cubic yards of material from the bottom and at the upper end of the canal between the aqueduct and the guard lock. Some of this excavation would be of rock, but how much can not now be stated. If half of it be rock, then $12,500 is a liberal estimate for its removal.

Very little, if any, dredging would be required between Enfield dam and the Willimansett bridge. Below Windsor Locks sufficient dredging to maintain a 7-foot channel through the five bars would be necessary. No 7-mile current would be required on this route.

It is true that Erie Canal boats, because of their length, could not pass the locks; nor could boats 19 feet wide, adapted to this canal, pass the locks of the Erie Canal, because of 1 foot excess of width. It is probable that boats would have to be built specially adapted to the local conditions; or, the locks might be lengthened sufficiently to pass Erie Canal boats, at an expense of less than $30,000, should it be deemed expedient to do so. With such enlargement of the locks this canal would equal in capacity the enlarged Erie Canal, which, it is claimed, regulates freight rates through central and western New York.

While capital can be found to aid efforts to establish permanently water communication, without transshipment, beween Chicago and Europe, it could probably be found to build and operate boats specially adapted to the conditions here, and for the purpose of supplying the cities of Springfield, Chicopee, Holyoke, and West Springfield with cheaper coal. It may well be doubted, however, whether any capitalists, familiar with traffic conditions and the cost of conducting transportation, would be inclined to engage in a freight controversy with existing lines for the purpose of enabling local communities to get something for nothing, or to gain a small advantage over their neighbors more remote from the river at Government expense.

Should the project for the improvement of the navigation of the Connecticut River by the General Government be carried out on the lines indicated in Major Leach's report, its advocates would be almost certain to be disappointed in failing to realize the anticipated material reduction in freight rates and in the volume of tonnage which would be diverted from the rail to the water route.

The reduced cost of transportation, which may be secured by long lines of canals admitting the passage of boats of large capacity, can not, for obvious reasons, be realized on short local lines, involving difficult and dangerous navigation through rocky channels, in which currents of 7 miles per hour are to be encountered during high water.

The Connecticut River Company's canal, improved as suggested would, however, serve every purpose required by this project.

Respectfully submitted.

D. M. GREENE,
Engineer.

Maj. WILLIAM T. ROSSELL,
Maj. GEORGE W. GOETHALS,
Maj. JAMES G. WARREN,
Board of Civil Engineers on Improvement of Connecticut River above Hartford.

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APPENDIX B.

REPORT OF MR. ARTHUR J. OBER, JUNIOR ENGINEER.

NEWPORT, R. I., *August 12, 1904.*

GENTLEMEN: I have the honor to submit the following report upon the survey of Connecticut River between Hartford, Conn., and Holyoke, Mass.

On October 18, 1902, I received instructions to undertake this survey and to organize parties for the same as early as possible. While the parties were being made up, data for the basis of the work were being collected, chiefly from Reports of the Chief of Engineers for 1871 to 1880, containing the results of General Ellis's surveys of the river made under the direction of Maj. Gen. G. K. Warren, from the U. S. Coast and Geodetic Survey, and from the Massachusetts topographical survey.

Field work was commenced November 17, 1902, by one transit and two level parties. The latter were in charge of Messrs. J. H. Stubbs and W. B. Hunter, who completed their work in February, 1903. The transit party, under the immediate direction of the writer, was small at first (5 men, including laborers), but was gradually increased until large enough to divide into two sections for topographical work. Messrs. C. O. Abell, C. A. Brownell, J. Campbell, E. A. Cottrell, H. V. Doherty, G. W. Hayden, E. J. Jones, F. McCullough, F. W. Milliken, L. D. Mott, and W. D. Murray were employed as assistants in various capacities during some portion of the work. In December, 1903, the field work, except borings to rock, and a detail survey of Enfield Canal was completed, and since that time Messrs. Doherty, Hayden, and Milliken have been completing the maps, drawings,[a] computations, etc., at the United States Engineer Office, Newport, R. I.

GENERAL DESCRIPTION OF THE RIVER.

[See also Report of Chief of Engineers for 1878, pages 264, 272, 276, and 298, and for 1898, page 977.]

The Connecticut River rises in the extreme northern part of New Hampshire near the Canadian border, and flows southerly between the States of Vermont and New Hampshire, and across Massachusetts and Connecticut to Long Island Sound. Its entire watershed is about 11,083 square miles, of which about 10,234 square miles are above Hartford. North of the Massachusetts line the watershed is mostly narrow and precipitous, and the tributaries are small, partaking of the character of mountain torrents. The principal streams entering above Holyoke are the Upper and Lower Ammonoosuc and the Ashuelot rivers in New Hampshire, the Passumpsic, White, and West rivers in Vermont, and the Millers and Deerfield rivers in Massachusetts. Between Holyoke and Hartford the Chicopee and Westfield rivers flow into it in Massachusetts, and the Farmington and Scantic in Connecticut. At Hartford the Park and Hockanum rivers, the last tributaries of any size, enter.

From its source to the Massachusetts line the banks of the Connecticut are generally of a permanent character. Through the States of Massachusetts and Connecticut the river flows mostly through an alluvial formation, and overflows the plain in many places during high freshets, although in some portions the bed is of hard material and the banks high.

The Connecticut is at present navigable to Hartford, 49 miles from its mouth, by boats drawing 9 or 10 feet. Above Hartford there was formerly considerable river traffic as far as Holyoke and even above the Massachusetts line, but at present there is little commercial navigation, owing to shoals and rapids and the advent of railroads. There is, however, considerable boating at and near Springfield, Mass., 75 miles from the Sound.

During ordinary stages the river between Hartford and Holyoke is obstructed in places by sand bars and by rapids. This stretch, about 34 miles long, is divided naturally into three characteristic sections or reaches: First. From Hartford to the foot of Enfield rapids at Windsor Locks, Conn., a distance of about 11 miles, in which the river runs over a sandy bottom through a fertile alluvial plain, which is overflowed in highest water. Villages and towns are located upon the second bank or terrace above the reach of floods and about a mile from the ordinary banks of the stream.

Second. From the foot of Enfield rapids to Enfield dam, a distance of 5 miles, in which the water flows over a rocky bed between steep rocky banks. Enfield or Windsor Locks Canal on the west bank extends from Enfield dam around these

[a] Not reprinted; printed in House Document No. 231, Fifty-eighth Congress, third session.

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rapids, supplying water power to the mills at Windsor Locks and furnishing the only means at present of navigating the rapids.

Third. From Enfield dam to Holyoke, a distance of 18 miles, in which the inclination at low stages is very slight, and in which the water is deeper than in the other reaches. The bed is chiefly sand and gravel, and the banks are subject to overflow in several places. On this section are located the cities of Springfield, Chicopee, and Holyoke, the towns of Thompsonville and West Springfield.

PREVIOUS SURVEYS.

Between 1871 and 1878 the Connecticut from Hartford to Holyoke was the field of numerous surveys made by General Ellis under the direction of Maj. G. K. Warren, Corps of Engineers, U. S. Army. These consisted of a general survey of the river, including topography, soundings, and determinations of the volume of discharge, together with surveys for several projects for improving navigation by the construction of wing dams, canals, dams, channels, etc. (See Report of the Chief of Engineers for 1878, pp. 248–391.) The work appears to have been very thorough and exhaustive, but none of the stations used for locations were permanently marked. This lack of definitely located points made an entirely new system of triangulation necessary for the present survey, and made the comparison of the two depend on natural and artificial objects common to both maps.

In 1897 a survey of the portion between Enfield dam and Holyoke was hastily made by Mr. H. B. Gorham, assistant engineer, under the direction of Maj. Smith S. Leach, Corps of Engineers, U. S. Army. It consisted of soundings and rerunning the shore lines, and the results are given in the Report of the Chief of Engineers for 1898, pp. 976–989. It should be noted that the lowest water to which the soundings of these earlier surveys were reduced was that determined by General Ellis when the crest of Enfield dam was at about elevation 39.1, while at present its crest is about 41.0. At Enfield dam the lowest water by Ellis was about 38.0 and by the present survey about 41.0, thus making the depths on the earlier maps about 3 feet too small, in relation to the present survey on that portion of the river above Enfield dam.

General Warren recommended improving the river above Hartford by building a canal on the east side from near the mouth of the Hockanum River in Hartford to Enfield dam, and by dredging in shallow places between the dam and Holyoke. Major Leach recommended improvement by slack-water navigation to be obtained by constructing a series of three locks and movable dams, one at Hartford and two at Enfield rapids.

THE PRESENT SURVEY.

The survey just completed consists of a general survey of the river between Hartford and Holyoke, including gage heights at several places, bench levels, triangulation, topography, soundings, discharge measurements at low stages, and detail surveys of Enfield Canal and of possible sites for the proposed locks and dams. All levels were referred to the same datum that General Ellis used in his 1871–1878 surveys, viz, Hartford, zero or lowest water mark approximately at Hartford. (See also under Levels.)

Before proceeding with details of the survey a table of distances of numerous points on the river above Hartford is given for convenient reference.

Table of distances above Hartford, Conn.

	Miles.
Steamboat wharf, Hartford, Conn	0.0
Highway bridge (new stone arch under construction), Hartford, Conn	0.32
Railroad bridge (New York, New Haven and Hartford Railroad), Hartford, Conn	1.0
Meter section of 1903, Hartford, Conn	1.32
Mouth of Podunk River, East Hartford, Conn	1.89
Telephone cable crossing (Wilsons), Windsor, Conn	3.72
Wing dam at "Barbers Landing bar," South Windsor, Conn	4.0
Mouth of Farmington River, Windsor, Conn	5.5
Wing dam at "Strongs Island bar," South Windsor, Conn	6.83
Bissells Ferry, South Windsor, Conn	7.56

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	Miles.
Mouth of Scantic River and wing dam, South Windsor, Conn	7.9
Mouth of Priors Creek, East Windsor, Conn	9.9
Red Hill, East Windsor, Conn	11.1
Foot of Windsor Locks Canal and of Enfield rapids	11.23
Warehouse Point-Windsor Locks suspension bridge	12.1
Railroad bridge (New York, New Haven, and Hartford Railroad), Warehouse Point, Conn	13.2
Foot of Kings Island	13.5
Head of Kings Island	14.5
Mouth of Stony Brook, Suffield, Conn	14.2
Old Enfield bridge site (telephone cable spans river), Enfield and Suffield, Conn	15.5
Enfield dam and head of canal, Suffield, Conn	16.3
Thompsonville bridge, Enfield and Suffield, Conn	17.2
Meter section at Thompsonville, 1903, Enfield and Suffield, Conn	18.0
Massachusetts-Connecticut State line	19.2
Pecowsic Brook, Springfield, Mass	22.9
South End Bridge, Springfield, Mass	23.35
Lower mouth of Agawam or Westfield River, West Springfield and Agawam, Mass	23.4
Upper mouth of Agawam or Westfield River, West Springfield and Agawam, Mass	24.15
Mouth of Mill River, Springfield, Mass	23.7
Old toll bridge, Springfield, Mass	24.7
Railroad bridge (Boston and Albany Railroad), Springfield, Mass	24.9
Meter section at Springfield, 1903, Springfield, Mass	25.4
North End Bridge, Springfield, Mass	25.8
Site of Chicopee-West Springfield bridge (destroyed by fire, 1903)	28.5
Mouth of Chicopee River, Chicopee, Mass	28.8
Meter section at Holyoke-Willimansett, 1903	32.1
Holyoke-Willimansett highway bridge	32.82
Holyoke-Willimansett railroad bridge (Boston and Maine Railroad)	32.86
Holyoke-South Hadley highway bridge	34.35
Holyoke dam	34.7

GAUGES.

At the beginning of the survey river gauges were established at eleven places between Hartford and Holyoke, as given in the following table:

List of gauges between Hartford and Holyoke, established November, 1902, and read until October 15, 1903.

Location.	Distance above steamboat wharf, Hartford.	Remarks.
	Miles.	
Hartford, temporary bridge	0.3	South side west pier, erected in 1896 by Connecticut River Bridge and Highway District.
Wilsons, at cable crossing	8.7	In sections, on stakes, trees, and telegraph pole; lower sections exposed to ice.
Bissells Ferry	7.6	In sections, on stakes, trees; lower sections exposed to ice.
Foot Windsor Locks Canal	11.2	In 3 sections, on lower gates of the three locks.
Warehouse Point toll bridge	12.1	In 2 sections, on east pier and telegraph pole on east bank.
Enfield dam	16.3	On upper side upper gate of lock.
Thompsonville (Suffield)	17.2	On west bank 200 feet ± below Thompsonville bridge; stake and tree; 2 sections.
Springfield, old toll bridge	24.7	On south side east pier; city's gauge.
Chicopee bridge	28.5	On south side east pier and east abutment; 2 sections.
Holyoke, lower canal outlet	32.7	Holyoke Water Power Co.'s gauge.
Holyoke dam	34.7	Do.

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Those at Hartford, Springfield, and Holyoke were already in existence and merely required connecting with our levels. The others were erected at the best available places, and the height of the zeros carefully determined. The lower sections of those at Wilsons and Bissells Ferry had to be reset frequently during the winter (1902–3) owing to their exposed positions. Near the close of the field work the heights of all were checked up and found to be substantially the same as when erected.

Daily readings were taken by local observers at all gauges about 7 a. m. and 5 p. m., and more frequently during freshets. Monthly reports were sent in by observers and monthly summaries compiled in the office after reducing the readings to elevations above Hartford zero (Table I). Diagrams from these records were made, one (Pl. I) showing relative daily heights at all the gauges from November, 1902, to October, 1903, and another (Pl. II) showing the freshets of March and June, 1903. The former shows clearly the ordinary fluctuations and the effect of ice gorges in the winter, while the latter presents graphically the progress of the freshet crest.

A careful study of the records was also made to determine the corresponding heights of the river at all gauges for any given height at Hartford. This was done by plotting simultaneous heights at all gauges and drawing a curve of corresponding heights for each gauge. In order to reduce the large number of observations at low stages to a few characteristic heights, averages by months of corresponding readings for half-foot intervals at Hartford were taken and plotted, and the curves drawn to fit the means of these average heights (Pl. III). The increase in slope of the river during rising water and decrease during falling water, especially at high stages, was very apparent in this study, but is not shown on the plate.

SLOPE OF RIVER.

On the section of the river below Enfield rapids the slope of the water surface at lowest stages was found to be somewhat different from that shown on General Ellis's profile of about 1873, being a little flatter on the portion between Bissells Ferry and Hartford, and about parallel to his between the ferry and Windsor Locks. This is shown best on the profile (Pl. IV), and is also given in the following table:

Place.	Lowest water of 1903.	Lowest water by Ellis's profile.
	Feet.	*Feet.*
Hartford, old toll bridge	1.5	0.0
Wilsons, 3.4 miles above Hartford	2.2	2.1
Bissells Ferry, 7.3 miles above Hartford	3.75	4.5
Foot of Windsor Locks Canal, 11 miles above Hartford	5.35	6.0
Warehouse Point toll bridge, 11.8 miles above Hartford	7.8	8.2

NOTE.—Distances refer to old toll bridge at Hartford as zero.

Thus it appears that our lowest water from about 3.4 miles to 11.8 miles above Hartford is lower than that given by General Ellis, although his lowest water at Hartford is 1.5 below ours. This difference may be due to the deepening of the river over bars by the construction of wing dams in 1871–1878. There can be no doubt as to the correctness of the present heights, as they have been checked within a few tenths by heights on other days. It is also noted that in Gneral Ellis's report (Report of the Chief of Engineers for 1878, p. 267) he found the difference in height between Hartford and Bissells Ferry to be 3.1 when the water at Hartford was at 2.64, while it is 2.4 by the present survey. The very lowest water at Hartford in 1903 (due to effect of tide) was 1.1 feet, and the highest freshet height was 23.6.

Following is a table of slopes in several reaches for various heights of water at Hartford:

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Reach.	Length in miles.	Height of water at Hartford.	By 1903 survey.		By Ellis, 1872–1877.	
			Fall.	Slope, per mile.	Fall.	Slope, per mile.
		Feet.	*Feet.*		*Feet.*	*Foot.*
Hartford to Wilsons (cable crossing)	8.4	0.0			2.1	0.62
		1.5	0.9	0.27		
		5.0	1.0	.29		
		10.0	1.0	.29		
		23.5	1.0	.29		
		29.8			1.1	.32
Wilsons to Bissells Ferry	8.9	0.0			2.4	.62
		1.5	1.5	.38		
		5.0	1.4	.36		
		10.0	1.3	.33		
		23.5	1.4	.36		
		29.8			1.3	.33
Hartford to Bissells Ferry	7.3	0.0			4.5	.62
		1.5	2.4	.33		
		5.0	2.4	.33		
		10.0	2.3	.32		
		23.5	2.4	.33		
		29.8			2.4	.327
Bissells Ferry to foot Windsor Locks	3.6	0.0			1.70	.47
		1.5	2.2	.61		
		5.0	1.9	.53		
		10.0	1.3	.36		
		23.5	1.1	.31		
		29.8			.60	.17
Enfield dam to Thompsonville	.9	1.5	0.0	0.0		
		5.0	.3	.33		
		10.0	.5	.56		
		23.5	2.0	2.22		
Thompsonville to Springfield	7.5	1.5	.3	.04		
		5.0	.6	.08		
		10.0	1.3	.17		
		23.5	5.2	.69		
Springfield to Chicopee	3.8	1.5	.1	.03		
		5.0	.4	.10		
		10.0	.6	.16		
		23.5	2.1	.55		
Chicopee to Willimansett	4.1	1.5	.2	.05		
		5.0	.2	.05		
		10.0	1.0	.24		
		23.5	1.5	.37		
Enfield dam to Willimansett	16.8	0.0			.70	.043
		1.5	.6	.04		
		5.0	1.5	.09		
		10.0	3.4	.21		
		23.5	10.8	.66		
		29.8			15.5	.95

Records of daily gauge heights at Hartford from 1871 to 1877 are given in Report of Chief of Engineers for 1878, pages 358 to 390, and for 1878 in Report for 1880, page 408; heights from 1896 to 1903 from records of Mr. Edwin D. Graves, chief engineer of the Connecticut River Bridge and Highway District, are given in Table II.

Tables are also given showing the number of days each year from 1871 to 1878 and 1897 to 1903 that the water was above each foot in height at Hartford (Table III); average monthly and yearly heights at Hartford (Table IV); daily gauge heights at Springfield from 1871 to 1902 reduced to Hartford zero from records furnished by Mr. Charles M. Slocum, city engineer (Table V) (from 1871 to 1882 the latter gauge consisted of painted figures on the south side of the east pier of the old toll bridge; since January, 1882, a wooden gauge has been maintained), and the number of days each year from 1871 to 1903 that the water was above each foot in height at Springfield (Table VI).

LEVELS.

Two lines of accurate bench-mark levels as a basis for all elevations were run between Hartford and Holyoke, one on the west bank of the river in charge of Mr. J. H. Stubbs, with Mr. L. D. Mott as rodman, the other on the east side in charge of Mr. W. B. Hunter, with Mr. C. A. Brownell as rodman. They began work November 17, 1902, and finished February 16, 1903.

A new 18-inch Buff & Buff level was used by Mr. Stubbs, and a nearly new 18-inch Keuffel & Esser instrument by Mr. Hunter, both being kept in good

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adjustment. More than ordinary care was taken to obtain, if possible, results nearly up to the standard of precise levels. Backsights and foresights were made equal by pacing; turning points were usually on a one-half inch square iron pin with collar, driven firmly into the ground; lines were either doubled or run with two turning points, and the parties occasionally checked across the river by water level or by direct readings.

The datum plane was the United States engineers' zero (approximately lowest water mark) at Hartford, as established by General Ellis during his surveys between 1871 and 1878, from an old gauge and marks on a pile at the steamboat wharf (see Report of Chief of Engineers for 1878, p. 265), and perpetuated by him in several bench marks in that vicinity. Only two of these benches were found that were apparently undisturbed, one "on outer edge of water table, center of curve, at northwest corner of Woodruff & Beach's office, Commerce street, Hartford," elevation 24.103, the other "on outer corner of water table of foundation at north corner of Colt's office (edge of water table)," elevation 34.732 (Report of Chief of Engineers for 1880, p. 422). These agreed within less than 0.01 foot, and also checked substantially with the gauges in existence at the steamboat wharf and at the temporary bridge.

The terminus of both lines was the well-known bench "110" at Holyoke dam, determined by General Ellis in 1872–1874. Several of his benches en route were also found and touched upon in the new systems. At the end the two lines checked with each other within 0.07 foot and nowhere was there more than 0.09 difference between them. The average of the two made bench mark "110" 0.34 of a foot higher than given by General Ellis. The new heights appear to gradually diverge from the old, and the only cause suggested for this discrepancy is the fact that the new lines were run during the winter, when a slight settlement of the instrument may possibly have occurred occasionally during the time between backsights and foresights, making the latter or minus readings a trifle too small.

Below is given a table of comparisons of the two lines with that of General Ellis, including also a bench in the line of precise levels run in 1893 by Mr. C. H. Van Orden from Boston to Albany from the datum of mean sea level at Boston. Van Orden's elevation of the bench mark on the east abutment of the Boston and Albany Railroad bridge at Springfield, Mass., is 72.07 (Report of Massachusetts Topographical Survey for 1903, p. 35), while its height by the mean of the two lines of this survey is 72.32, to which should be added 0.09 foot to refer it to mean level of Long Island Sound (Ellis in Report Chief of Engineers for 1880, p. 411), making it 72.41, and showing a difference of 0.34 of a foot.

Table of comparisons with each other of lines of levels, Hartford to Holyoke, in survey of 1902–3, and with those of Ellis, 1872–1874; also with bench marks in line of precise levels from Boston to Albany, 1893.

Bench.	Elevation above Hartford zero, by—			Above mean low water, Boston, Van Orden
	Stubbs.	Hunter.	Ellis.	
Outer edge water table, Woodruff & Beach's office, Hartford	24.103	----------	24.103	----------
Outer corner water table, Colt's office, Hartford	34.739	----------	34.732	----------
Stone bounds, west end, temporary bridge, Hartford	27.069	27.069	----------	----------
Stone bounds, east end, temporary bridge, Hartford	32.287	32.373	----------	----------
Stake and nail at Wilsons, 8¼ miles above Hartford.	19.104	[a] 19.148 / 19.104	----------	----------
Water surface at Bissells Ferry	10.941	10.946	----------	----------
Spike in foot of northerly pine tree, Bissells Ferry [b]	----------	28.431	[b] 28.310	----------
Northeast corner underpinning stone, Bassinger's tobacco shed, west side river road at Warehouse Point [b]	29.927	29.925	[b] 29.810	----------
Iron post, corner roads east end Windsor Locks toll bridge	32.304	32.302	----------	----------
Northeast corner southerly parapet east end Windsor Locks toll bridge	36.002	35.990	----------	----------

[a] Stubb's line from Hartford to Wilsons checked by doubling and adjusted. Hunter's line not doubled, but adjusted to agree with Stubb's, his height of 19.148 of stake and nail being reduced to 19.104.

[b] Height may have changed slightly since Ellis survey.

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Table of comparisons with each other of lines of levels, Hartford to Holyoke, in survey of 1902–3, and with those of Ellis, 1872–1874, etc.—Continued.

Bench.	Elevation above Hartford zero, by—			Above mean low water, Boston, Van Orden.
	Stubbs.	Hunter.	Ellis.	
Southeast corner west abutment Warehouse Point railroad bridge	61.892	61.921	61.750	.....
Southwest corner east abutment Warehouse Point railroad bridge	62.024	62.069	61.900	.....
Water surface at Thompsonville, Conn., Jan. 16, 1903	42.710	42.780	.....	.....
Northeast corner capping, railroad bridge over second road south of Thompsonville [a]	.....	[b] 76.77	[a] 76.663	.....
Van Orden's bench mark, north end abutment Boston and Albany R. R. bridge, Springfield	[a] 72.378 72.288	[a] 72.445 72.355	72.155	72.070
T. P. on wing wall east end Holyoke dam	110.835	110.756	.....	.....
T. P. on wing wall west end Holyoke dam	110.334	110.266	.....	.....
Bench mark "110," near west end Holyoke dam	108.343	108.275	107.975	.....

[a] Height may have changed slightly since Ellis survey.
[b] Elevation determined approximately, as an aditional capping stone about 0.85 of a foot high had been added since Ellis survey, and cracks in the wall showed signs of settlement.
[c] Elevation above Long Island Sound (mean level), Hartford zero being 0.09 foot above that plane. (Report Chief of Engineers, 1880, p. 411.)

Table VII gives a list of the more permanent bench marks established, including also some of those left on roots of trees for stadia work. The elevations in each line are as determined by that line, and are not adjusted to a mean of the two. They are arranged in the order of their sequence above Hartford, all on the east side of the river being taken first, then those on the west, and lastly those up the Farmington River.

TRIANGULATION AND TOPOGRAPHY.

TRIANGULATION ALONG RIVER BANKS.

Triangulation—Numbering stations.—The general survey—topography, soundings, etc.—was based on a system of triangulation between stations along the ordinary banks of the river, numbered odd on the east and even on the west shore. Stations were usually chosen about opposite each other in pairs, and the pairs spaced a little farther apart than the width of the river.

Marking of points.—Oak stakes 2 inches square by 18 inches long were used to mark most of the stations, and a 1 by 2 inch furring, with flag attached, was erected at each. A few of the stations were chosen upon the masonry of bridge abutments and permanently marked by drill holes, and some 40 or more were marked by 1-inch galvanized pipe driven 3 feet into the ground and nearly flush with the surface.

Base lines.—At intervals of 1 to 5 miles base lines between adjacent stations were measured (and checked within less than 0.1 foot) with a 100-foot steel tape. Each base served as a check on the triangulation work above the last previous base, and was used as the initial line for the system between it and the next succeeding base.

Measuring—Angles—Adjustment.—The angles of the system were observed and checked to the nearest half minute with ordinary Gurley and Keuffel & Esser transits by reading azimuths to all stations visible from the station occupied, this being done by the topographic party as soon as the instrument was set up at a station and previous to taking stadia shots. All three angles of each triangle were thus measured, and adjusted when necessary, before computing the sides; corrections of 30 seconds in any one angle being seldom required.

Results—Check.—The results obtained by this method proved very satisfactory. Computed and measured lengths of base lines checked usually within a few tenths of a foot, and the total error in the 34 miles was only 1.08 feet; i. e., the algebraic sum of the differences between the computed and the measured lengths of all the base lines, each computed from the next previously measured

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base through the intervening triangles, was 1.08 feet, as shown in the following table:

Table showing comparisons between computed and measured lengths of base lines, the computed length being the result obtained from the previously measured base line and the intervening triangles.

Stations.	Location.	Computed length.	Measured length.	Difference error.	Distance from previous base.
		Feet.	*Feet.*	*Feet.*	*Miles.*
A to B	Stone bounds at Hartford temporary bridge.	.....	1,139.50	.....	.....
32 to 34	Below mouth of Farmington River	1,447.90	1,445.50	+2.40	5
48 to 50	Opposite Bissells Ferry	1,104.30	1,103.95	+ .35	3
70 to 72	Below Enfield Canal outlet	1,592.20	1,592.86	− .66	3
G to H	Warehouse Point railroad bridge	1,529.90	1,530.10	− .80	2
121 to 130	Thompsonville bridge	1,071.50	1,071.11	+ .40	4
139 to 141	Longmeadow meadows	1,024.90	1,025.42	−1.10	2
153 to 155	do	1,660.90	1,661.90	−1.00	2
168 to 172	South End Bridge, Springfield, Mass	1,353.31	1,353.21	+ .10	2
178 to 182	Boston and Albany Railroad bridge, Springfield, Mass.	1,265.30	1,265.70	− .40	1
181 to 190	North End Bridge, Springfield, Mass	1,142.50	1,143.02	− .50	1
206 to 214	Chicopee bridge	1,267.50	1,266.15	+1.35	2½
227 to 229	Willimansett—opposite Ingleside	976.20	974.98	+1.20	2½
251 to 260	Willimansett—Holyoke bridge	732.54	732.60	− .06	2
278 to 280	Holyoke dam	1,050.50	a1,050.68	− .20	2
	Total	17,198.25	17,197.17	+1.08	34

a Portion comprising crest not measured; taken to be 1,020 feet, on good authority.

Governing azimuths—In order to check and eliminate slight errors in azimuth that were liable to occur on account of reading angles to minutes or half minutes only, a system of main or governing azimuths was run between stations as far apart as it was possible to see, varying from one-half to 4 miles. These angles were observed with a Buff & Berger transit, graduated to ten seconds, measuring carefully the main angles or those between the immediately preceding and succeeding stations in the system by repeating five or six times and taking the mean. It is believed that this governing line was correct throughout within less than half a minute. Readings were taken to all stakes visible from the station occupied for checks on the azimuths of those lines.

TERTIARY TRIANGULATION.

Basis.—As no permanent marks of the previous survey were found, other than locations of bridges, etc., on the plan, it was thought desirable to connect the present survey with Coast Survey points by a system of tertiary triangulation, called locally "hill" triangulation. This system was begun after the river triangulation had progressed some 5 or 6 miles, and was behind the latter until Windsor Locks was reached, after which the two were kept more nearly together.

Stations.—Stations were from one-half to 3 miles apart, according to the territory, and usually on high ground back from the river. They were marked by granite posts 4 feet long with 5-inch square dressed tops, having small drill holes and the letters U. S. on the top faces. They were set about flush with the ground with the line of the letters parallel to the river and placed so as to be read when facing the river.

Party.—No special party was employed for this branch of the work and but little time was available for it without delaying the topography, hence in a few places where the country was but partly open, triangles of poorer shape than desirable were included in order to hasten the work and avoid erecting elevated stations.

Angles.—Very fine work was not attempted, but considerable care was taken to obtain good results. Angles were observed with a Buff & Berger transit graduated to ten seconds, first, by reading round in series and then by repeating each desired angle at least five times (until the total came near 360° or a multiple), and taking the average. Triangles were usually adjusted separately, but occasionally quadrilaterals were adjusted.

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The basis for this system was the four Coast Survey distances from the station "Kennedy" (which was found in good condition), in East Hartford, Conn., to stations "Head of Victory," "St. Patrick's spire," and "Mrs. Sage's house" (cupola), in Hartford, and "East Hartford Catholic Church spire." From each of these lines the distance "Laurel" to "South Windsor" of the system was determined independently, and the probable mean was taken for continuing the computation. At Springfield, Mass., the terminus of the system, a check was obtained in the lines from the U. S. Coast Survey and Massachusetts topographical survey station "Arsenal" to the Massachusetts topographical survey stations "First Congregational Church, West Springfield," "Banky," and "Longmeadow water tower." These distances in the present survey came out too large by amounts varying from four-tenths to 2 feet, which error may have entered in the poorly shaped triangles before mentioned. Geographical positions of the stations have not yet been computed.

Connections between the river and tertiary systems were made at many points by angles read from stations of one to those of the other, some lines being read in both directions and others in only one.

Above Springfield it was thought unnecessary to continue the system, as several prominent Massachusetts topographical survey points exist near the river. Angles to these points were read frequently from the river stations, and their known location served as a check on the river triangulation.

Following is a list of the tertiary triangles and their computations:

Tertiary triangulation.

No.	Station.	Observed angle.	Corrected angle.	Log. sin.	Log. side.	Side.	Initial side from—
		° ′ ″	° ′ ″			*Feet.*	
1	Laurel	41 36 14	41 36 14	9.822153	4.396434	24,913.00	U. S. C. S.
	Kennedy	134 22 40	134 22 40	9.854150	4.428431	26,818.00	
	Victory		4 01 06	8.845567	3.419848	2,629.30	
2	South Windsor	60 29 04	60 29 04	9.939630	4.428431	26,818.00	1.
	Laurel	75 35 50	75 35 50	9.986132	4.474933	29,849.00	
	Victory		43 55 06	9.841129	4.329930	21,376.00	
3	Laurel	45 09 17	45 09 17	9.850055	4.373464	23,630.00	U. S. C. S.
	Kennedy	130 19 23	130 19 23	9.882188	4.404997	25,410.00	
	St. Patrick's		4 31 20	8.896778	3.419587	2,627.80	
4	South Windsor	60 44 15	60 44 15	9.940711	4.404997	25,410.00	3.
	Laurel	72 02 50	72 02 50	9.978822	4.442008	27,708.00	
	St. Patrick's		47 12 55	9.865643	4.329029	21,376.00	
5	Laurel	73 50 04	73 50 04	9.982479	4.339074	21,876.00	U. S. C. S.
	Kennedy	99 32 42	99 32 42	9.993945	4.351440	22,462.00	
	Mrs. Sage's house		6 37 14	9.061805	3.419000	2,626.00	
6	South Windsor	71 58 18	71 58 18	9.977980	4.351440	22,462.00	5.
	Laurel	43 22 04	43 22 04	9.836754	4.210264	16,228.00	
	Mrs. Sage's house		64 44 38	9.956365	4.329675	21,373.00	
7	Laurel	52 40 49	52 40 49	9.900511	4.103944	12,704.00	U. S. C. S.
	Kennedy	117 51 38	117 51 38	9.946495	4.149928	14,123.00	
	E. Hart. Cath		9 27 33	9.215755	3.419188	2,625.40	
8	South Windsor	39 48 02	39 48 02	9.806259	4.149928	14,123.00	7.
	Laurel	64 31 23	64 31 23	9.955571	4.299240	19,918.00	
	E. Hart. Cath		75 40 35	9.986285	4.329954	21,377.00	
9	Barber	63 24 17	63 24 17	9.951490	4.428431	26,818.00	1.
	Laurel	59 21 58	59 21 58	9.934720	4.411721	25,806.00	
	Victory		57 13 45	9.924715	4.401716	25,218.00	
10	Barber	62 30 15	62 30 15	9.947946	4.404997	25,410.00	8.
	Laurel	55 49 00	55 49 00	9.917634	4.374685	23,697.00	
	St. Patrick's		61 40 45	9.944533	4.401584	25,216.00	
11	South Windsor	111 54 41	111 54 45	9.967434	4.401700	25,217.00	9 and 10.
	Laurel	16 13 52	16 13 55	9.446423	3.880089	7,597.80	
	Barber	51 51 19	51 51 20	9.895674	4.329940	21,377.00	
12	Barber	51 51 19	51 51 20	9.895674	4.329943	21,377.00	Probable mean.
	South Windsor	111 54 41	111 54 45	9.967434	4.401703	25,217.00	
	Laurel	16 13 52	16 13 55	9.446423	3.880092	7,598.00	
13	Windsor	40 28 02	40 28 07	9.812265	3.880092	7,597.90	12.
	South Windsor	63 36 08	63 36 08	9.952176	4.020003	10,486.00	
	Barber	75 55 45	75 55 45	9.986770	4.055197	11,355.00	
14	Windsor	45 30 12	45 30 12	9.853267	4.428431	26,818.00	1.
	Laurel	74 02 35	74 02 35	9.982665	4.558099	36,149.00	
	Victory		60 27 13	9.939498	4.514632	32,709.00	
15	Windsor	44 40 35	44 40 35	9.847018	4.404997	25,410.00	3.
	Laurel	70 29 35	70 29 35	9.974928	4.532907	34,065.00	
	St. Patrick's		64 49 50	9.956674	4.514653	32,708.00	
16	Barber	127 47 04	127 47 04	9.897808	4.514658	32,708.00	14 and 15.
	Windsor	37 32 12	37 32 16	9.784820	4.401675	25,216.00	
	Laurel	14 40 37	14 40 40	9.405777	4.020632	10,486.50	
17	South Windsor	63 36 08	63 36 08	9.952176	4.020632	10,486.50	16.
	Barber	75 55 45	75 55 45	9.986770	4.055226	11,356.00	
	Windsor	40 28 02	40 28 07	9.812265	3.880721	7,598.40	

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Tertiary triangulation—Continued.

No.	Station.	Observed angle.	Corrected angle.	Log. sin.	Log. side.	Side.	Initial side from—
		° ′ ″	° ′ ″			*Feet.*	
	Scantic	44 37 52	44 37 52	9.846871	4.055197	11,355.00	
18	South Windsor	36 17 29	36 17 30	9.772245	3.980771	9,566.90	13.
	Windsor	99 04 36	99 04 38	9.994527	4.203053	15,961.00	
	Priors	32 46 31	32 46 33	9.733481	3.980771	9,566.90	
19	Scantic	117 28 11	117 28 16	9.948043	4.195338	15,680.00	18.
	Windsor	29 45 02	29 45 11	9.696711	3.943001	8,770.10	
	Haydens	32 46 01	32 46 04	9.998531	3.943001	8,770.10	
20	Priors	51 12 06	51 12 09	9.891741	3.838211	6,889.90	19.
	Scantic	46 01 47	46 01 47	9.857151	3.803621	6,362.40	
	Red Hill	24 43 09	24 43 10	9.621359	3.803621	6,362.40	
21	Priors	130 38 17	130 38 17	9.880149	4.062411	11,546.00	20.
	Haydens	24 38 33	24 38 33	9.620089	3.802351	6,344.00	
	Webb	66 12 16	66 12 17	9.961418	4.062411	11,546.00	
22	Red Hill	96 51 47	96 51 49	9.996877	4.097870	12,528.00	21.
	Haydens	16 55 53	16 55 54	9.464238	3.565231	3,675.00	
	Warehouse Point	27 01 37	27 01 43	9.657472	3.565231	3,674.80	
23	Red Hill	109 51 11	109 51 14	9.973387	3.881146	7,605.80	22.
	Webb	43 07 00	43 07 06	9.834737	3.742496	5,527.10	
	Canal	40 18 22	40 18 20	9.810813	3.742496	5,527.10	
24	Warehouse Point	86 20 20	86 20 18	9.999113	3.930796	8,527.00	23.
	Red Hill	53 21 23	53 21 22	9.904370	3.836053	6,855.70	
	Smith	85 18 43	85 18 43	9.998545	3.836053	6,855.70	
25	Warehouse Point	48 59 39	48 59 38	9.877740	3.715248	5,191.00	24.
	Canal	45 41 40	45 41 39	9.854684	3.692192	4,922.60	
	Smith	61 37 05	61 37 00	9.944377	3.930796	8,527.00	
26	Red Hill	32 22 10	32 22 59	9.728822	3.715241	5,190.90	24.
	Canal	86 00 04	86 00 01	9.998941	3.985360	9,668.50	
	Pease	37 08 23	37 08 25	9.780671	3.715246	5,191.00	
27	Smith	109 54 54	109 54 55	9.973219	3.907594	8,083.40	25 and 26.
	Canal	32 56 22	32 56 40	9.735460	3.669835	4,675.60	
	Pease	31 25 55	31 25 56	9.717245	3.930796	8,527.00	
28	Red Hill	29 37 38	29 37 38	9.694089	3.907590	8,083.30	24.
	Canal	118 56 26	118 56 26	9.942069	4.155620	14,309.00	
	Kings	67 56 48	67 56 50	9.967004	3.669834	4,675.60	
29	Pease	63 46 12	63 46 18	9.952806	3.655636	4,525.20	27.
	Smith	48 16 56	48 16 57	9.872992	3.575822	3,765.50	
	Cupola	28 39 ±	28 40 04	9.680997	3.575822	3,765.50	
30	Pease	78 55 54	78 55 54	9.991846	3.886671	7,703.20	29.
	Kings	72 24 02	72 24 02	9.979181	3.874006	7,481.80	
	Riverview	133 27 30	133 27 23	9.860878	3.874006	7,481.80	
31	Pease	31 32 51	31 32 45	9.718651	3.731779	5,392.30	30.
	Cupola	15 00 03	14 59 53	9.412941	3.426069	2,667.30	
	Enfield	44 32 01	44 32 02	9.845923	3.731779	5,392.30	
32	Riverview	51 42 54	51 42 56	9.894840	3.780696	6,035.30	31.
	Cupola	83 44 30	83 45 02	9.997411	3.883267	7,643.10	
	Bridge	124 02 54	124 02 54	9.918327	3.780696	6,035.30	
33	Enfield	25 21 13	25 21 13	9.631651	3.494020	3,119.00	32.
	Cupola	30 35 59	30 35 53	9.706728	3.569097	3,707.60	
	Suffield	34 58 38	34 58 38	9.758345	3.569097	3,707.60	
34	Enfield	50 49 20	50 49 21	9.889410	3.700162	5,013.70	33.
	Bridge	94 12 00	94 12 01	9.998832	3.809584	6,450.40	
	Parsons	65 05 30	65 05 33	9.957602	3.700162	5,013.70	
35	Bridge	72 40 05	72 40 08	9.979821	3.722381	5,276.90	34.
	Suffield	42 14 15	42 14 19	9.827511	3.570071	3,716.00	
	Parsons	37 15 25	37 15 25	9.782035	3.731779	5,392.30	
36	Riverview	47 09 19	47 09 20	9.865224	3.814968	6,530.80	31.
	Cupola		96 35 15	9.997932	3.947676	8,865.00	
	Bridge	145 34 48	145 34 47	9.752248	3.814968	6,530.80	
37	Parsons	15 39 42	15 39 40	9.431279	3.493999	3,118.90	36.
	Cupola		18 45 33	9.507304	3.570024	3,715.60	
	Suffield	42 14 15	42 14 19	9.827511	3.570024	3,715.60	
38	Parsons	65 05 30	65 05 33	9.957602	3.700115	5,013.20	37.
	Bridge	72 40 05	72 40 08	9.979821	3.722334	5,276.40	
	High School	58 25 46	58 25 53	9.930447	3.722370	5,276.80	
39	Parsons	44 50 20	44 50 28	9.848277	3.640200	4,367.50	35 and 38.
	Suffield	76 43 35	76 43 39	9.988242	3.780165	6,027.90	
	Flora	43 33 10	43 33 05	9.838223	3.640200	4,367.20	
40	High School	98 03 10	98 03 05	9.995697	3.797675	6,275.90	39.
	Suffield	38 23 56	38 23 50	9.793168	3.595146	3,936.80	
	New house	65 41 45	65 41 50	9.959702	3.595146	3,936.80	
41	High school	47 33 14	47 33 19	9.868015	3.503459	3,187.60	40.
	Flora	66 44 47	66 44 51	9.963209	3.598653	3,968.70	
	State	26 42 43	26 42 41	9.652727	3.503459	3,187.60	
42	New house	99 38 14	99 38 14	9.993827	3.844559	6,991.30	41.
	Flora	53 39 07	53 39 05	9.906026	3.756758	5,711.60	
	240 hill	56 54 58	56 54 57	9.923177	3.756758	5,711.60	
43	State	76 26 30	76 26 34	9.987727	3.821308	6,626.90	42.
	New house	46 38 20	46 38 29	9.861577	3.695158	4,956.30	
	240 hill	22 12 03	22 12 04	9.577390	3.598653	3,968.70	
44	New house	118 41 35	118 41 35	9.943101	3.964424	9,213.50	41.
	High school	39 06 21	39 06 21	9.799861	3.821184	6,625.00	

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Tertiary triangulation—Continued.

No.	Station.	Observed angle.	Corrected angle.	Log. sin.	Log. side.	Side.	Initial side from—
		° ′ ″	° ′ ″			*Feet.*	
	Railroad	36 44 57	36 44 55	9.776922	3.695100	4,955.60	
45	State	107 28 31	107 28 31	9.979478	3.897656	7,900.50	43 and 44.
	240 hill	35 46 34	35 46 34	9.766873	3.685051	4,842.30	
	152	55 02 51	55 02 50	9.913614	3.685051	4,842.30	
	Railroad	74 02 29	74 02 27	9.982990	3.754367	5,680.20	
46	State	50 54 44	50 54 43	9.889961	3.661338	4,585.60	45.
	Longmeadow	45 06 11	45 06 11	9.850265	3.754367	5,680.20	
	State	63 58 12	63 58 15	9.953552	3.857654	7,205.80	
47	152	70 55 33	70 55 34	9.975477	3.879579	7,578.40	46.
	Agawam	37 01 02	37 01 10	9.779659	3.879579	7,578.40	
	Longmeadow	96 00 41	96 00 45	9.997605	4.097525	12,518.00	
48	State	46 58 01	46 58 05	9.863902	3.963822	9,200.70	47.
	Agawam		50 12 44	9.885599	3.857654	7,205.80	
a49	Longmeadow	50 54 80	50 54 30	9.889939	3.861994	7,277.70	47.
	152		78 52 46	9.991768	3.963823	9,200.75	
	Forest	28 30 27	28 30 27	9.678767	3.861994	7,277.70	
50	152	43 48 01	43 48 02	9.840200	4.023427	10,554.20	49.
	Agawam	107 41 31	107 41 31	9.978958	4.162185	14,527.80	
	Banky	34 09 06	34 10 00	9.749428	4.023427	10,554.00	
51	Forest	144 40 36	144 41 32	9.761904	4.035902	10,862.00	50.
	Agawam	1 06 28	1 06 28	8.299177	2.573175	374.26	
	Agawam Church		55 43 54	9.917195	3.963822	9,200.70	
52	Longmeadow	24 58 16	24 58 16	9.625478	3.672105	4,700.10	48.
	Agawam	99 17 50	99 17 50	9.994258	4.040885	10,987.00	
	Banky	22 46 31	22 46 31	9.587846	3.672105	4,700.10	
53	Agawam	40 40 37	40 40 37	9.814110	3.898369	7,913.50	52.
	Agawam Church		116 32 52	9.951610	4.035869	10,861.00	
	Forest	23 57 49	23 57 49	9.606692	3.672104	4,700.10	
54	Agawam	41 49 04	41 49 04	9.823972	3.887365	7,715.90	52.
	Agawam Church		114 13 07	9.959988	4.023401	10,554.00	
	Banky	56 56 31	56 56 31	9.923805	3.887365	7,715.90	
55	Forest	120 42 50	120 42 50	9.934362	3.898442	7,914.90	54.
	Agawam Church		2 20 39	9.611745	2.575825	376.55	
	Arsenal	22 11 21	22 11 28	9.577143	4.035895	10,861.60	
56	Banky	131 39 44	131 39 46	9.873362	4.332114	21,484.00	51 and 53.
	Agawam	26 08 44	26 08 46	9.644105	4.102857	c 12,672.40	
	Arsenal	26 10 24	26 10 24	9.644525	3.898380	7,913.70	
57	Banky	108 53 13	108 53 13	9.975965	4.229820	16,975.40	53 and 55.
	Agawam Church		44 56 23	9.849028	4.102883	c 12,673.10	
	First Congregational Church		30 18 26	9.702979	4.035895	10,861.60	
58	Banky	90 46 12	90 46 12	9.999961	4.332877	21,521.70	51 and 53.
	Agawam	58 55 22	58 55 22	9.932718	4.265629	18,434.40	
	Arsenal	95 58 35	95 58 35	9.997633	4.265629	18,434.40	
	Banky	40 53 26	40 53 26	9.815987	4.083983	b 12,133.40	
59	First Congregational Church		43 07 59	9.834863	4.102859	c 12,672.40	53.
	Longmeadow water tower		97 53 23	9.995870	4.332114	21,484.00	
60	Agawam	50 51 51	50 51 51	9.889667	4.225911	d 16,823.30	56.
	Arsenal	31 14 46	31 14 46	9.714929	4.051173	11,250.30	

a Angles at 152 Agawam are computed, as line 152 to Agawam is invisible on the ground.
b Length by Massachusetts topographical survey=12,133.80 feet.
c Length by Massachusetts topographical survey=12,674.40 feet.
d Length by Massachusetts topographical survey=16,824.30 feet.

TOPOGRAPHY.

Topography was taken to show shore lines, contours, natural and artificial features along the bank for the entire distance. Transit and stadia methods entirely were used for this work, based on the systems of triangulation and bench marks. No distances were measured with the tape, other than the base lines previously mentioned, and when substations were required their locations were checked, when possible, by the closing of branch lines on triangulation points.

Horizontal and vertical angles were read to the nearest minute, and at each set up the compass bearing of the zero azimuth was observed in order to check roughly the orienting of the instrument. Differences in elevation were computed by means of a diagram, and elevations found in the usual manner. Corrections of less than 3 feet for horizontal distances were neglected, being too small to show on the scale of the plan.

Topography along the tributary streams below Windsor Locks was taken at least as high as elevation 10. Above Enfield dam the Westfield and Chicopee

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rivers were included for a distance of a mile or more from the Connecticut. The low meadows back from the river and near the foot of the second river terrace in Hartford and East Hartford were also included. For the basis of topographical locations on these streams and meadows stadia traverse lines were run, the elevations being checked frequently on bench marks the same as along the river banks. The names of these streams and meadows thus surveyed, and the distance along each, is given in the following table, arranged in the order of their sequence above Hartford:

Name.	Location.	Miles.
Meadow Brook	Hartford, Conn	1.70
Meadows	do	1.00
Do	East Hartford, Conn	2.00
Podunk River	do	2.50
Farmington River	Windsor, Conn	7.00
Scantic River	East Windsor, Conn	1.25
Priors Creek	do	.50
Other brooks	Windsor and East Windsor, Conn	1.00
Stony Brook	Suffield, Conn	.25
Agawam or Westfield River	Agawam and West Springfield, Mass	2.60
Chicopee River	Chicopee, Mass	1.00
		20.80

SOUNDINGS.

Soundings across the river were taken on ranges about 400 feet apart. A pole graduated to half feet was used to measure depths, except in places deeper than 23 feet, where a lead and chain marked in feet was substituted. One end of each range line was fixed by a tape measurement along the bank from the nearest river triangulation station, and its direction was determined by magnetic bearing with a prismatic compass reading to single degrees. The sounding boat was kept on this range by a flagman (who was also the compass man) on shore, and the locations of soundings on the range were cut off by angles from one transit, whose position was so chosen as to have a long stretch of river in view. Soundings were made every fifteen seconds and a transit location taken each minute on signal from the recorder in the boat.

At Enfield rapids these methods had to be modified to cover shallow places where boating was impossible, and soundings were taken by wading. Two transits were used and every sounding located. From the middle of the east side of Kings Island to below the Warehouse Point railroad bridge the channel is narrow and irregular, varying in width from 20 to 100 feet, and the water runs very swiftly over the rough bed. The best that could be done for soundings in it, without spending a large amount of time and labor, was to follow the course of the channel as slowly as it could be boated, and take depths at as frequent intervals as the two transitmen could locate them. Levels in the bed, as well as soundings, were taken just below Enfield dam, at the site of the old Enfield bridge, and on the west side of Kings Island, the water surface at these places being so uneven that depths alone were of little value. At all other parts of the rapids soundings only were taken, and the height of the water surface at the time determined at frequent points by temporary gauges.

All soundings were reduced to the practically lowest water of the season of 1903, occurring on the afternoon of June 7, when the gauge at Hartford read 1.5 feet. The water reached about the same stage on September 27 and 28, reading a trifle lower on some of the gauges on the latter date. Lines across the river a mile apart, shown on the general plan with figures in parentheses, show this lowest water as determined by interpolation between observed heights at the several gauges maintained during the survey. Over the rougher portions of Enfield rapids the water surface at lowest stages varies a foot or more in height in different parts of a cross section; hence the figures are not exactly correct for some of these sections, but represent a fair average of the water surface.

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PLOTTING.

The general survey was plotted to the scale of 400 feet to an inch, on mounted paper, in three sections. On each section or sheet a straight line through the center was first drawn, and its azimuth decided upon, thus affording a convenient and accurate basis for plotting azimuths on any part of the plan.

The river triangulation was carefully plotted by distances and checked by azimuths, and then was further checked by laying out the long main or governing azimuth lines by tangents, starting each at the point representing its lower end, and requiring the station at its upper end to fall on the line. These long lines of known azimuth furnished an independent and rigid check on the plotting, making the whole probably nearly as accurate as the latitude and departure method, and much quicker.

Tertiary triangulation points were also plotted by distances and azimuths, and checked in with the river points by the connecting lines; all agreed very closely, indeed, and entirely within the limits of stretching and shrinking of the paper.

Details of topography taken from each station were plotted rapidly by polar coordinates, by means of a swinging paper scale set to work inside an annular paper protractor oriented on a parallel to the center line through the station in question. Actual elevations were shown on the plan, and contours drawn, usually at 5-foot intervals.

COMPARISON OF PRESENT WITH PREVIOUS SURVEYS, AND DESCRIPTION OF RIVER IN DETAIL.

As already mentioned, the only previous complete survey of the Connecticut between Hartford and Holyoke was made by General Ellis in 1871–1874, under the direction of Gen. G. K. Warren. Soundings in the portion above Enfield dam were taken in 1897, under the direction of Major Leach, who recommended improvement of navigation by a series of pools to be formed by locks and dams.

A comparison of the bench-mark levels and of the water-surface slopes, as determined by the present survey, with those of General Ellis was given under the heads of levels and gauges respectively.

On the new general map (scale 1 inch = 400 feet) distances, directions, and locations of permanent features such as bridges, brooks, canal, roads, railroads, etc., agree with the Ellis map very closely, and usually within the limits of change in the paper. The banks have remained nearly stable, except in portions of the first 8 or 9 miles above Hartford, Conn., where both cutting and filling have taken place. Changes in the bed have occurred in many places, but chiefly in the lower portions where wing dams were built in 1871–1881 to increase the depth over bars.

The features, comparisons, and changes of each characteristic reach will be considered separately.

HARTFORD TO THE FOOT OF ENFIELD RAPIDS.

[See Report of Chief of Engineers for 1878, pp. 267 and 300, for description by General Ellis, and report for 1898, p. 979.]

From Hartford to the foot of Enfield rapids, a distance of 10.9 miles, the river runs, with slight inclination, over a sandy bed, through an alluvial formation. The minimum depth of water in the channel is about 2 feet opposite Bissells Ferry, and at a point about one-half mile below the foot of Enfield Canal. The average width of the river at ordinary stages is 1,250 feet, although in times of highest freshets the banks are overflowed for widths varying up to about a mile. At extreme low stages the width is reduced to about one-half in many places, and large sand beaches appear upon the shores.

The banks in this reach have remained unchanged in many portions, but are washing and caving off in some places, and filling up in others. The changes have been the most marked for 2 miles above the railroad bridge at Hartford.

On the east side from the bridge to near the present mouth of Podunk River, the bank has washed badly since 1873, reaching a maximum of 220 feet about 2,000 feet above the bridge. The present mouth of the Podunk is about 2,000

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feet south of its position (at the mouth of Boyles Brook) in 1873, by reason of the extension of the sandy ridge between its lower portion and the Connecticut. This ridge is covered with trees and bushes, and varies from 100 feet wide and elevation 11.5 feet, at the mouth of the Podunk, to 400 feet wide and elevation 18 at Boyles Brook. At a point 2,000 feet above this brook the ridge is now 900 feet wide and at elevation 19, where in 1873 it was about 1,100 feet wide and at elevation 6 feet. Thus it appears that the ridge has risen and lengthened; but it has been cut away about 200 feet on the river side for a distance of about 3,000 feet above its former lower end near Boyles Brook, a loss of 10 feet having been observed in one place during the winter of 1902–3.

A short ridge, which formerly ended at the mouth of the first brook above the telephone cable crossing, has now extended downstream a distance of about 4,800 feet to the low and nearly flat peninsula below the crossing. Its formation was largely due to the construction of wing dams (now partly buried under the ridge) at Barbers Landing bar in 1879. It is covered by thick bushes, and has an average width of about 200 feet and elevation of 17 feet, and lies at the foot of the higher bank or edge of the river plain. On the river side it presents a gradual slope except for a short stretch near the upper end, where it is being cut away slightly. The lower end of this ridge terminates in a low and nearly flat sandy peninsula about 400 feet wide, extending downstream about one-half mile, with a bay 200 feet wide between it and the east shore. The peninsula existed in 1873 and is visible at low water only. Opposite the mouth of the Farmington River the east bank is washing away, having lost a maximum amount of 120 feet at a point just below the mouth of Stoughtons Brook. Strongs Island, so called in General Ellis's report, has increased in size, owing to the wing dam built across its upper end in 1871. It is now about 1,600 feet long and 400 feet wide at ordinary stages, and is covered with a dense growth of bushes. About a quarter of a mile above Priors Creek the wooded island shown on General Ellis's plan has almost entirely disappeared, and the remainder, in the form of a peninsula, is washing away rapidly.

The west shore for a distance of 1,800 feet above the railroad bridge at Hartford has made out about 200 feet, in the form of a nearly flat beach. Above here and up as far as the mouth of a brook, a distance of 2¼ miles above the railroad bridge, the west bank is eroding, and has cut away for a width averaging nearly 200 feet. From this brook to within one-third of a mile of the mouth of the Farmington River, the shore appears to have remained unchanged. For a third of a mile below the Farmington it has lost about 100 feet, and is still caving slightly. The island which exists at ordinary stages of the river at the mouth of this tributary has extended downstream about 1,000 feet, while its upper end has cut away to a considerable extent. Above the Farmington, up to within a quarter of a mile of Bissells Ferry, the west bank has eroded about 100 feet, but beyond here no changes are apparent.

The changes in the bed and channel have been numerous, and a close study of the present map and that of 1873 is essential for a complete observance of them.

With the exception of a slight deepening of the channel between the bridges at Hartford, few changes have occurred below the bar (called "Higleys Point bar" by General Ellis) at the mouth of the Podunk River. This bar has mostly disappeared, there being now about 4 feet on it at lowest water, where formerly there was but 2.7 feet.

At the next bar which formerly existed ("Barbers Landing bar" by General Ellis) two wing dams about 1,700 feet apart were built from the east shore in 1879, the lower one 500 feet long and the upper one 550 feet. They were repaired in 1885, and now their shore ends are buried under the ridge that has formed as already mentioned. The channel is now 8 to 10 feet deep opposite these dams where in 1873 there was only a foot of water. A new bar with only 2.5 feet on it has formed about 1¼ miles below, where the channel now crosses the river, and where in 1873 there was 6 feet of water and the channel remained on the west side.

In order to improve the bar at the mouth of the Farmington River (Farmington or Tunxis River bar by General Ellis) three wing dams were built in 1871 and 1881, two on the east side about 2,000 feet apart, and one on the west side about 500 feet below the northerly of the others. Those on the east are at right angles to the shore, while the one on the west extends diagonally downstream from the lower part of the island at the mouth of the Farmington. They have deepened the water to about 5 feet, but a portion of the bar with 3.5 feet on it still exists just below the southerly dam where the channel crosses from the

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east to the west side of the river. Except for 300 feet on its outer end the dam on the west side is now buried in sand, and has probably aided in prolonging the island and in cutting away the west bank of the river just below the Farmington, as mentioned above.

Above Strongs Island bar, on the east side of the Connecticut, a wing dam about 1,000 feet long was built in 1871. It has made the water opposite about 7 feet deep and about 4.5 feet deep on the bar itself, one-half mile below, where the channel crosses from the west to the east side, and where there was but 2.5 feet in 1873. All except 300 feet on the outer end of this dam is now buried under the deposit of sand which has accumulated on the north side of the island.

The wing dam, 1,550 feet long, built in 1871, and extending diagonally downstream from the east shore just above the mouth of the Scantic River, appears to have failed in its purpose, as there is but 2 feet of water opposite it, and the water is shallow for a quarter of mile below. A small basin about 4 feet deep has been scoured out on the lower side of the dam, owing to its being too low. This basin decreases in depth to the south, and the water flows over a flat, shallow area to the channel on the west side.

With the exception of the small peninsula and island above Priors Creek, previously mentioned as washing away, the banks and channel above the Scantic have not changed materially since 1873. The channel in this portion (Scantic River to foot of Windsor Locks Canal) is on the west side of the river for the greater part of the way, and it varies between 3 and 5 feet in depth. The bed in this stretch is sand and gravel.

ENFIELD RAPIDS.

[See Report of Chief of Engineers for 1878, pp. 272 and 300, and for 1898, p. 978.]

The second reach of the river consists of a stretch of rapids, commencing at the foot of Enfield Canal, in the village of Windsor Locks, and extending to Enfield dam, a distance of 5¼ miles. At a distance of 10,400 feet below the dam is Kings Island, 5,000 feet in length and 1,600 feet wide, which separates the stream into two parts, the greater volume of water passing to the eastward of the island. Enfield Canal extends along the westerly shore of the rapids their entire length.

The bed of the river in the rapids is mostly rock, except in the lower portion between the villages of Warehouse Point and Windsor Locks, where it is composed of stones, gravel, and sand.

On the easterly side the bank of the river from the foot of the rapids to within half a mile of the railroad bridge at Warehouse Point is sandy, and subject to overflow in high freshets. Above this and extending to a point opposite the middle of Kings Island, a distance of 1¼ miles, the bank is steep and composed mostly of rock, thinly covered with sandy loam and a growth of trees and bushes. Opposite the head of the island the shore for a distance of 4,000 feet is lower and sandy, and is partially overflowed during freshets. At this place there are a few small buildings, as shown on the map. Beyond and to above Enfield dam the bank is again very steep and mostly ledge, overlaid with sandy soil, and fringed with trees and bushes.

Back of the immediate bank, on the easterly side, the ground rises gradually. No large streams and but two small brooks enter the river on this side.

The only manufacturing establishment on this bank is the power house (an electric plant using steam power) of the Hartford and Springfield Street Railway Company, situated close to the river and about 1,200 feet below the railroad bridge at Warehouse Point. Highest freshets overflow the lower floors of this building, and the highest water of 1903 came within about a foot of the workroom floor. The elevation of the bottom of the pump pit is but 27.9, of the workroom floor 30.9, of the boiler room floor 32.5, while the highest water at this place by General Ellis's profile is about 34 feet.

The total fall in the water surface over the dam and rapids at lowest stages of the river is about 35.5 feet. This is not a gradual slope but is made up of a series of pools and swift rapids. At lowest stages the water tumbles over the steep portions of the rocky bed in such a manner that the surface laterally across the stream is very uneven, making it impossible to obtain exactly the height of the surface in such cross sections. In high stages the slope is more uniform. The approximate rise over various portions of the rapids at lowest water of

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1903 (taken on September 27), and at a moderate freshet in April, 1904, is given in the following table:

Portion.	At lowest water in 1903.			At moderate freshet in April, 1904.		
	Distance.	Rise.	Rise per mile.	Distance.	Rise.	Rise per mile.
	Feet.	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*
Foot of canal to 3,000 feet below railroad bridge	7,500	3.5	2.46	7,500	1.8	1.27
3,000 feet below railroad bridge to middle of Kings Island	8,100	17.5	11.4	8,100	6.5	4.24
Middle of Kings Island to just below Enfield bridge	7,000	1.5	1.13	7,000	6.1	4.60
Just below Enfield bridge to just above Enfield bridge	800	2.5	16.5	800	1.2	7.91
Just above Enfield bridge to 2,500 feet below Enfield dam	1,800	.2	.59	1,800	2.4	7.04
2,500 feet below Enfield dam to foot of dam	2,500	5.9	12.5	2,500	3.6	7.60
Foot of dam to top of dam	----------	4.4	(a)	----------	3.5	(a)
Total	----------	35.5	----------	----------	24.6	----------

a Vertical.

KINGS ISLAND.

This island was included in the general survey of the river, and its shore lines and topography are shown on the map. It begins in a point at its lower end, and gradually widens toward its upper portion, becoming widest about 1,300 feet below its rounded northerly end. Excepting on the extreme lower end, and for a short distance on the east side in the widest part, the banks of the island are of rock and very steep, and in many places perpendicular for a height of 25 feet. The entire island is composed of sandstone rock covered with varying depths of sandy loam and a growth of trees. Most of its area is above elevation 60, its highest point being south of the center and at elevation 112 feet. The island is said to be owned by the Connecticut River Company, which also owns the canal on the west bank of the river and Enfield dam.

During lowest stages the river bed to the west of the island is mostly bare. It is composed almost entirely of rock, a portion of which, between the head of the island and the west shore, forms almost a complete dam, at elevation 26.5. Stony Brook, a small and shallow stream, enters the Connecticut on the west side about midway of Kings Island. About 1,050 feet above its mouth is a dam, whose crest is at elevation 55.7, and which furnishes power for a paper mill situated on the north bank. The elevation of the water in the tail race of this mill is 28.3. During dry seasons of the year the water frequently stands 2 feet below the crest of the dam.

ENFIELD DAM.

A survey of Enfield dam was made to determine its shape, height and condition. This was done at very low water when the depth on the crest was from 0.2 to 1 foot. About 40 points on its crest were located by two transits from the ends of a base line on the east shore, and the elevation of each point determined by level.

The dam is a low cribwork structure, about 5 feet high, irregular in plan and uneven in profile. It extends from the east shore nearly at right angles to the course of the stream for about 610 feet, and then runs southwest diagonally downstream about 870 feet to the head-gate house of the Enfield Canal. A gap, or fishway, 43 feet wide, is in the easterly portion, about 525 feet from the east shore. The structure has been changed both in plan and elevation since General Ellis's survey, the angle point at the northwest corner having been moved southerly, the gap, or fishway, relocated and made narrower, and the whole structure raised. Its present crest elevation and length are shown by a drawing on the general map and also by the following table:

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Portion.	Length.	Average elevation above Hartford zero.
	Feet.	*Feet.*
Crest, omitting fishway and end slopes	1,320	40.925
Crest of end slope on west end of dam	85	41.25 to 43.65
Crest of end slope on east end of dam	80	41.00 to 43.80
Crest, omitting fishway but including end slopes	1,435	41.04
Crest of fishway	43	40.08
Crest, total, including end slopes and fishway	1,478	41.01

It is in fairly good condition except for a few holes in the top planking and stone filling.

ENFIELD OR WINDSOR LOCKS CANAL.

[See also Report of Chief of Engineers for 1878, p. 274, and for 1898, pp. 978-979.]

Enfield Canal extends along the west bank of the river from Enfield dam to Windsor Locks, a distance of 5.3 miles. It furnishes water power for the mills at Windsor Locks, and is the only present means of navigation around the rapids. The survey included its shore lines, towpath, locks, water-surface profile, and volume of discharge.

The width of the canal varies between 80 and 120 feet, except through the village of Windsor Locks, where mills, towpath, railroad, and highway are closely crowded together, reducing the canal width to about 50 feet. Very thorough soundings of the canal north of the mills were taken in May, 1904, and the average depth at the center throughout this entire length is 12 feet. In some places the canal has a depth of more than 16 feet, while in others it is only 7. The velocity of the water is about 2 miles per hour, being perhaps a little greater near the head and just above the northerly mills. The towpath runs along the embankment between the canal and the river; its average top width, above the mills, is about 10 feet. North of the railroad bridge the outside bank is riprapped on a slope of 1 to 1½.

On the west side of the canal, from below the railroad bridge at Warehouse Point to Enfield dam, the ground is mostly high, with a steep slope in which the canal forms a sidehill cut, partly of solid rock. Extending for a little more than a mile along the foot of the rapids is the town of Windsor Locks. Here, between the canal and the river are located many large manufacturing establishments which use water from the canal for power. These mills and a portion of the town are shown on the map.

At the upper end of the canal there is a guard lock, 19.6 feet wide and 86.5 feet long between gates, with a depth of 7.5 feet over the sill. Between the end of the dam and the guard lock are head gates to regulate the flow of water into the canal. About 250 feet below the site of the old Enfield bridge is a set of stop gates, by which the water can be raised 5 feet, to equalize the pressure inside and out, and render the embankment along the upper portion of the canal more secure in times of high freshets.

Opposite Kings Island the canal crosses over Stony Brook by means of an aqueduct, having a water-surface width of 100 feet and a depth of 6½ to 7 feet at ordinary stages.

At the lower end of the canal there are three lift locks, recently built, each 20 feet wide and 88 feet long between gates. Between these locks are basins or pools about 220 feet long and 60 feet wide. The minimum depth in each lock (over the mud sill) is 6.8 feet for the upper lock, 5.8 feet for the middle lock, and 5.4 feet for the lower lock. When the river at Hartford is but 4.8 feet above zero, the depth over the miter sill of the lower gate of the lower lock is 5.4 feet (the same as over its mud sill at its upper gate), and this depth is reduced to about 3 feet when the water at Hartford is at elevation 2 feet.

A profile of the surface of the water in the canal, when running normal, was obtained by practically simultaneous readings at 13 gauges along the entire length at an average interval of 2,400 feet. Heights of the water surface at various places in the canal, taken at other times, show that the profile represents a fair average of ordinary conditions.

The total fall in the canal is about 3.3 feet; the normal water surface is at elevation 40.9 feet just below the guard lock at the head; 39.9 feet at the stop gates; 39.4 feet at the head of Kings Island; 39 feet at Stony Brook Aqueduct; 37.9 feet at the most northerly mill; 37.7 feet at Warehouse Point toll bridge; and 37.6 feet above the lower locks.

Tail races.—The mills at Windsor Locks all discharge directly into the river

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through tail races whose elevations vary from 13 to 10. One tail race has an elevation of 18.75. At the foot of the canal just above the upper lock is an outlet 5 feet in diameter emptying directly into the river. The discharge of the outlet is controlled at its head near the canal by outlet gates. The elevation of the bottom of the invert of the outlet where it enters the river is 8.35. The outlet and tail races are all shown on the general plan.

The average yearly head at the mills in Windsor Locks is about 26.7 feet, the height of water in the canal being about 37.7, and in the river 11 feet, the latter corresponding to the average yearly height of 6.12 feet at Hartford.

The volume of discharge of the canal, computed from meter observations taken in a cross section at Stony Brook Aqueduct on August 24, 1903, at a time when the water surface at the section was elevation 38.9 feet, or about normal, was 1,417 cubic feet per second. At the same place on September 19, 1903, with the water surface at elevation 38.7 feet the discharge was 1,360.9 cubic feet per second.

Mr. David M. Greene, the engineer of the Connecticut River Company, states in his report of October 6, 1902, submitted to the Board at their hearing at Windsor Locks, October 14, 1902, that "1,420 cubic feet per second are now habitually used at Windsor Locks, representing 3,267 net horsepower," estimated on the basis of 27 feet net head on the wheels whose average efficiency is 75 per cent.

As shown above, the average yearly head is about 26.7 feet, instead of 28 as stated by Mr. Greene. On the basis of his estimate, deducting 1 foot for loss in reaching and leaving the wheels, the normal average effective head is 25.7, which, for 1,420 cubic feet per second, would yield 3,100 net horsepower.

In regard to the damage the Connecticut River Company claims would be caused to their developed power at Windsor Locks by a series of dams and pools built as suggested by Major Leach in his report of 1897, attention is invited to the erroneous and misleading figures and deductions by Mr. Greene on pages 16–17 of the "Statement of the Connecticut River Company" presented at the hearing of the Board. The plan contemplates a pool level 39 feet above Hartford zero to be maintained from Holyoke to Kings Island by dams erected across both channels of the river at the island, and a new canal intake (and guard lock) to be built at or just above the proposed fixed dam across the west channel at the head of the island. Under the new régime there would be, according to Mr. Greene, a loss of head in the canal of 2.63 feet, obtained as follows:

Normal height of water at present in canal at point where new intake would be located	39.63
Height of water in canal at same place after execution of the project	37.00
Loss in head in canal	2.63

These figures, however, are all incorrect. Several determinations of the present height of water in the canal at this proposed new intake give an average of 39.4 feet, but the present mean height of Enfield dam is about 41 feet, or 1.5 greater than the mean height (39.5 approximately) authorized by a decree of the court. So that, assuming the conditions in the canal relatively the same in both instances, the normal height at present at the new intake point should be 1.5 feet lower or at elevation 38±.

In obtaining 37 feet for the new height of water at the intake, Mr. Greene deducts 2 feet from the height of the proposed dam, because he says "the normal loss of head at the entrance of the present canal is 2 feet." Now this may be the normal loss, but it is a loss made necessary by the limit in the capacity of the canal, and such a loss occurs only in higher stages of the river.

The actual loss at lowest stages, as measured during the present survey, was only 0.5 foot or less, and with improved head gates this loss might be further reduced. Hence, as the water in the river is practically always above the crest of the dam, the height of water in the canal at the new intake would never be less than 39 minus 0.5, or 38.5 feet. In other words, there would properly be an increase of 0.5 foot in head. That there should be a gain and not a loss of head in the canal is evident, and the gain would be the difference between the slope in the present canal and that in the proposed pool from Enfield dam to the new intake, the height of water at Enfield dam remaining unchanged.

The deductions that Mr. Greene draws from this stated loss of 2.63 feet head are therefore incorrect, if the lawful height of Enfield dam be considered pertinent.

The present average yearly head at the mills at Windsor Locks is about 26.7 feet, as previously stated, but properly it should be reduced 1.5 feet to correspond with the allowable height of Enfield dam. As the mean yearly

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height of water in the river opposite the mills varies from 10.5 at the lower mills to 11.5 at the upper mills, or is above the proposed 10-foot pool level from Hartford to Windsor Locks, it is difficult to see how any injury could be done to the power at Windsor Locks. In fact it appears that the proper head would be increased at least 0.5 foot, and at higher stages the increase might be greater if the canal were of sufficient capacity.

ENFIELD DAM TO HOLYOKE, MASS.

[See also Report of Chief of Engineers for 1878, p. 298, and for 1898, p. 977.]

Above the rapids, from Enfield dam to Holyoke, the river has but slight inclination, with a minimum depth in the channel of about 6 feet and an average depth of 8 or 9 feet.

The principal tributaries in this reach are the Agawam (or Westfield) and the Chicopee rivers, the former entering the Connecticut opposite the lower end of the city of Springfield, and the latter in the city of Chicopee. Topography along these streams is shown on the general map for distances of 2.6 miles and 1 mile, respectively. Numerous small streams and brooks empty into this portion of the river, the largest of which is Mill River in Springfield, which furnishes water-power for the United States Armory shops and other mills in that city.

At Holyoke navigation is interrupted by a short stretch of rapids and by the Holyoke Water Power Company's dam, which has no provision for passing boats. Formerly a navigable canal existed around the north end of this structure, but when a new masonry dam was erected, in 1893–1899, the canal having fallen into ruin through lack of use for many years, it was not rebuilt.

The average width of the river from Enfield dam to the North End Bridge, Springfield, Mass., is 1,350 feet, and from the bridge to Holyoke is 1,000 feet. The widest portion is at Longmeadow, where for a distance of 3 miles it varies from 1,800 to 2,150 feet. The narrowest part is 700 to 900 feet wide, for a distance of 2 miles below the Holyoke-Willimansett highway bridge. At other places—namely, just below Pecowsic, at the North End Bridge, at the bend below the Chicopee bridge, and 1½ miles above the Chicopee bridge—the river is contracted to 800 feet in width for short distances.

For the greater portion of this reach the river flows through an alluvial plain, which at extreme freshets is subject to overflow in several places, notably at Longmeadow and the lower valleys of the Agawam and Chicopee rivers, and also for short distances at the following places: The west bank, one-half a mile above the Massachusetts-Connecticut State line; below Chicopee bridge, 1½ miles above Chicopee bridge, and one-half mile below Holyoke-Willimansett bridge, and the east bank about a mile above the mouth of Chicopee River.

The bed for 1½ miles above Enfield dam is mostly rock. From this point to near Springfield it is sand and gravel. For 2 miles below Springfield the bottom has a more muddy character, with a small outcropping of rock near Pecowsic. Above Springfield, to the foot of the rapids at Holyoke it is sand and gravel, and from this last point to Holyoke dam the bed is again rocky.

While the bed and banks are composed mostly of erosible material, they have changed noticeably in but one place, namely, on the west side, about 1½ miles above the State line. In comparing depths of water of the 1873 and 1896 maps with that of 1903, it should be borne in mind that the lowest water plane to which the 1903 soundings are reduced is about 3 feet higher than that for the other two, the difference being due to the raising of Enfield dam.

At Longmeadow Brook, in 1873, a bar with but 3 feet depth over it existed where the channel crossed the river. At present (and on the 1896 map) this bar has disappeared, and the channel, 7 to 9 feet deep, is continuous on the west side. On the east side the shore has made out about 150 feet, and a shoal with 1.5 feet depth has formed, extending downstream 4,000 feet and out into the stream about 600 feet.

Above the mouth of the Chicopee the bar which formerly had 3 to 4 feet of water over it now has 6 to 8 feet, the increase being due, however, to the change in water surface and not to a change in the bed.

The new dam at Holyoke, Mass., built 1893–1899, is a stone masonry ogee-faced structure, situated about 175 feet below the old wooden cob-work dam. The elevation of its granite crest is 98.34 feet, on top of which 24-inch flashboards are erected at low stages in the summer season. The fall from the crest to the water surface at the foot is 29 feet, and to still water at the foot of the rapids, 2 miles below, is 56.5 feet at lowest water. This dam furnishes water for three mills in South Hadley and for a series of canals in Holyoke on the

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west bank, whose water surfaces are at three distinct levels, with overflows at the following elevations.

Canal.	Overflow into—	Elevation of top of granite crest.	Elevation of top of flash-boards.
First level	River	96.34	98.74
Do	Second-level canal	96.20	98.60
Second level	River	75.41	78.41
Do	Third-level canal (southerly overflow)	75.18	78.10
Do	Third-level canal (northerly overflow)	76.22	78.22
Third level	River	62.88	65.90

The elevation of the water surfaces in the tail races discharging into the river below the Willimansett bridge from the mills on the third-level canal, taken where they come into the open on the river bank, varies from 43 to 43.6 feet.

The dam and canals are owned by the Holyoke Waterpower Company, which supplies about 30,000 horsepower to a large number of paper mills and other manufacturing establishments in Holyoke.

The nine bridges over the Connecticut between Enfield and Holyoke dams are described under separate heading of bridges.

Bordering directly upon this portion of the river are eight thriving cities and towns, which, according to the United States census of 1890, have a total population of 147,610. They use stock in manufacturing to the value of $30,236,834, produce manufactures to the value of $59,428,624, and have $55,419,202 capital invested in manufacturing.

BRIDGES.

Between Hartford and Holyoke dam there are at present twelve bridges crossing the river, only one of which, as noted below, has a draw. A new stone arch bridge with draw is under construction at Hartford to replace the present temporary structure. At Chicopee, Mass., the old wooden bridge was destroyed by fire in November, 1903, and a new modern structure is under consideration. At the site of the old Enfield bridge two cables carrying telephone wires span the river.

Brief descriptions of the bridges are given, followed by a table of the same giving condensed data and clear heights over the channel for various heights of water at Hartford.

Highway bridge at Hartford, Conn.—A temporary steel through truss, about 1,020 feet long and 28 feet wide, consisting of nine spans of 80 to 136 feet, without a draw, built in 1895 (by a State commission) to replace an old wooden structure that was destroyed by fire. A new stone arch bridge 1,074 feet long and 80 feet wide, with 100-foot draw opening of double rolling-lift type, is under construction at this place. It is being built by the commissioners of the Connecticut River bridge and highway district, and was authorized by act of Congress approved February 18, 1903.

Railroad bridge at Hartford, Conn.—An iron through truss, 1,240 feet long and about 18.3 feet wide, consisting of 7 spans of 160 feet and a pivot draw with 45-foot openings; draw pier is on the east bank and at ordinary stages of the river there is no water under the easterly opening; built after 1873 to replace an old Howe truss; original bridge built by the Hartford, Providence and Fishkill Railroad, incorporated in 1849; now owned by the New York, New Haven and Hartford Railroad.

Warehouse Point, Windsor Locks highway (toll) bridge.—Steel suspension bridge, 544.1 feet long between piers, 1,148.6 feet total length, and 19.2 feet wide; built in 1886 by the present owners, the Windsor Locks and Warehouse Point Bridge and Ferry Company, under charter from the State.

Warehouse Point railroad bridge, Conn.—Iron truss deck bridge, 1,522 feet long and 15.5 feet wide, consisting of 17 spans varying from 22 to 177 feet, with provision made for a 40-foot draw near the west end; built 1865–66 to replace old structure; original bridge built in 1843 by Hartford and Springfield Railroad Company, incorporated under State laws; now owned by the New York, New Haven and Hartford Railroad. Being widened and rebuilt (1904).

Enfield bridge, Conn.—Destroyed by freshet in 1900 and not rebuilt; its old stone piers, partly demolished, remain in the river; was owned by incorporated company, and built in 1834. Two cables carrying telephone wires now span the river at this site.

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Thompsonville bridge, Conn.—A steel through truss bridge, 1,064 feet long and 20 feet wide, consisting of five spans of about 213 feet, without draw; built in 1892–93 by the owners, the Suffield and Thompsonville Bridge Company, under special charter.

South End Bridge, Springfield, Mass.—A steel through truss, 1,350 feet long and 20 feet wide, consisting of eight spans of 164 to 176.5 feet, without a draw; a county bridge, built in 1878 under authority of State, and cost $116,188. In 1903 the four easterly spans were raised 15.5 feet by order of the Secretary of War, and the remaining spans were raised varying amounts to slope up to the high portion.

Old toll bridge, Springfield, Mass.—An old, covered wooden bridge, about 1,200 feet long and 33.4 feet wide, consisting of nine spans (six averaging about 100 feet and three about 200 feet), built by a corporation under act of State legislature; rebuilt in 1812; made free in 1872 at a cost of $30,000 to the county (of Hampden). A new bridge near this site is under consideration.

Boston and Albany Railroad bridge, Springfield, Mass.—An iron through truss bridge, about 1,260 feet long and 32 feet wide, consistnig of seven spans of 180 feet, without a draw; built by the Western Railroad Corporation previous to 1873.

North End Bridge, Springfield, Mass.—A steel through truss, 1,136 feet long and 40 feet wide, made up of seven spans of 153 to 166 feet, without a draw; built in 1876 by the county of Hampden, under State authority, at a cost of $170,904.

Chicopee bridge, Chicopee, Mass.—Was destroyed by fire November 12, 1903, the piers alone remaining; was formerly a covered wooden bridge, 1,230 feet long and 32 feet wide, consisting of seven spans of 170 to 183 feet, without a draw; built by a corporation under legislative act of 1846, and made free by the county in 1870 at a cost of $36,000. A new bridge is under consideration.

Holyoke-Willimansett bridge, Mass.—A steel truss through bridge, 798 feet long and 46 feet wide, consisting of five spans of 107 to 173 feet, without a draw; built in 1891 by the Hampden County commissioners, under State authority, and cost $178,326.

Boston and Maine Railroad bridge, Holyoke, Mass.—An iron truss through bridge, 755 feet long and 23 feet wide, consisting of five spans of about 152 feet, without a draw; built under act of State legislature; superstructure rebuilt in 1883.

Holyoke-South Hadley bridge, Mass.—A steel truss through bridge, 1,606.5 feet long and 47 feet wide, consisting of ten spans of about 160.5 feet, without a draw; built under acts of State legislature of 1870 at a cost of $162,780, and rebuilt under acts of 1888 at a cost of $169,300.

Name.	Location.	Miles above Hartford.	Built.	Style.	Elevation in clear.	Clear height for given heights of water at Hartford.				
						2 feet.	5 feet.	10 feet.	15 feet.	20 feet.
Temporary bridge	Hartford, Conn.	0.32	1895	Through truss	28.0	26.0	23.0	18.0	13.0	8.0
Stone arch bridge	do	.32	Begun.	Stone arch	43.0	41.0	38.0	33.0	28.0	23.0
Railroad bridge	do	1.00	1849+	Through truss	32.0	30.0	26.9	21.9	16.8	11.8
Windsor Locks	Warehouse Point, Conn.	12.10	1886	Suspension	30.5	28.0	26.2	22.6	18.2	13.0
Railroad bridge	do	13.20	1865–66	Deck truss	[a]43.2 [b]49.2 [c]57.4					
Thompsonville bridge.	Connecticut	17.30	1892–93	Through truss	62.5	21.0	19.8	18.2	16.5	14.0
South End Bridge	Springfield, Mass.	23.35	1878	do	79.4	37.8	36.3	34.1	31.7	27.7
Old toll bridge	do	24.70	1812+	Covered, wooden	60.8	18.7	17.1	14.7	12.1	7.9
Boston and Albany Railroad bridge.	do	24.90		Through truss	70.4	28.7	27.2	24.8	22.2	18.0
North End Bridge	do	25.80	1876	do	65.7	23.9	22.2	19.7	17.0	12.7
Chicopee bridge [d]	Chicopee, Mass	28.50	1846+	Covered, wooden	67.1					
Willimansett-Holyoke bridge.	Massachusetts	32.82	1891	Through truss	71.9					
Boston and Maine Railroad bridge.	Holyoke, Mass	32.86	1883	do	75.3					
Holyoke-South Hadley bridge.	Massachusetts	34.35	1888	do	75.0					

[a] At channel. [b] In general. [c] At canal. [d] Destroyed by fire Nov. 12, 1903.

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DISCHARGE MEASUREMENTS.

During the summer of 1903 (July to September) the volume of discharge of the river at low stages was determined by current-meter observations covering a range of heights corresponding to from 2.3 to 5.5 feet at Hartford. The principal meter station was at Thompsonville, Conn., above the bridge, at nearly the same location that General Ellis took his observations with meters and floats in 1874. Some determinations of the discharge were also made above the railroad bridge at Hartford, Conn., at Springfield, Mass., opposite Hampden Park, and at Holyoke, Mass., below the mills. In addition the Farmington, Scantic, and Westfield rivers (tributary streams), and Enfield Canal were metered, but ranges in height of water for all except Enfield Canal were limited to the ordinary summer stages and only a small part of their total yearly range.

The instrument used was a new Price current meter (No. 600, maker's number 130) with electric register counting single revolutions. It would have been an advantage if the register had counted fractions of a revolution, as several of the speeds were slow and one revolution was sometimes a considerable percentage of the total number for a single observation.

RATING OF THE METER.

Before beginning and near the end of the work of metering, the meter was rated in still water covering the range of velocities likely to occur in the river. Shaker Pond, 4 miles from Thompsonville, was selected for a rating station, as it afforded deep, still water across a small arm sheltered on three sides from the wind. A course 200 feet long was laid out, with sensitive cut-off ranges on shore to mark the ends, which came far enough from shore to allow maneuvering room for the boat. A braided sash-cord rope marked in feet was stretched the length of the course and kept taut by securing the ends on shore, one to a tree and the other to a windlass. The meter was fastened (but free to swing) 2½ feet under water to a one-half inch iron rod 18 inches ahead of the bow of a boat, which was hauled by hand along the tagged line at uniform speeds. Battery, counter, etc., were placed in the boat, and four men were required—one in the bow to haul it ahead, one in the stern to keep it steady and in line, one to watch the ranges and to start and stop the counter and watch when crossing the initial and final points of the course, and one to call aloud seconds for keeping the speed uniform and to record the results. The counter, as mentioned previously, registered only whole revolutions of the meter wheel, and the watch read to fifths of a second. In order to have the meter going smoothly at the initial point of the course, the boat was started at the speed to be tested well back of the range.

Velocities varying from one-half to 3 feet per second were used, the meter being run over the course at least twice in each direction at each speed, in order to eliminate the effects of possible current beneath the surface of the pond.

The rating curves (Pl. VI) were obtained by plotting the tests on squared paper with revolutions per second as abscissas and velocities in feet per second as ordinates, and the two ratings agree very closely with each other and also with the curve plotted from the maker's rating, claimed to be right within 2 per cent.

The curve of the first rating, above velocities of 1.5 feet per second, coincides almost exactly with the maker's rating; and a few lower velocities show a difference of only 0.4 of a foot per second for a given number of revolutions per second. The second rating shows the meter was running a little freer than at first. The following table shows these comparisons:

Revolutions per second.	Velocities in feet per second.		
	Maker's rating.	First rating.	Second rating.
0.15	0.617	0.575	0.59
.20	.775	.74	.74
.30	1.089	1.075	1.04
.40	1.404	1.395	1.35
.50	1.717	1.71	1.663
.60	2.029	2.02	1.975
.80	2.645	2.64	2.60

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OPERATIONS AT RIVER STATIONS.

A careful cross section of the river was taken at each metering point, and a gauge established near one end convenient for reading. Soundings from 10 to 20 feet apart were taken with a pole and each one located by transit angle from the end of a base line, the boat being kept closely on the section by a flagman on shore. The location of each sounding was computed, and the elevation of the bed determined from the depth and the height of water on the gauge.

At Thompsonville additional sections were taken 50 feet and 150 feet above and below the section in which velocities were measured in order to make sure that the bottom was reasonably uniform up and down stream. These sections, as previously mentioned, were in nearly the same location as sections F and G of the Ellis survey, but they differ somewhat from his, showing that filling from 0 to 8 feet deep has taken place for a width of about 400 feet on the east side of the river, where formerly the deepest water occurred. As in both surveys several sections were made at this place 50 to 150 feet apart, those of each survey agreeing in themselves, there can be no doubt whatever as to the truth of this change. This deposit accounts for decreased areas of the present sections for a given height of water, as shown by the following table:

Table of areas of cross sections at Thompsonville meter station in 1874 and 1903 for certain heights of water surface.

Height of water surface above Hartford zero.	Area meter section (middle section) 1903.	Area by Ellis survey. Average of F and G.	Difference.
	Sq. ft.	*Sq. ft.*	*Sq. ft.*
41.00	13,308	14,730	1,420
42.00	14,453	15,900	1,450
43.00	15,614	17,080	1,470
44.00	16,790	18,260	1,470
45.00	17,974	19,450	1,480
46.00	19,178	20,650	1,480
			a1,478

a Average.

At the Hartford section additional soundings were taken on lines 100 feet above and below the center or meter section, while at all others the meter section was the only one taken.

Shore ranges were erected at all the sections on which current observations were taken, to aid in anchoring the boat and setting the meter on line. Current velocities were observed in certain verticals of the cross section, the verticals being spaced about 100 feet apart for the Connecticut and 10 to 30 feet apart for other streams, the boat and meter being placed on these verticals by transit angles from a base line. In each vertical, velocities were taken at each foot in depth, beginning at 0.5 feet below the surface and continuing to within about 1 foot of the bottom. The 0.3, 0.5, and 0.6 depth velocities were also usually observed; and the mean velocity (by the integration method) determined by lowering the meter from the surface to the bottom and raising it again to the surface at a uniform speed of 0.1 foot per second, noting total time and total revolutions. (See table on page 47 for comparison of these results.)

APPARATUS.

The apparatus used in metering was rigged in a manner similar to that employed by General Ellis in 1874. (See description and sketch in Report of Chief Engineers for 1878, p. 305 and Pl. VII following same.) It consisted of a flat-bottomed rowboat with a spring board overhanging the stern about 2 feet, over the end of which a sash-cord standing line was run to a heavy weight on the bottom of the river. A piece of one-half inch iron pipe 18 inches long with 3 pounds of lead cast on its lower end slid freely up and down on the standing line and had a small chain marked in half feet attached to its upper end for lowering and raising it. To this pipe the meter could be readily clamped and detached when desired. Thus the meter could be run down or up the stand-

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ing line or held at any desired depth. The battery was placed in the boat and the wires run loosely to the meter, with the counter or register connected in the circuit near the battery and convenient for the observer.

In taking the observations in any vertical, the boat was anchored, bow and stern, in the direction of the current, with stern or, rather, end of the springboard on the section line at the proper location, as determined by the transitman on shore. Then the standing line weight of about 15 pounds was lowered to the bottom and the line made plumb and kept taut over the end of the springboard. And finally the meter, with wires connected, was clamped to the pipe, lowered to the desired depth, and held there by the chain. An observation at any one point in a vertical consisted of obtaining the number of revolutions of the meter in fifty and one hundred seconds. If a discrepancy appeared between the two results, the test was either repeated or run for a longer period of time. For the 0.3, 0.5, and 0.6 depth observations special readings were sometimes taken, while at other times the results for the nearest points in the series of foot-intervals were used, but the integration observation was always made separately.

COMPUTATION OF RESULTS.

Revolutions and time were the observed factors from which revolutions per second were computed, and velocities in feet per second then obtained from the rating curve or table. A velocity curve with depths and velocities as coordinates was plotted from each set of observations in a vertical, and the mean velocity in that vertical for water surface at the known height was computed with the aid of a planimeter and checked by a numerical average by the 0.6 depth velocity, and by the mean obtained by mechanical integration.

The volume of discharge was computed by considering the mean velocity in one vertical as appplying to that portion of the cross section of the river halfway from it to the next vertical on either side. In other words, the cross section was divided into a number of partial sections or vertical strips, usually 100 feet wide, whose middle verticals were those in which meter observations had been taken; the discharge for one of these strips was taken as its area times the mean velocity of its middle vertical, and the discharge of the whole river was the sum of the discharges of all these strips composing the cross section, both areas and mean velocities being taken for the same height of water surface in any one determination.

At the Thompsonville section the river was too wide to obtain a full set of observations in verticals 100 feet apart in one day, or when the water surface was near a constant height; hence a method of computing the discharge of each partial section or strip (and thus of the entire river) at any height of water was devised as follows: Considering one vertical strip or partial section, its middle vertical had been metered on several different days, on all of which the water surface was at different heights, varying from 41.50 to 43.20; the mean velocity in this vertical for each day or each individual height of water was computed, and a curve was drawn with mean velocities and corresponding heights of water surface as coordinates, from which the mean velocity for any height of water could be read; the discharge of this partial section could then be computed for any height of water, knowing its area and mean velocity (of its middle vertical) for any height. Each partial section was thus treated. The discharge of the entire river at any height would obviously be the sum of the discharges of all the partial sections of the cross section taken for the same height of water surface; and thus discharges for as many heights as desired could be computed. They have been figured for heights varying by half-foot intervals within and to a little beyond the range of heights actually observed.

The diagrams on Plate VII show the various steps in this computation, and Table VIII gives the individual observations with the current meter at Thompsonville.

This method, it is believed, was the best for the conditions met, and well adapted to all cases where the elevation of the water surface is changing. The results were checked by computations of the discharge on individual days or by combining two days' observations when the water was about the same height and calling the result obtained the discharge for the mean height of the river during the period.

At other sections of the Connecticut and on the tributary streams metered, the discharge was computed for each day's observations, as a full set could usually be taken and (except at Hartford) the water surface in that period varied but little.

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RESULTS AND COMPARISONS.

The discharge at Thompsonville, Conn., the principal metering station, was measured a sufficient number of times to give a check on the results and assure their probable correctness within the fluctuations of water-surface heights occurring during the observations. A further approximate check on these results was obtained from the current observations taken at Springfield and at Holyoke by reducing the discharges at the latter places to corresponding discharges at Thompsonville.

Owing to the raising and other changes that have been made in Enfield dam since General Ellis's measurement of the volume of discharge at Thompsonville in 1874, it is impossible to compare directly his results with those taken at the same place during the present survey. He reduced his results to discharges at Hartford for heights of water at Hartford; therefore those of the present survey were also computed for that place. Corresponding heights of water at the respective places and the estimated flow of intermediate tributary streams were, of course, carefully taken into account in all these reductions.

The estimate of the flow of the river at Hartford was roughly checked by current observations taken near Hartford, above the railroad bridge.

In determining heights of water at Hartford corresponding to those at Thompsonville for which discharges had been computed, two diagrams of relative gauge heights were used. One of these (Pl. III), plotted from the record of a season's observations, gave accurate average comparisons between Hartford and the gauge just below the Thompsonville bridge. The other showed relative heights at the latter point and at the meter section.

A Springfield, Mass., the flow was metered on three different days, and was computed for each day separately.

At Holyoke, Mass., current observations were taken on several days and were computed for each day, and also by the method used for the work at Thompsonville.

Separate estimates of the discharge of each tributary stream were made, based on various data and observations, as follows:

Chicopee River.—Heights on the Chicopee Manufacturing Company's dam at Chicopee Falls and records of flow of one branch of the river from Edw. A. Buss, C. E., of Boston.

Agawam River.—Current meter observations, 2 miles above its mouth.

Mill River.—Data on amount of water used and wasted at the "Watershops" of Springfield Armory, furnished by Col. Frank C. Phipps.

Pecowsic Brook.—Personal observations at its mouth and at dam one-half mile above.

Freshwater Brook.—Weir measurements at dam in village of Thompsonville.

Scantic and Farmington rivers.—Meter observations near their mouths.

All other streams and brooks.—Personal observations, drainage areas; weir measurement of one for a unit to guide in estimating the others.

In the estimates of all the tributaries due consideration was given to the areas and characters of their watersheds, and to General Ellis's estimates of their minimum and mean discharge. (See Report of Chief of Engineers for 1878, p. 303.) Their discharge was assumed to vary according to the rise and fall of the Connecticut.

When the water is 2.5 feet or lower at Hartford the discharge there is influenced by several conditions which render a close computation or estimate of it impossible.

First. The tide has a material effect on the height of the water, and a very low or a very high tide will often rise or fall at the rate of half a foot an hour and cause a total rise or fall of 1.5 feet. It is evident, then, that if a very low tide should occur when a considerable quantity of water was flowing in the Connecticut, the discharge for a certain gauge height would be enormously greater than the true mean for that height, while with a very high tide and a slight flow the discharge would be much below the mean. A long series of discharge observations with special instruments would be required to obtain a true mean at such stages.

Second. Very lowest water usually occurs on Sunday or on a holiday, when much water is held back by dams. The discharge at such times is small and difficult to measure accurately, owing to tidal effects and low velocities. Near Hartford (or below Enfield rapids) tidal effects would be very troublesome. Above Enfield dam velocities would be almost zero, and hence be very difficult to measure. An attempt has been made, however, to estimate the probable

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maximum and minimum flow at Hartford for very low stages, based on scanty data and personal observations. It was made up as follows:

Height of water at Enfield dam. Corresponding height of water at Hartford.	41.0.		40.8.		40.5.	
	1.8-1.0.		1.5-0.5.		0.7-0.0.	
	Maximum.	Minimum.	Maximum.	Minimum.	Maximum.	Minimum.
Flow past Enfield dam:						
Fishway	140	140	105	105	50	50
Leaks	400	300	205	250	250	250
Canal	1,400	350	1,400	235	1,150	200
Intermediate streams	760	510	600	500	500	300
Discharge at Hartford	2,700	1,300	2,390	1,090	1,950	800

It was from these rough estimates that the results given in the Table No. IX and marked thus ⊕ were obtained and the lower dotted portion of the curve on Plates VIII and IX.

The tables and diagrams embodying the results and comparisons indicated above are self-explanatory, and will now be referred to briefly.

Table No. IX gives the discharge of the river at Thompsonville, for various heights of water at Thompsonville, and corresponding heights and discharges at Hartford.

Table No. X gives the measured discharge of the river at Springfield, Mass., for certain days, and this discharge reduced to Thompsonville and compared with results at that place. A table is also included showing the estimated discharge of intermediate streams for the days when observations were taken at Springfield.

Table No. XI gives the measured discharge of the river at Holyoke, Mass., for a given height of water at Holyoke, and this discharge reduced to Thompsonville and compared with results at that place. It also includes a table of the estimated discharge of intermediate streams for given heights of water at Holyoke.

Table No. XII gives, for heights at Hartford, a comparison of the discharges at Thompsonville and Hartford by the present survey, with the results obtained at those places by General Ellis's survey. A table giving the estimated discharge of the intermediate streams is also given.

Table No. XIII gives a comparison of the discharge at Hartford by the present survey with General Ellis's survey for certain heights of water at Hartford, and also the discharge as computed by General Ellis for each foot in height ranging from zero to 30 feet at Hartford.

Plate No. VII shows the comparisons of the cross sections of the river taken at Thompsonville meter section and velocity and discharge curves from observations taken at the center section.

Plate No. VIII shows the discharge of the river at Thompsonville and Hartford for heights of water at Thompsonville meter section and corresponding heights of water at Hartford for heights at Thompsonville, and thus the discharge at Thompsonville and Hartford for heights of water at Hartford.

Plate IX shows the discharge of the river at Hartford by the present survey and also as determined by General Ellis's survey, the corresponding heights of water at the regular Thompsonville gauge and the meter section gauge for given heights at Hartford, and the discharge of the intermediate streams between Hartford and Thompsonville as determined by the present survey and by General Ellis's survey, all plotted for heights of water at Hartford.

From these tables and diagrams (particularly Pl. IX) it appears that for heights of water between 3 and 6 feet at Hartford the results of the two surveys agree reasonably close.

As no observations for heights above 5.5 feet at Hartford were taken during the present survey, we have no means of comparing or checking General Ellis's results for higher stages.

Below 3 feet General Ellis's results are much larger than those obtained by the present survey. As nearly all of the observations during the present survey were taken at quite low stages of water and were taken a sufficient number of times to obtain a check on the results, it is thought that these results are very nearly correct. As previously mentioned, an estimate of the probable discharge for very lowest waters was made.

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By examining the results of the two surveys it is found that the discharge at Hartford given by General Ellis for a gauge height of zero is 5,000 cubic feet per second, while by the present survey a discharge of 5,000 cubic feet per second is obtained by actual observation when the gauge is about 2. From this and similar comparisons it appears that the results obtained by General Ellis for very lowest waters are somewhat too large.

In order to show approximately the relation between the corresponding velocities of the current at 0.3, 0.5, and 0.6 depth and the mean velocities by the integration and by the point methods, averages of these respective velocities were made from the observations taken at each of the meter stations—Hartford, Thompsonville, Springfield, and Holyoke. If one or more of these velocities in any set of observations in a vertical was missing, the entire set was omitted in making up these averages. Again, averages for these respective velocities were found from all the complete sets of observations taken in the river.

The following table shows the results obtained:

Station.	Sets of observations.	Average of corresponding velocities, in feet per second.				
		0.3 depth	0.5 depth.	0.6 depth.	Mean by integration.	Mean by point method.
	Number.					
Hartford	35	1.395	1.272	1.227	1.202	1.202
Thompsonville	68	.709	.652	.615	.677	.625
Springfield	26	.824	.762	.737	.793	.724
Holyoke	37	.768	.725	.689	.726	.676
Average of all observations	166	.872	.816	.780	.817	.774
Average of all, omitting Hartford	131	.748	.695	.660	.714	.659

Thus it appears that for each station the average velocity at 0.3 depth is the highest and for all but one station that by the point method the lowest, but the other velocities do not retain the same relative numerical order in each case. For the averages of all and also for the averages of all omitting Hartford the order of velocities commencing with the highest is, velocity at 0.3 depth, by integration at 0.5 depth, at 0.6 depth, and the mean velocity by the ordinary point method. The results for Hartford are not as reliable as the others, owing to rapid and irregular tidal effects during observations.

The velocity at 0.6 depth is practically the same as the mean by the ordinary point method, which is supposed to be the most accurate. This agrees with General Ellis's deductions and is in accordance with the prevailing opinion on the subject among engineers at the present time.

SURVEYS OF SITES FOR PROPOSED LOCKS AND DAMS.

The scheme for improving the Connecticut River by means of a system of dams and locks as proposed by Maj. Smith S. Leach, Corps of Engineers, U. S. Army, in his report of November 13, 1897, has again been considered in this survey and study of the river.

Accordingly it was found advisable to make detailed surveys of the sites for proposed dams in order to make sufficiently accurate estimates of quantities. Surveys were made at each of the sites proposed by Major Leach, as near as they could be located by scale on his plan, and also at other places which appeared to be favorable alternative locations.

Following is a general description of each site, arranged in order of their sequence from Hartford north:

The first is located at Hartford, about 400 feet south of the new highway bridge between Hartford and East Hartford. The river at this place is about 800 feet wide and 20 feet deep in the channel at lowest water. The east bank is natural and composed of clay and sand, rising about 20 feet above low water. To the east the ground is practically level for a distance of 500 feet. There are few buildings of any importance located within the limits of this portion of the site.

On the west shore is a retaining wall about 20 feet high, running nearly the entire length of this site. Immediately west of the wall is the freight yard of

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the New York, New Haven and Hartford Railroad, and beyond are the tracks of the valley division of that road. At the extreme south end of the site is located a coal yard and dock.

The whole locality on the west side of the river at this place will probably undergo radical changes in the next few years, as the Connecticut River bridge and highway commission have plans made for improvements in connection with their new bridge now under construction.

Test borings for rock were taken at this site and will be described fully under the head of "Borings."

The second site in order is located about 500 feet south of the New York, New Haven and Hartford Railroad bridge between Hartford and East Hartford. The river here is about 950 feet wide and has a maximum depth of 12 feet at lowest water. On the east side the ground rises on a gradual slope to elevation 22 and then continues about level for a considerable distance east.

On the west shore the ground is lower and cut to some extent with ponds and lagoons for a distance of 1,000 feet or more inland. To dam the river at this place it would be necessary to build retaining walls and dikes to protect the west end.

Test borings for rock were also taken at this site and will be described under the head of "Borings."

The third site is located near the lower end of the village of Windsor Locks, and at the foot of the Windsor Locks or Enfield Canal, where the width of the river is about 1,100 feet and depth 8 feet. The greater portion of the bed is gravel and sand, but near the shores it is of soft alluvial deposit. On the east side, at the extreme south end of this site, the bank is very steep and rises to the top of Red Hill (elevation 100±). At the foot of the northerly slope of the hill a small brook, with its bed at about elevation 15, enters the river. North of the brook the river bank rises in a broken slope to grade 25, and the ground beyond continues at that height some 400 or 500 feet eastward. The brook and this low portion are overflowed in high freshets. Tests made with a bar, on the east side of the river at the water's edge, indicate rock at elevations varying from 10 to 5 feet.

On the west side the ground rises quite steep to the tracks of the New York, New Haven and Hartford Railroad at grade 34 at the south end and grade 41 at the north end of the site. Tests for rock were made with a bar, but there were only a few places at the extreme north end of the site where there were any indications of ledge. A test boring (No. 14, shown on General Ellis's plan) at the foot of the locks indicates rock at grade 3. An attempt was made to obtain other information about the depth of rock at the present locks. Mr. Saxton, the superintendent of the Enfield Canal, stated that all the locks were built on piles. This being the case, it is evident that rock at the lowest lock must be considerably below elevation 0.0. As General Ellis's boring No. 14 was taken very near the lowest lock, and shows rock at elevation 3, the conclusion is that the rock must be very irregular, or there may be some question about the boring. His borings were taken with an auger worked by hand, and it may be that a bowlder and not solid ledge was struck.

The fourth site is located between the Warehouse Point and Windsor Locks toll and railroad bridges, about 2,500 feet south of the latter. At this place the river is about 1,500 feet wide, and at low stages of water quite shallow, except in the narrow channel. The bed is mostly covered with loose stones and small bowlders. On the west side of the river ledge is exposed in the bed, and the indications are that the ledge is near the surface of the whole width of the river.

On the west side the ground rises on a gradual slope for about 200 feet until it reaches the tow path of the canal at elevation 41.

On the east side the Hartford and Springfield turnpike runs within 250 feet of the river, but at this place it is high enough not to be affected by a dam. Ledge is exposed on the bank at the northerly end of the site. About 1,200 feet below the railroad bridge is situated the power house of the Hartford and Springfield Street Railway Company. The building is on low ground near the river, and with a permanent dam below would be liable to be flooded at high stages of water, as its workroom floor is only at elevation 30.9. The turnpike near the power house is at elevation 35 and might also be flooded.

In order to eliminate the damage that would be incurred to the railway company by a dam below their power house, an alternative site was chosen just above the railroad bridge, where the river is about 1,200 feet wide. A dam at this site would cause no damage whatever to property, the banks of the river being so high and steep that the water would always remain confined within

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them. At this place the bed of the river is exposed ledge for nearly its entire width, and both banks are nearly perpendicular ledge.

The next site in order, up the river, is at the east side of Kings Island, about 2,000 feet north of its lower end. The bed of the river here is all ledge, covered with loose stones, and in extreme low water is almost bare, except in the channel near the west side.

The banks on both sides are nearly perpendicular and are of solid ledge, furnishing excellent conditions for a dam. The width between the banks is about 1,050 feet.

The last site is in the west branch of the river at the north end of Kings Island. The bed is of solid ledge, partly covered with loose stones, with very little water flowing over it at low stages. The bank on Kings Island is perpendicular ledge for a height of 20 feet or more, east of which the ground rises gradually for a distance of 300 feet.

The west shore of the river is formed by the towpath of the canal, the top of which is at elevation 41. At the northerly end of this site there is a perpendicular ledge on the west bank of the canal, which would be an excellent place for the end of a dam extending across the stream slightly diagonally. Should a dam square across be desired, the end would come in a sloping earth bank west of the canal where the depth to rock is probably five feet or more below the surface.

In the preceding description of the sites for dams, it has been the object to point out only a few of the important facts about each. An examination of the accompanying plans and sections of each will show the details more fully.

After the surveys and plans of the dam sites were made, and a careful study of the various schemes of improvement was made, it was found advisable to reject both sites at Hartford, and choose another site about 3,700 feet above the railroad bridge. These two sites, the one below the railroad bridge, and the one below the highway bridge, were abandoned on account of their proximity to the bridges, and also on account of the large area of valuable property that would be flooded.

The site chosen above the railroad bridge eliminates practically all of the defects of the other two sites; and appears to be a very favorable location.

The site at the foot of Windsor Locks was also rejected as unfavorable on account of the insufficient benefit that would be derived from a dam at this place.

At Warehouse Point, the site above the railroad bridge was abandoned on account of the large amount of rock excavation necessary to reach it. The expense of excavating the rock would greatly exceed any benefits of cheaper construction of a dam at this place.

TEST BORINGS AT HARTFORD, CONN.

Borings to determine the elevation of underlying rock were made at proposed sites for locks and dams at Hartford, Conn., beginning work in February and completing in May, 1904. Four holes were made at the site about 400 feet below the new highway bridge and four at the alternative site about 500 feet below the railroad bridge, two holes being made on each side of the river at each site.

The borings were made by Hammond & Mullen, of Hartford, at a contract price of $12 per day for the machine and two men to operate it, the Government agreeing to pay for any diamonds lost while drilling rock. The outfit consisted of a well-drilling machine with drilling frame, mounted on wheels, and the boiler and engine on skids. For earth drilling a heavy chisel bit was used, working inside of a 6-inch pipe casing, which was driven down as the hole progressed. In rock a diamond drill was used, and samples of core about 1 inch in diameter were secured. The 6-inch casing was removed after completing the boring.

In order to avoid minus elevations the datum plane used for the levels of the borings was Hartford zero=100 feet.

At the site below the highway bridge the two holes on the west side of the river were taken in the freight yard of the New York, New Haven and Hartford Railroad, one (boring No. 1) about 40 feet from the river, on the base line of the dam-site survey, and the other (boring No. 2) 150 feet south of the first and about 50 feet from the edge of the river. The elevation of rock at No. 1 is 63 and at No. 2 is 69. On the east side of the river one boring (No. 4) was taken on the base line, about 65 feet from the edge of the river, and the other (No. 3) 150

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feet south of No. 4 and about 90 feet from the river. The elevation of rock at No. 4 is 48.3 and at No. 3 is 54.4.

The elevation of rock, as found by these borings, corresponds reasonably close with the results obtained by the bridge commission in numerous tests recently made entirely across the river at the site of their new bridge. For preliminary purposes, the elevation of rock in the bed of the river at the dam site may be estimated sufficiently close by assuming a similarity between the rock cross sections at two places.

At the dam site below the railroad bridge, borings were taken 150 feet north and south of the base line. On the east side, boring No. 5 was located north of the base line and at the west edge of the road, about 170 feet from the edge of the river. The southerly boring (No. 6) was about 110 feet from the edge of the river. The elevation of rock at No. 5 is 46.2, and at No. 6 is 32.7. On the west side of the river the borings were in Riverside Park, the southerly one (No. 7) being about 200 feet from the edge of the river, and the northerly one (No. 8) about 250 feet from the edge. The elevation of rock at No. 7 is 57.3 and at No. 8 is 59. It was not deemed advisable to go to the expense of taking borings in the bed of the river at this site, as it is not a very favorable location for a dam.

The locations of these borings are shown on the plans of the dam sites, and also on the general plan of the river. The borings are shown in elevation on the cross sections of the river at these sites. Numerous samples of the material encountered in each hole were taken and arranged to scale in wooden boxes, thus showing as nearly as possible a vertical section of each hole.

Summary of borings, showing cost.

Total number of feet bored	549.9
Number of holes bored	8.0
Average depth of hole	68.7
Contract price:	
80½ days' use of machine and 2 men, at $12 per day	$966.00
Loss of one diamond, $\frac{3}{8}\frac{1}{4}$ carat, at $54 per carat	27.84
Weighing and resetting diamonds twice, at $12	24.00
Total amount of contract	1,017.84
Average cost per foot of boring	1.85
Average cost per hole	127.23

The following table shows the results of the borings (Hartford 0.0=100.0):

BORING NO. 1—SURFACE ELEVATION, 127.25.

Depth.	Elevation.	Material.
Feet.	*Feet.*	
26.00	101.3	Fine sand and fine gravel.
40.00	87.3	Do.
44.50	82.8	Coarse river sand.
54.00	73.3	Gravel and hardpan.
58.00	69.3	Fine red sand.
64.30	63.0	Blue slate.
68.26	59.0	Red slate.

BORING NO. 2.—SURFACE ELEVATION, 127.30.

Feet.	*Feet.*	
14.00	113.3	Coarse sand and fine gravel.
19.00	108.3	Fine sand and fine gravel.
31.00	96.3	Fine sand and clay.
40.00	87.3	Coarse sand and fine gravel.
48.00	79.3	Do.
53.00	74.3	Gravel and hardpan.
60.10	67.2	Red sandstone.

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BORING NO. 3.—SURFACE ELEVATION, 117.65.

Depth.	Elevation.	Material.
Feet.	*Feet.*	
28.00	89.7	Fine river sand.
60.00	57.7	Red clay.
63.00	54.7	Gravel and hardpan.
65.40	52.3	Brown stone.
67.40	50.3	Red sandstone.

BORING NO. 4.—SURFACE ELEVATION, 118.48.

Feet.	*Feet.*	
10.00	108.5	Fine sand.
18.00	100.5	Coarse river sand.
33.00	85.5	Coarse river sand and fine gravel.
62.00	56.5	Red clay.
65.00	53.5	Fine red sand.
68.50	50.0	Gravel and hardpan.
72.40	46.1	Red sandstone.

BORING NO. 5.—SURFACE ELEVATION, 121.24.

Feet.	*Feet.*	
25.00	96.2	Fine sand.
37.00	84.2	Coarse river sand.
62.00	59.2	Red clay.
74.50	46.7	Gravel and hardpan.
77.25	44.0	Red slate.

BORING NO. 6.—SURFACE ELEVATION, 113.89.

Feet.	*Feet.*	
10.00	103.9	Fine sand.
21.00	92.9	Coarse river sand.
27.00	86.9	Coarse river sand and fine gravel.
72.00	41.9	Red clay.
80.50	33.4	Gravel and hardpan.
83.00	30.9	Red sandstone.
83.40	30.5	Brownstone.

BORING NO. 7.—SURFACE ELEVATION, 115.53.

Feet.	*Feet.*	
15.00	100.5	Fine sand.
28.00	87.5	Coarse river sand.
46.00	69.5	Red clay.
53.00	62.5	Coarse gravel and hardpan.
57.00	58.5	Fine gravel and hardpan.
58.20	57.3	Brownstone.
59.90	55.6	Red slate.

BORING NO. 8.—SURFACE ELEVATION, 116.10.

Feet.	*Feet.*	
15.00	101.1	Fine sand.
24.00	92.1	Coarse river sand.
27.00	89.1	Coarse river sand and fine gravel.
48.00	68.1	Red clay.
50.00	66.1	Gravel and hardpan.
55.00	61.1	Fine gravel.
56.00	60.1	Fine sand and gravel.
57.10	59.0	Brownstone.
61.10	55.0	Red slate.

SURVEY OF ENFIELD CANAL.

In considering the different methods possible for improving the Connecticut River it was thought that a plan for improving the present canal of the Connecticut River Company was worthy of consideration. As the general survey

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did not embody sufficient detail to make an estimate within a desired degree of accuracy, it was deemed necessary to make a detail survey of the canal from Enfield dam to the most northerly mill at Windsor Locks, where it is proposed to enter the river. This survey was made during the latter part of April and the first three weeks of May, 1904, taking in all about four weeks. A survey party of four men and two laborers performed this work.

Before taking topography a line of bench levels was run for the entire length of the work and bench marks were left at frequent intervals.

The base lines for this survey were run entirely on the towpath, and were connected with the regular river triangulation stations as they were reached, thus giving a check on the distances and azimuths. Beginning near the head house at Enfield dam, stations were put in every 200 feet and numbered consecutively.

A set-up was made at each station, and sections taken from the edge of the river, across the canal, and up the west bank far enough to include the proposed change. Sections were taken as nearly square with the line of the canal as possible. Where the ground was irregular between sections, additional topography was taken to show such changes.

Soundings in the canal were taken at each station and their locations determined by estimating the distances from the edges.

Special care was used to make notes on the general character of the ground at each section, stating where ledge was exposed, and also the character of the bed of the canal, as near as could be determined by tests with a bar. Frequent tests for rock were made with an iron rod on the west bank of the canal, but owing to the shaly nature of the ground and the hardness of the material in many places it was very difficult to sink the rod very deep at those places and also to determine the material struck at the bottom. In softer places the rod was generally put down from 5 to 10 feet unless rock was encountered. The results of these tests are shown on the plan.

From Enfield dam southerly, for a distance of 6,000 feet, the west bank of the canal is all very steep ledge, rising almost perpendicularly to heights varying from 5 to 20 feet above the water surface. The bed of the canal for this section is probably about all rock. From this section to about 1,200 feet south of Stony Brook the ground on the west bank is more sloping and the ledge less predominant.

At Stony Brook, about 11,800 feet south of the dam, the canal passes over the brook in an aqueduct. This aqueduct is built of wood resting on masonry piers built in the brook, and is about 100 feet wide on the water line and 100 feet long. From 1,200 feet south of the aqueduct to the railroad bridge the bank is very steep, with frequent outcrops of ledge. From the bridge south the canal and railroad follow along very close together and nearly parallel, the railroad being west of the canal. The ground rises on a steep slope from the edge of the canal to the edge of the railroad bed.

The top of the towpath is at about grade 50 for the first 2,500 feet from the dam. In the next 5,000 feet it drops gradually to about elevation 41, and continues at about this height for the remainder of its length.

At the time this survey was made the water in the river was high, and it was impossible to obtain levels and locations of the foot of the towpath north of the railroad bridge. At these sections the slope of the towpath was determined and the elevation of the foot taken from the general plan of the river.

Careful locations and levels of the locks at the head and foot of the canal were taken. The locks at the foot of the canal are shown on the Windsor Locks dam site plan, and the lock at the head is shown on the detail plan of Enfield Canal.

Very respectfully submitted.

ARTHUR J. OBER,
Junior Engineer.

The BOARD OF ENGINEERS, U. S. ARMY,
ON THE IMPROVEMENT OF CONNECTICUT RIVER.

REPORT OF THE BOARD OF ENGINEERS FOR RIVERS AND HARBORS.

WASHINGTON, D. C., *December 23, 1904.*

GENERAL: In compliance with first indorsement, Office of Chief of Engineers, dated October 25, 1904, the Board of Engineers for Rivers

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and Harbors has the honor to submit the following report on the proposed improvement of the Connecticut River between Hartford, Conn., and Holyoke, Mass.

The river and harbor act of June 13, 1902, provided for a special board of three officers of the Corps of Engineers to report upon certain features of this improvement. The report of this Board and the large number of papers submitted to it at public hearings and all other data available have received careful consideration. A committee of the Board of Engineers for Rivers and Harbors visited the locality on December 8, 1904, and inspected the flight of locks at Windsor, the site of the proposed lower dam, a portion of the canal, and Enfield dam.

In the report of Major Leach, November 13, 1897, which was the subject under consideration by the special Board, it was proposed to improve this stretch of river, about 34 miles in extent, by dredging and the construction of three locks and movable dams at an estimated cost of $2,075,000, and $8,000 per annum for maintenance. The special Board was of the opinion that the estimate of Major Leach in the items for locks, dams, and maintenance should be increased, making the estimated cost of improvement as proposed by Major Leach $3,800,000, and $50,000 per annum for maintenance. The Board of Engineers for Rivers and Harbors is of the opinion that the estimates of the special Board are not too large.

The special Board did not confine its investigations to the particular plan proposed by Major Leach, but submitted estimates for three alternate plans that appeared feasible at costs amounting to $2,725,000, $2,621,000, and $2,393,500, not including possible damages to the Connecticut River Company or the cost of modifying the three railroad and four highway bridges. The plan involving the least expenditure amounts to about $70,000 per mile.

The business of the several towns located on this stretch of river is large. The principal industry is manufacturing. The estimate of the business concerned is as follows: Value of stock used, $31,918,617; value of manufactured products, $62,678,437; capital invested, $59,304,384. The total estimated tonnage of freight above Hartford, receipts and shipments, amounts to 2,275,000, the principal item of which is coal, estimated at 565,000 tons. What part of this tonnage would be handled by water if the improvement were made is a matter of conjecture, as there is no water transportation above Hartford at the present time. Major Leach estimated that 500,000 tons would be carried by water. The special Board states that should the improvement be made large amounts of bulky freight would undoubtedly be carried up the river at cheaper rates than they can be carried by the railroads.

An analysis of the papers submitted at the public hearings leads to the conclusion that the principal object desired by those in favor of the improvement is primarily to create competition between rail and water with a view to securing lower freight rates, and, secondarily, to obtain quicker deliveries of freight to New York City than noncompetitive transportation now affords. At present these towns are practically dependent upon a single system of railroads which has no competition.

The plan of improvement is to provide a depth of 9 feet, this being thought to be sufficient to accommodate the class of vessels that would

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seek this route. In the opinion of the Board this depth is the minimum that should be considered in any plan providing for future navigation. Any improvement of this stretch of river would naturally be dependent upon the condition of the river below, as the principal commerce would come from Long Island Sound.

The project for the Connecticut River below Hartford, adopted in 1870 and modified in 1887, provides for a channel from Long Island Sound to Hartford, Conn., 400 feet wide and 12 feet deep at mean low water across Saybrook bar, and thence to Hartford 100 feet wide and 9 feet deep at extreme low water, the channel in the river to be maintained by annual dredging. Since 1870 twenty-six appropriations have been made for the prosecution of this project, aggregating $634,039.12. The Annual Reports of the Chief of Engineers make it clear that under the existing project for the Connecticut River below Hartford 7 feet is all that is usually available at low water.

At an assumed first cost of $3,000,000, the annual interest charge at 3 per cent would be $90,000. Adding to this the sum of $50,000 for maintenance, and assuming the annual tonnage that would avail itself of the new waterway at 500,000, it is seen that the cost to the Government would be 28 cents per ton. In this estimate no account is taken of the amount that the United States might be compelled to pay for damage to existing water power nor the cost to the people and States for the modification of existing bridges.

Owing to the large cost as compared with the probable benefits, and the insufficient depth of water in the channel below Hartford, the Board is of the opinion that the proposed improvement of the Connecticut River between Hartford and Holyoke is not worthy of being undertaken by the General Government.

Respectfully submitted.

D. W. LOCKWOOD,
Lieut. Col., Corps of Engineers.
R. L. HOXIE,
Lieut. Col., Corps of Engineers.
S. W. ROESSLER,
Major, Corps of Engineers.
CHARLES W. KUTZ,
Captain, Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

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APPENDIX E.

IMPROVEMENT OF RIVERS AND HARBORS IN NEW YORK ON LONG ISLAND SOUND AND ON THE SOUTHERN SHORE OF LONG ISLAND, OF HUDSON RIVER AND HARBORS THEREON, AND OF HARLEM AND EAST RIVERS, NEW YORK.

REPORT FOR THE FISCAL YEAR ENDING JUNE 30, 1905, WITH OTHER DOCUMENTS RELATING TO THE WORKS. OFFICERS IN CHARGE, COL. W. R. LIVERMORE AND CAPT. EDWARD H. SCHULZ, CORPS OF ENGINEERS.

IMPROVEMENTS.

1. Port Chester Harbor, New York.
2. Mamaroneck Harbor, New York.
3. Larchmont Harbor, New York.
4. Echo Bay Harbor, New York.
5. Bronx River and East Chester Creek, New York.
6. Harbors at Port Jefferson, Mattituck, Huntington, Glencove, Flushing Bay, Canarsie Bay, and Sag Harbor, New York.
7. East River and Hell Gate, New York.
8. Harlem River, New York.
9. Newtown Creek, New York.
10. Browns Creek, New York.
11. Great South Bay, New York.
12. Hudson River, New York.
13. Saugerties Harbor, New York.
14. Harbors at Rondout and Peekskill, New York.
15. Wappinger Creek, New York.
16. Removing sunken vessels or craft obstructing or endangering navigation.

EXAMINATION AND SURVEY.

17. Flushing Bay, New York.

HARBOR LINES.

18. Greenport Harbor, New York.
19. East River, New York, between East Thirty-second and East Thirty-seventh streets, New York City.

UNITED STATES ENGINEER OFFICE,
New York City, July 26, 1905.

GENERAL: I have the honor to forward herewith annual reports upon works of river and harbor improvements in my charge in New York * * * for the fiscal year ending June 30, 1905.

* * * * * * * *

Very respectfully, your obedient servant,

W. R. LIVERMORE,
Colonel, Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

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E 1.

IMPROVEMENT OF PORT CHESTER HARBOR, NEW YORK.

Detailed descriptions of the harbor and of projects for its improvement are printed in the Reports of the Chief of Engineers for 1897, page 1084, and 1900, page 1378.

OPERATIONS DURING THE PAST FISCAL YEAR.

No work was done during the year. The funds on hand prior to the approval of the river and harbor act of March 3, 1905, were not sufficient to secure any practical results, and the new appropriation became available too late to commence work. A project for the expenditure of funds was approved May 26, 1905.

Specifications for dredging have been prepared. About 92 per cent of the work proposed under the present project has been completed.

The available funds and the additional appropriation are to be applied to completing the improvement and to maintaining the same.

Money statement.

July 1, 1904, balance unexpended		$965. 75
Amount appropriated by river and harbor act approved March 3, 1905		3, 000. 00
		3, 965. 75
June 30, 1905, amount expended during fiscal year, for maintenance of improvement		403. 84
July 1, 1905, balance unexpended		3, 561. 91
Amount (estimated) required for completion of existing project		2. 000. 00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905		2, 500. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

APPROPRIATIONS.

June 10, 1872	$12, 000	June 3, 1896	$5, 000
August 2, 1882	15, 000	March 3, 1899	25, 000
August 11, 1888	5, 000	June 13, 1902	5, 000
September 19, 1890	5, 000	March 3, 1905	3, 000
July 13, 1892	5, 000		
August 18, 1894	5, 000	Total	85, 000

COMMERCIAL STATISTICS.

Vessels employed in trade in 1904.

Class	Tonnage.	Draft.
		Feet.
Steam	300	10
Sail	500	12
Barges, etc	800	12

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Freight handled.

	Tons.
General mechandise	75,000
Iron	30,000
Coal and other fuel	60,000
Brick	90,000
Total	255,000

Estimated value of 1904 tonnage, $4,590,000.
Total number of trips reported for above vessels, 312.

E 2.

IMPROVEMENT OF MAMARONECK HARBOR, NEW YORK.

Detailed description of the harbor and project for its improvement is printed in the Report of the Chief of Engineers for 1900, page 1381.

OPERATIONS DURING THE PAST FISCAL YEAR.

No work was done during the year. The funds on hand prior to the approval of the river and harbor act of March 3, 1905, were not sufficient to secure any practical results, and the new appropriation became available too late to commence work. A project for the expenditure of funds was approved May 26, 1905.

Specifications for dredging have been prepared. About 82 per cent of the work proposed under the present project has been completed.

The available balance and the new appropriation are to be applied to continuing the improvement and maintaining same.

Money statement.

July 1, 1904, balance unexpended		$618.26
Amount appropriated by river and harbor act approved March 3, 1905		2,000.00
		2,618.26
June 30, 1905, amount expended during fiscal year, for maintenance of improvement		350.00
July 1, 1905, balance unexpended		2,268.26
Amount (estimated) required for completion of existing project		5,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$5,000.00	
For maintenance of improvement	2,500.00	
		7,500.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

APPROPRIATIONS.

August 2, 1882	$15,000
June 3, 1896	10,000
March 3, 1899	7,000
June 13, 1902	6,000
March 3, 1905	2,000
Total	40,000

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COMMERCIAL STATISTICS.

Vessels employed in trade in 1904.

Class.	Trips made.	Tonnage.	Draft.
			Feet.
Steam	225	94–154	7
Sail	1	138	7
Barges, etc	45	225–1,494	5½–10

Freight handled.

	Tons.
General merchandise	15,214
Coal and other fuel	17,844
Brick	138
Building stone	15,393
Cement, lime, and sand	1,000
Total	49,589

Estimated value of 1904 tonnage, $859,242.

E 3.

IMPROVEMENT OF LARCHMONT HARBOR, NEW YORK.

Detailed description of the harbor and of the present and previous projects for its improvement is printed in the Report of the Chief of Engineers for 1900, pages 1383 to 1387.

OPERATIONS DURING THE PAST FISCAL YEAR.

No work was done during the year. The funds on hand prior to the approval of the river and harbor act of March 3, 1905, were not sufficient to secure any practical results, and the new appropriation became available too late to commence work. A project for the expenditure of funds was approved May 26, 1905.

Specifications for rock removal have been prepared. About 55 per cent of the work proposed under the present project has been completed.

Under the present project the breakwater off Long Beach Point was built to a length of 1,410 feet, with side slopes of 1 on 1 and top width of 5 feet, with a height of 10 feet above low-water plane, and the outer end for a length of 25 feet was 10 feet wide and 14 feet above low water. Owing to the effects of settling, storms, and ice the breakwater has deteriorated somewhat.

The available funds and the additional appropriation recommended are to be applied to completing the removal of ledge adjoining Huron rock and to the completion and maintenance of breakwater off Long Beach Point.

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Money statement.

July 1, 1904, balance unexpended	$720.93
Amount appropriated by river and harbor act approved March 3, 1905	5,000.00
	5,720.93
June 30, 1905, amount expended during fiscal year, for works of improvement	252.24
July 1, 1905, balance unexpended	5,468.69
Amount (estimated) required for completion of existing project	43,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	20,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

APPROPRIATIONS.

September 19, 1890	$5,000
March 3, 1899	50,000
June 13, 1902	10,000
March 3, 1905	5,000
Total	70,000

COMMERCIAL STATISTICS.

The commerce of the harbor is not large. It is mainly used by the Larchmont Yacht Club and also by coasting and fishing vessels for night anchorage and as a harbor of refuge.

Number of vessels other than yachts entering harbor of refuge, or for the night, during 1901 (estimated)	850
Draft of such vessels—feet	4–18
Tonnage of such vessels—tons	100–500

Freight discharged in Larchmont Harbor in 1901.

Number of cargoes	150
Amount in tons	15,500

Vessels owned by the Larchmont Yacht Club.

[Draft, from 3 to 22 feet; tonnage, from 3 to 600 tons.]

Steamers	86
Schooners	51
Sloops	160
Smaller boats	66
Total	363

E 4.

IMPROVEMENT OF HARBOR AT ECHO BAY, NEW YORK.

Detailed history of this improvement is printed in the Report of the Chief of Engineers for 1900, pages 1423 to 1430.

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OPERATIONS DURING THE PAST FISCAL YEAR.

No work was done during the year. The project at this place has been completed, but the localities cleared of rock are subject to shoaling by inflow of mud.

There is a balance of $8,548.28 remaining under the appropriation of June 13, 1902.

On May 26 the Chief of Engineers approved a recommendation that a portion of this balance be expended in making an examination of Long Rock, with a view to submitting a project to the Department for its removal with the funds available, in accordance with the terms of the river and harbor act approved March 3, 1905.

An examination of Long Rock will be made and a project prepared for its removal.

Money statement.

July 1, 1904, balance unexpended	$8,799.75
June 30, 1905, amount expended during fiscal year, for works of improvement	251.47
July 1, 1905, balance unexpended	8,548.28
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	2,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

APPROPRIATIONS.

June 18, 1878	$10,000	August 2, 1882	$3,000
March 3, 1879	3,000	June 13, 1902	17,000
June 14, 1880	3,000		
March 3, 1881	3,000	Total	39,000

COMMERCIAL STATISTICS.

Vessels employed in trade in 1904.

Class.	Trips made.	Tonnage.	Draft.
			Feet.
Steam	320	113	7
Sail	3	200	5
Barges, etc	68	250-965	6-12

Freight handled.

	Tons.		Tons.
General merchandise	54,000	Hay and straw	750
Coal and other fuel	44,000	Grain, flour, and feed	3,750
Brick	15,000	Fruits and farm products	1,200
Cement, lime, and sand	7,500		
Lumber and timber	25,000	Total	151,200

Estimated value of 1904 tonnage, $1,647,500.

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E 5.

IMPROVEMENT OF BRONX RIVER AND EAST CHESTER CREEK, NEW YORK.

(A) BRONX RIVER, NEW YORK.

Detailed history of this improvement was printed in the Report of the Chief of Engineers for 1900, pages 1389 to 1391. A sketch of a portion of the river is printed in the Annual Report of the Chief of Engineers for 1904, page 1016.

OPERATIONS DURING THE PAST FISCAL YEAR.

No work was done during the year. There were no funds on hand prior to the approval of the river and harbor act of March 3, 1905, and the new appropriation became available too late to commence work.

An allotment of funds was made by the Secretary of War May 29, 1905, and a project for the expenditure of same was approved June 6, 1905.

Specifications for dredging and for rock removal have been prepared. About 40 per cent of the work proposed under the present project has been completed.

The available funds and the additional appropriation recommended are to be applied to continuing the improvement and to maintenance.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1905		$21,500.00
July 1, 1905, balance unexpended		21,500.00
July 1, 1905, outstanding liabilities		10.50
July 1, 1905, balance available		21,489.50
Amount (estimated) required for completion of existing project		34,485.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$20,000.00	
For maintenance of improvement	5,000.00	
		25,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

APPROPRIATIONS.

June 3, 1896	$10,000
March 3, 1899	20,000
June 12, 1902 (allotment)	5,000
March 3, 1905 (allotment)	21,500
Total	56,500

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COMMERCIAL STATISTICS.

Vessels employed in trade in 1904.

Class.	Tonnage.	Draft.
		Feet.
Sailing vessels		5
Barges, etc	175-200	5

Freight handled.

	Tons.
General merchandise	106
Iron	185
Coal and other fuel	41,420
Lumber and timber	575
Total	42,286

Estimated value of 1904 tonnage, $196,642.
Total number of trips reported for above vessels, 73.

(B) EAST CHESTER CREEK, NEW YORK.

Detailed descriptions of the stream and of the project for improvement are printed in the Reports of the Chief of Engineers for 1897, pages 1089 to 1090, and for 1904, pages 1016 to 1018. A sketch of the creek is printed in the Annual Report of the Chief of Engineers for 1904, page 1016.

OPERATIONS DURING THE PAST FISCAL YEAR.

Specifications for redredging the channel up to a point 3,000 feet above Lockwood's bridge were issued June 16 and bids were opened July 12, 1904. Proposals were received from John & Joseph McSpirit at 39 cents per cubic yard, from Kirk, Driscoll & Co., at 44½ cents per cubic yard, and from Edward A. Berry, at 49 cents per cubic yard, scow measure. The offer of John & Joseph McSpirit was accepted and a contract made. Work commenced September 12, 1904, and was completed November 30, 1904, 28,846 cubic yards, scow measure, being removed.

The dredging was done from Lockwood's bridge to the proposed bridge at Pelham Parkway, a distance of 2,400 feet, restoring the channel to the projected depth of 9 feet at mean high water (2 feet at mean low water).

An allotment of funds was made by the Secretary of War May 29, 1905, and a project for the expenditure of same was approved June 6, 1905. Specifications for dredging have been prepared.

The project at this place has been completed.

The available funds and the additional appropriation recommended will be applied to maintaining the channel by dredging.

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Money statement.

July 1, 1904, balance unexpended	$12,522.00
Amount appropriated by river and harbor act approved March 3, 1905	3,000.00
	15,522.00
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	12,522.00
July 1, 1905, balance unexpended	3,000.00
July 1, 1905, outstanding liabilities	10.50
July 1, 1905, balance available	2,989.50
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	3,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

APPROPRIATIONS.

March 3, 1873	$25,000	June 3, 1896	$10,000
March 3, 1875	12,000	June 13, 1902 (allotment)	3,000
June 18, 1878	10,000	June 13, 1902 (allotment)	10,000
March 3, 1879	3,500	April 28, 1904 (allotment)	2,500
June 14, 1880	3,500	March 3, 1905 (allotment)	3,000
August 5, 1886	10,000		
August 11, 1888	5,000	Total	109,500
August 18, 1894	12,000		

CONTRACT IN FORCE.

Name of contractors: John & Joseph McSpirit.
Date of contract: July 29, 1904.
Date of approval: August 12, 1904.
Date of commencement: September 13, 1904.
Date of completion: December 31, 1904.
For dredging 28,846 cubic yards, at 39 cents.

COMMERCIAL STATISTICS.

Vessels employed in trade in 1904.

Class.	Tonnage.	Draft.
		Feet.
Steam		9
Sail	600	8
Barges, etc	4-1,425	6-8½

Freight handled.

	Tons.		Tons.
General merchandise	23,385	Cement, lime, and sand	1,100
Iron	4,699	Lumber and timber	110
Coal and other fuel	109,177	Hay and straw	110
Brick	5,000		
Building stone	3,374	Total	146,955

Estimated value of 1904 tonnage, $963,263.
Total number of trips reported for above vessels, 193.

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E 6.

IMPROVEMENT OF HARBORS AT PORT JEFFERSON, MATTITUCK, HUNTINGTON, GLENCOVE, FLUSHING BAY, CANARSIE BAY, AND SAG HARBOR, N. Y.

(A) PORT JEFFERSON HARBOR.

Detailed descriptions of the harbor and of previous reports are printed in the Reports of the Chief of Engineers for 1897, page 1097, and for 1900, page 1393.

OPERATIONS DURING THE PAST FISCAL YEAR.

A survey was made July 18 to 28, 1904, of the harbor entrance, which disclosed shoaling of the channel in various places. A report of the examination was submitted to the Department August 31, 1904, and a request made for an allotment of funds from the emergency appropriation of April 28, 1904, to be used in dredging the channel. An allotment of $2,400 was made by the Secretary of War September 13, 1904.

A timber fence, 7 feet high and 600 feet long, extending across the sand bar in prolongation of the shore end of the east breakwater was built to prevent the drift of sand into the channel. This work was done under agreement with Loper Brothers, at a cost of 49 cents per linear foot.

Specifications for dredging were prepared and proposals were invited, to be opened October 14, 1904. No bids were received. A circular letter was sent out on October 20, 1904, asking for proposals for dredging. This resulted in two bids, one at the rate of 45 cents and the other at the rate of 42 cents per cubic yard. As these prices were considered excessive, the bids were rejected, and on account of the approach of cold weather the work was postponed until the next season. A new survey of the entrance was made June 13 to 19, 1905, which shows that a considerable area has a depth slightly less than 12 feet and that at the inner end of the entrance channel the depth is somewhat less. About 75 per cent of the present project has been completed.

An additional allotment of $1,500 from the consolidated appropriation of June 13, 1902, and $8,500 from the appropriation of $62,500, made by the river and harbor act of March 3, 1905, has been made for this work.

The available funds and the additional appropriation recommended for fiscal year ending June 30, 1907, will be applied to enlarging the east jetty and in maintaining the channel through the entrance by dredging.

Money statement.

July 1, 1904, balance unexpended	$2,120.57
Amount appropriated by river and harbor act approved June 13, 1902 (allotment)	1,500.00
Amount appropriated by river and harbor act approved March 3, 1905 (allotment)	8,500.00
Amount allotted from appropriation for maintenance of river and harbor improvements, act of April 28, 1904	2,400.00
	14,520.57

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June 30, 1905, amount expended during fiscal year, for works of improvement	$820.57
July 1, 1905, balance unexpended	13,700.00
July 1, 1905, outstanding liabilities	132.19
July 1, 1905, balance available	13,567.81
Amount (estimated) required for completion of existing project	68,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:	
For works of improvement	$15,000.00
For maintenance of improvement	2,500.00
	17,500.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

For previous projects.

March 3, 1871	$15,000	
June 10, 1872	15,000	
March 3, 1875	15,000	
August 14, 1876	6,000	
June 18, 1878	8,000	
March 3, 1879	5,000	
June 14, 1880	3,000	
March 3, 1881	4,000	
August 2, 1882	8,000	
		$79,000

For present project.

September 19, 1890	$25,000	
July 13, 1892	10,000	
August 18, 1894	7,500	
June 3, 1896	7,500	
March 3, 1899	7,500	
June 13, 1902 (allotment)	10,500	
April 28, 1904 (allotment)	2,400	
March 3, 1905 (allotment)	8,500	
		78,900
Total		157,900

COMMERCIAL STATISTICS.

Vessels employed in trade in 1904.

Class.	Tonnage	Draft.
		Feet.
Steam		11
Sail	50-100	5-9
Barges, etc	250	6

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Freight handled.

	Tons.		Tons.
Coal and other fuel	1,625	Grain, flour, and feed	2,000
Brick	300	Fruits and farm products	650
Building stone	2,480		
Cement, lime, and sand	447	Total	8,832
Lumber and timber	1,330		

Estimated value of 1904 tonnage, $90,424.
Total number of trips reported for above vessels, 93.

(B) MATTITUCK HARBOR.

Detailed description of the harbor and the project for improvement are printed in the Annual Reports of the Chief of Engineers for 1891, page 843, and for 1897, page 1095.

OPERATIONS DURING THE PAST FISCAL YEAR.

No work was done during the year, there being no funds available. An allotment of $20,000 from the consolidated appropriation of $62,500, made by the river and harbor act of March 3, 1905, has been made for this work.

About 18 per cent of the work proposed under the present project has been completed.

The available funds and the additional appropriation recommended will be applied to continuing the improvement.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1905 (allotment)	$20,000.00
July 1, 1905, balance unexpended	20,000.00
Amount (estimated) required for completion of existing project	48,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	20,000.00

APPROPRIATIONS.

June 3, 1896	$10,000
March 3, 1899	5,000
March 3, 1905 (allotment)	20,000
Total	35,000

COMMERCIAL STATISTICS.

Freight handled.

	Tons.		Tons.
General merchandise	15,952	Grain, flour, and feed	1,800
Coal and other fuel	3,900	Fruits and farm products	30,911
Building stone	458		
Lumber and timber	2,795	Total	56,602
Hay and straw	786		

Estimated value of 1904 tonnage, $2,041,766.

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(c) HUNTINGTON HARBOR.

Detailed description of the harbor and the project for improvement are printed in the Report of the Chief of Engineers for 1897, pages 1100 to 1102. A sketch of the upper part of the harbor is printed in the Annual Report for 1904, page 1023.

OPERATIONS DURING THE PAST FISCAL YEAR.

No work has been done during the year, the funds available being insufficient to secure any practical results. An allotment of $2,500 from the consolidated appropriation of $62,500, made by the river and harbor act of March 3, 1905, has been made for this work. The project at this place has been completed.

The available funds and the additional appropriation recommended will be applied to maintaining the channel.

Money statement.

July 1, 1904, balance unexpended	$119.30
Amount appropriated by river and harbor act approved March 3, 1905	2,500.00
	2,619.30
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	119.30
July 1, 1905, balance unexpended	2,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	2,500.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

APPROPRIATIONS.

June 10, 1872	$22,500	March 3, 1899	$7,500
September 19, 1890	10,000	June 13, 1902 (allotment)	2,500
July 13, 1892	5,000	March 3, 1905 (allotment)	2,500
August 18, 1894	2,000		
June 3, 1896	5,000	Total	57,000

COMMERCIAL STATISTICS.

Vessels employed in trade in 1904.

Class.	Trips made.	Tonnage.	Draft.
			Feet.
Steam	800	125–350	6–8
Sail	375	50–300	5–12
Barges etc	100	200	5–7

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Freight handled.

	Tons.		Tons.
General merchandise	24,500	Lumber and timber	3,000
Iron	100	Hay and straw	2,600
Coal and other fuel	22,000	Grain, flour, and feed	5,750
Brick	2,000	Fruits and farm products	7,500
Building stone	27,000		
Cement, lime, and sand	500	Total	94,950

Estimated value of 1904 tonnage, $2,818,250.
Number of passengers carried, 6,000.

(D) GLENCOVE HARBOR.

Details concerning the harbor and project for improvement are printed in the Report of the Chief of Engineers for 1897, page 1103.

OPERATIONS DURING THE PAST FISCAL YEAR.

No work has been done during the year, the funds available being insufficient to secure any practical results. An allotment of $3,000 from the consolidated appropriation of $62,500 made by the river and harbor act of March 3, 1905, has been made for this work.

About 51 per cent of the work proposed under the present project has been completed.

The available funds will be applied to continuing the improvement.

Money statement.

July 1, 1904, balance unexpended	$428.09
Amount appropriated by river and harbor act approved March 3, 1905 (allotment)	3,000.00
	3,428.09
June 30, 1905, amount expended during fiscal year, for works of improvement	428.09
July 1, 1905, balance unexpended	3,000.00
Amount (estimated) required for completion of existing project	63,000.00

APPROPRIATIONS.

August 11, 1888	$20,000	June 13, 1902 (allotment)	$6,000
September 19, 1890	15,000	March 3, 1905 (allotment)	3,000
July 13, 1892	10,000		
August 18, 1894	10,000	Total	72,000
June 3, 1896	8,000		

COMMERCIAL STATISTICS.

Vessels employed in trade in 1904.

Class.	Trips made.	Tonnage	Draft.
			Feet.
Barges, etc	42	200	5½-6

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Freight handled.

	Tons.
Iron	628
Coal and other fuel	7,901
Hay and straw	20
Total	8,549

Estimated value of 1904 tonnage, $40,515.

(E) FLUSHING BAY.

Details in reference to this improvement may be found in the Report of the Chief of Engineers for 1897, page 1106. A sketch of the locality is printed in the Annual Report of the Chief of Engineers for 1903, page 868.

In accordance with the provisions of the river and harbor act of June 13, 1902, an examination of Flushing Bay was made and a project for the improvement submitted.

OPERATIONS DURING THE PAST FISCAL YEAR.

No work has been done in the field during the year. About 71 per cent of the work proposed under the present project has been completed.

An allotment of $10,000 from the consolidated appropriation of $62,500 made by the river and harbor act of March 3, 1905, has been made for this work.

The available funds and the additional appropriation recommended will be applied to continuing the improvements.

Money statement.

July 1, 1904, balance unexpended	$2,148.67
Amount appropriated by river and harbor act approved March 3, 1905 (allotment)	10,000.00
	12,148.67
June 30, 1905, amount expended during fiscal year, for works of improvement	148.67
July 1, 1905, balance unexpended	12,000.00
Amount (estimated) required for completion of existing project	40,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	10,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

APPROPRIATIONS.

March 3, 1879	$20,000	July 13, 1892	$10,000
June 14, 1880	15,000	August 18, 1894	4,000
March 3, 1881	10,000	June 3, 1896	4,000
August 2, 1882	5,000	June 12, 1902 (allotment)	2,000
July 5, 1894	10,000	March 3, 1905 (allotment)	10,000
August 5, 1886	10,000		
August 11, 1888	15,000	Total	135,000
September 19, 1890	20,000		

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COMMERCIAL STATISTICS.

Vessels employed in trade in 1904.

Class.	Trips made.	Tonnage.	Draft.
			Feet.
Steamers	956	150- 400	8-14
Sailing vessels	29	400-2,100	8-13½
Barges, etc	122	200- 350	6-12

Freight handled.

	Tons.		Tons.
General merchandise	62,120	Ice	4,745
Iron	150	Lumber and timber	11,804
Coal and other fuel	45,444	Hay and straw	50
Brick	4,284		
Building stone	12,849	Total	142,996
Cement, lime, and sand	1,550		

Estimated value of 1904 tonnage, $2,599,488.

(F) CANARSIE BAY.

Description of the locality and the project for improvement is printed in the Report of the Chief of Engineers for 1897, page 1114. A sketch of the locality is printed in the Annual Report for 1904, page 1026.

OPERATIONS DURING THE PAST FISCAL YEAR.

A contract with Kirk, Driscoll & Co. to dredge about 14,000 cubic yards of material, at the rate of 35 cents per cubic yard, scow measure, had been made on June 14, 1904. Dredging commenced September 23, 1904, and was continued until November 26, 1904, when further work was deferred until spring, 9,216 cubic yards being removed. Work was resumed on April 10, 1905, and the contract was completed May 3, 1905, during which time 4,373 cubic yards were removed. The total amount of material excavated under the contract was 13,589 cubic yards. This resulted in securing a channel from 100 to 150 feet wide with a least depth of about 6 feet at mean low water from Big Channel to Canarsie Landing. The greater part of the channel has a depth of 7 feet, and the average width is 125 feet.

The work proposed under the present project has been completed. An allotment of $2,500 from the consolidated appropriation of $62,500, made by the river and harbor act of March 3, 1905, has been made for this work.

The available funds and the additional appropriation recommended will be applied to maintaining the channel.

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Money statement.

July 1, 1904, balance unexpended	$5,233.59
Amount appropriated by river and harbor act approved March 3, 1905	2,500.00
	7,733.59
June 30, 1905, amount expended during fiscal year, for works of improvement	5,105.95
July 1, 1905, balance unexpended	2,627.64
July 1, 1905, outstanding liabilities	42.50
July 1, 1905, balance available	2,585.14
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	3,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

APPROPRIATIONS.

June 14, 1880	$10,000	July 13, 1892	$5,000
March 3, 1881	5,000	August 18, 1894	2,000
August 2, 1882	3,000	June 3, 1896	10,000
July 5, 1884	5,000	June 13, 1902 (allotment)	5,000
August 5, 1886	10,000	March 3, 1905 (allotment)	2,500
August 11, 1888	10,000		
September 19, 1890	5,000	Total	72,500

CONTRACT IN FORCE.

Name of contractor: Kirk, Driscoll & Co.
Date of contract: July 14, 1904.
Date of approval: July 30, 1904.
Date of commencement: November 3, 1904.
Date of completion: Time limit waived.
For dredging 14,000 cubic yards, at 35 cents per cubic yard, scow measure.

COMMERCIAL STATISTICS.

Vessels employed in trade in 1904.

Class.	Tonnage.	Draft.
		Feet.
Steamers	10–248	5–10
Sailing vessels	5–1,000	2–18
Barges, etc	300–600	9½–11

Freight handled.

	Tons.
General merchandise	107,874
Coal and other fuel	16,720
Total	124,594

Estimated value of 1904 tonnage, $1,861,008.

(G) SAG HARBOR.

For description of locality, project, etc., see Reports of the Chief of Engineers for 1900, page 1451, and for 1903, page 130.

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The breakwater is to be built of riprap, in accordance with the present project, to extend from Conklin Point in a north-by-west direction about 1,330 feet, thence in a nearly northwest direction 1,850 feet to the 9-foot curve, making a total length of 3,180 feet. The top is to be 8 feet above mean low water and 5 feet wide; the side slopes are to be 1 on 1.

OPERATIONS DURING THE PAST FISCAL YEAR.

On September 17, 1904, a request was made for an additional allotment of $3,500 from the funds unallotted from the consolidated appropriation of $39,500 made by the river and harbor act of June 13, 1902. On September 23, 1904, this allotment was made by the Secretary of War.

The contract with Peter Lynam for the construction of the breakwater having been annulled on account of the failure of the contractor to prosecute the work, informal bids were asked to complete the work under the specifications of September 5, 1902. Two bids were received, one from E. S. Belden & Sons, at $1.67 per ton, and the other from Smith & Robinson, at $1.70 per gross ton. A contract was entered into with E. S. Belden & Sons on August 5, 1904. Work commenced August 30, 1904, and was finished November 3, 1904, 5,920 tons of stone being placed in the breakwater, completing 610 lineal feet. The shore end extends out 65 feet; then there is a gap of 535 feet, after which the breakwater extends a farther distance of 775 feet, making the total length of completed work 840 feet. About 19 per cent of the work proposed under the present project has been completed.

After the completion of this contract suit was entered against Peter Lynam and his surety for the extra expense incurred by the United States on account of his failure to do the work contracted for, and the amount of $2,296 was received and placed to the credit of the appropriation.

An allotment of $16,000 from the consolidated appropriation of $62,500 made by the river and harbor act of March 3, 1905, has been made for this work.

The available funds and the additional appropriation recommended will be applied to continuing the construction of the breakwater.

Money statement.

July 1, 1904, balance unexpended	$7,058.44
Allotted from river and harbor appropriation of June 13, 1902	3,500.00
Amount appropriated by river and harbor act approved March 3, 1905 (allotment)	16,000.00
Recovered on bond of Peter Lynam, failing contractor	2,296.00
	28,854.44
June 30, 1905, amount expended during fiscal year, for works of improvement	10,558.44
July 1, 1905, balance unexpended	18,296.00
Amount (estimated) required for completion of existing project	41,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	20,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

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APPROPRIATIONS.

June 13, 1902 (allotment)	$10,000
June 13, 1902 (allotment)	3,500
March 3, 1905 (allotment)	16,000
Total	29,500
Received on bond of Peter Lynam, failing contractor	2,296

CONTRACT IN FORCE.

Name of contractor: E. S. Belden & Sons.
Date of contract: August 5, 1904.
Date of approval: August 24, 1904.
Date of commencement: September 26, 1904.
Date of completion: December 1, 1904.
To furnish and place in breakwater 4,900 gross tons of riprap at $1.67 per ton.

COMMERCIAL STATISTICS.

Freight handled.

	Tons.
General merchandise	3,026
Grain, flour, and feed	211
Fruits and farm products	217
Total	3,454

Estimated value of 1904 tonnage, $187,015.
Deepest draft reported, 10 feet.

E 7.

IMPROVEMENT OF EAST RIVER AND HELL GATE, NEW YORK.

Detailed descriptions of the locality, projects, and work done were printed in the Reports of the Chief of Engineers for 1868, page 471; for 1874, Part 2, page 164, and for 1897, page 1026.

OPERATIONS DURING THE PAST FISCAL YEAR.

No work has been done during the year. A survey to determine the present condition of Middle reef has been commenced.

The public property stored at Mill rock, including the drill scow *Hudson*, was cared for. Public notices, dated December 15, 1904, were issued, inviting proposals, to be opened December 27, 1904, for the sale of condemned property. As a result of the sale, $1,326 was realized, which sum was deposited in the United States Treasury to the credit of the appropriation for this work.

A project for the expenditure of the available balance and the new appropriation made by the river and harbor act of March 3, 1905, was approved April 18, 1905. Specifications for this work have been prepared.

About 84 per cent of the work proposed under the present project has been completed.

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The following are the least depths at localities where improvement has not been completed:

Locality.	Least depth June 30, 1905.
	Feet.
Battery reef	19
Reef off South Ferry slips	19
Shell reef off Ninth street	13
Ferry reef off Thirty-fourth street	24
Middle reef, including Flood Rock, etc	18.3
Heel Tap	20.5
Frying Pan	18
Pot rock	22.3

It is proposed to apply the available balance and the amount estimated as a profitable expenditure for the fiscal year ending June 30, 1907, to completing the removal of Pot rock and the southern portion of Frying Pan, to remove stone already broken by blasting from Middle reef, and to reduce the outer portions of Battery reef and Shell reef.

Money statement.

July 1, 1904, balance unexpended	$8,894.80
Amount appropriated by river and harbor act approved March 3, 1905	200,000.00
Received from sale of condemned property	1,326.00
	210,220.80
June 30, 1905, amount expended during fiscal year, for works of improvement	3,927.96
July 1, 1905, balance unexpended	206,292.84
July 1, 1905, outstanding liabilities	257.58
July 1, 1905, balance available	206,035.26
Amount (estimated) required for completion of existing project	705,778.55
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	300,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

By other than river and harbor acts prior to 1852	$13,861.59	August 2, 1882	$200,000.00
August 30, 1852	20,000.00	July 5, 1884	360,000.00
July 25, 1868 (allotment)	85,000.00	August 5, 1886	112,500.00
April 10, 1869 (allotment)	176,841.45	August 11, 1888	250,000.00
July 11, 1870	250,000.00	September 19, 1890	200,000.00
March 3, 1871	250,000.00	July 13, 1892	150,000.00
June 10, 1872	225,000.00	August 18, 1894	75,000.00
March 3, 1873	225,000.00	June 3, 1896	60,000.00
June 23, 1874	214,000.00	March 3, 1899	250,000.00
March 3, 1875	250,000.00	June 13, 1902	100,000.00
August 14, 1876	250,000.00	March 3, 1905	200,000.00
June 18, 1878	350,000.00	Total	4,967,203.04
March 3, 1879	250,000.00	June 6, 1904 (received from sale of condemned property)	8.25
June 14, 1880	200,000.00	December 27, 1904 (received from sale of condemned property)	1,326.00
March 3, 1881	200,000.00		
May 4, 1882	50,000.00		

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COMMERCIAL STATISTICS.

The commerce of the East River is so intimately connected with that belonging to New York proper that it is impracticable to make a separate statement of it.

E 8.

IMPROVEMENT OF HARLEM RIVER, NEW YORK.

Detailed description of the river and projects for improvement are printed in Report of the Chief of Engineers for 1897, page 1019.

The improvement has progressed so that there is now a continuous channel from the Hudson River to the East River, with a width of not less than 150 feet and a depth of not less than 15 feet, and below Macombs Dam Bridge the width varies from 150 to 400 feet. At and near the Hudson River it is 400 feet wide.

OPERATIONS DURING THE PAST FISCAL YEAR.

Six automatic self-registering tide gauges placed along the Harlem River from the East River at the mouth of the Bronx Kills to the Hudson River, were in operation from August, 1904, to June, 1905, except for a short period when the ice interfered with their working.

An obstruction having been reported near the Fourth Avenue Bridge, an examination was made by a diver, who found a quantity of loose rock, estimated at about 200 tons, lying in the channel near the center pier and extending to within 10 feet of the surface. Public notices were issued on September 23, 1904, requesting bids for the removal of obstruction, to be opened October 3, 1904. Six bids were received, ranging in price from $489 to $1,600. An agreement was made with R. G. Packard & Co. to remove the obstruction for $489. This work was completed in December, 1904.

A project for the expenditure of $75,000, appropriated by the river and harbor act of March 3, 1905, was approved May 9, 1905.

About 60 per cent of the work proposed under the present project has been completed.

It is proposed to expend the available funds and the additional appropriation recommended in dredging out the channel for increased width at points where it is most needed and in removing the ledge rock under Macombs Dam Bridge that was uncovered by dredging operations pursued under last appropriation for this waterway.

Money statement.

July 1, 1904, balance unexpended	$1,717.54
Amount appropriated by river and harbor act approved March 3, 1905	75,000.00
	76,717.54
June 30, 1905, amount expended during fiscal year, for works of improvement	1,717.54
July 1, 1905, balance unexpended	75,000.00
July 1, 1905, outstanding liabilities	3.50
July 1, 1905, balance available	74,996.50
Amount (estimated) required for completion of existing project	1,305,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	200,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

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APPROPRIATIONS.

June 23, 1874 (allotment)	$11,000	August 18, 1894	$125,000
March 3, 1875	10,000	June 3, 1896	125,000
June 18, 1878	300,000	March 3, 1899	100,000
March 3, 1879	100,000	June 13, 1902	75,000
August 11, 1888	70,000	March 3, 1905	75,000
September 19, 1890	250,000		
July 13, 1892	175,000	Total	1,416,000

COMMERCIAL STATISTICS.

Vessels employed in trade in 1904.

Class.	Tonnage.	Draft.
		Feet.
Steamers	50–541	6–14
Sailing vessels	95–2,000	6–20
Barges, canal boats, lighters, etc	65–8,000	5–14

Freight handled.

	Tons.		Tons.
Fertilizer	14,328	Hay and straw	72,858
General merchandise	4,264,077	Grain, flour, and feed	377,142
Iron	25,035	Fruits and farm products	3,103
Coal and other fuel	2,576,288		
Brick	880,908	Total	8,867,268
Building stone	160,264		
Cement, lime, and sand	193,556	Ashes and sweepings	186,309
Ice	172,493	Garbage	77,186
Lumber and timber	127,216		

Estimated value of 1904 tonnage, $231,384,004.
Number of passengers carried, 107,046.

E 9.

IMPROVEMENT OF NEWTOWN CREEK, NEW YORK.

Details concerning this improvement appear in the Reports of the Chief of Engineers for 1896, pages 760 and 761, and 1900, page 1141.

OPERATIONS DURING THE PAST FISCAL YEAR.

No work has been done during the year.

A project for the expenditure of funds was approved May 25, 1905. Specifications for dredging have been prepared. The project at this place has been completed, except removal of works near the mouth of the creek and widening the same.

The completed channel, 125 feet wide and 18 feet deep at mean low water from the mouth of the creek to the head of navigation at the Metropolitan Avenue Bridge has deteriorated somewhat.

The present appropriation is to be applied to maintaining the channel by dredging.

The appropriation recommended for fiscal year ending June 30, 1907, will be applied to maintaining the channel.

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Money statement.

Amount appropriated by river and harbor act approved March 3, 1905	$5,000.00
July 1, 1905, balance unexpended	5,000.00
Amount (estimated) required for completion of existing project	14,792.61
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:	
For works of improvement	$14,792.61
For maintenance	5,000.00
	19,792.61
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

June 14, 1880	$10,000	June 3, 1896	$30,000
August 2, 1882	15,000	June 4, 1897	183,000
July 5, 1884	20,000	June 13, 1902 (allotment of May 20, 1904)	400
August 5, 1886	37,500	March 3, 1905	5,000
August 11, 1888	25,000		
September 19, 1890	35,000		
July 13, 1892	35,000	Total	415,900
August 18, 1894	20,000		

COMMERCIAL STATISTICS.

Vessels employed in trade in 1904.

Class.	Tonnage.	Draft.
		Feet.
Steamers, tugs not included	125–350	8–19
Sailing vessels	54–5,000	6–19
Barges, canal boats, and lighters	35–6,000	4–20½

Freight handled.

	Tons.		Tons.
General merchandise	138,914	Lumber and timber	358,610
Iron	43,626	Hay and straw	5,890
Coal and other fuel	1,250,530	Oil	800,755
Brick	186,313	Grain, flour, and feed	395
Building stone	143,998	Fertilizer	103,545
Cement, lime, and sand	227,661	Copper ores and mattes	383,237
Chalk, whiting, etc	12,473		
Ice	115,779	Total	3,771,726

Estimated value of 1904 tonnage, $108,513,377.
Total number of trips reported for above vessels, 22,404.

E 10.

IMPROVEMENT OF BROWNS CREEK, SAYVILLE, LONG ISLAND, NEW YORK.

Detailed descriptions of this improvement are printed in the Reports of the Chief of Engineers for 1897, pages 1111 to 1114, and for 1900, page 1417.

OPERATIONS DURING THE PAST FISCAL YEAR.

No work has been done during the year. A project for the expenditure of funds appropriated by the river and harbor act of March 3,

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1905, was approved May 26, 1905. Specifications for dredging have been prepared. About 54 per cent of the work proposed under the present project has been completed.

The present appropriation is to be applied in extending and in maintaining the channel by dredging.

It is proposed to apply the amount estimated as a profitable expenditure for the fiscal year ending June 30, 1907, to maintaining the channel.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1905	$3,000.00
July 1, 1905, balance unexpended	3,000.00
Amount (estimated) required for completion of existing project	15,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	3,000.00

APPROPRIATIONS.

September 19, 1890	$12,000	March 3, 1899	$3,000
July 13, 1892	5,000	March 3, 1905	3,000
August 18, 1894	4,000		
June 3, 1896	4,000	Total	31,000

COMMERCIAL STATISTICS.

Vessels employed in trade in 1904.

Class.	Number of vessels.	Tonnage.	Draft.
			Feet.
Steam and tow boats	40	5-75	3-6
Sail	176	3-100	2-7
Barges, etc	16	5-100	1-4

Freight handled.

	Tons.		Tons.
Oysters, clams, and fish	21,000	Lumber and timber	400
Coal and other fuel	1,500	Hay and straw	50
Brick	800	Fertilizers	50
Building stone	50		
Cement, lime, and sand	150	Total	24,000

Estimated value of 1904 tonnage, $807,075.

E 11.

IMPROVEMENT OF GREAT SOUTH BAY, NEW YORK.

For description of locality and projects for improvement see Reports of the Chief of Engineers for 1901, pages 1249 to 1261, and for 1903, page 134.

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OPERATIONS DURING THE PAST FISCAL YEAR.

The work having been stopped December 12, 1903, by an injunction, it was recommended that Kirk, Driscoll & Co.'s contract be terminated. This was done by a supplemental contract dated June 2, 1904, and approved July 19, 1904.

About 87 per cent of the work proposed under this project has been completed.

Complaints having been made regarding the obstruction of navigable channels in Great South Bay by fish pounds, a survey has been made of the portion of the bay obstructed.

A project for the expenditure of funds appropriated by the river and harbor act of March 3, 1905, was approved on May 26, 1905, and specifications for dredging have been prepared.

It is proposed to expend the funds appropriated by the river and harbor act of March 3, 1905, in maintaining the channel by dredging.

The available balance and the appropriation recommended for fiscal year ending June 30, 1907, will be applied to maintaining the channel.

The effect of the improvement has probably been to reduce the freight rates since the channel has been deepened.

Money statement.

July 1, 1904, balance unexpended	$16,783.19
Amount appropriated by river and harbor act approved March 3, 1905	2,000.00
	18,783.19
June 30, 1905, amount expended during fiscal year, for works of improvement	8,025.06
July 1, 1905, balance unexpended	10,758.13
July 1, 1905, outstanding liabilities	594.50
July 1, 1905, balance available	10,163.63
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	2,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

APPROPRIATIONS.

For first project.

September 19, 1890	$15,000
July 13, 1892	8,000
August 18, 1894	4,000
June 3, 1896	13,000
Total	40,000

For present project.

June 13, 1902	$66,000
March 3, 1905	2,000
Total	68,000
Total for both projects	108,000

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CONTRACT IN FORCE.

Name of contractor: Kirk, Driscoll & Co.
Date of contract: October 7, 1902.
Date of approval: November 6, 1902.
Date of commencement: November 28, 1902.
Date of completion: Time limit waived.
To dredge 140,000 cubic yards in Great South Bay, at 23½ cents per cubic yard, and 120,000 cubic yards in Patchogue River, at 23 cents per cubic pard.

This contract was terminated by a supplemental contract dated June 2 and approved July 19, 1904.

COMMERCIAL STATISTICS.

Vessels employed in trade in 1904.

Class.	Trips made.	Tonnage.	Draft.
			Feet.
Steam	2,800	18–70	3-5
Sail	9,020	4-300	2-8
Barges, etc	4,000	30-100	2-5

Freight handled.

	Tons.
Fish and oysters	5,162
General merchandise	37,500
Coal and other fuel	17,175
Brick	380
Lumber and timber	197,662
Total	257,879

Estimated value of 1904 tonnage, $4,037,130.

E 12.

IMPROVEMENT OF HUDSON RIVER, NEW YORK.

At the beginning of the fiscal year dredging was in progress under contract with the Newburgh Dredging Company, and dike construction and repairs under contracts with the United States Fidelity and Guaranty Company and Kirk, Driscoll & Co.

Dredging for the relief of navigation under contract with the Newburgh Dredging Company, as shown by the following table, was carried on until July 12, when, the contract being completed, the plant was moved elsewhere:

Mulls Cross-over:	
Cubic yards	2,493
Price	$0.25
Amount	$623.25

Dike construction and repairs under contract with Kirk, Driscoll & Co. was continued until December 30, 1904, when it was suspended on account of ice, and resumed April 8, 1905. The contract was completed June 20, 1905, when the following material had been put in place, viz:

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Material.	Amount.	Price per unit.	Value.
Pine piling ..... linear feet..	27,137	$0.12	$3,256.44
Sheet piling ..... feet B. M..	116,985	.15	5,849.25
Round timber ..... linear feet..	2,429	.10	242.90
Square timber ..... feet B. M..	126,131	.05	6,306.55
Tie-rods and screw bolts ..... pounds..	47,999	.05	2,399.95
Driftbolts and washers ..... do....	19,658	.05	982.90
Paving stone ..... cubic yards..	88	1.60	140.80
Large rubble ..... do....	2,552	1.50	3,828.00
Ordinary rubble ..... do....	4,335	1.00	4,335.00
Quarry spalls ..... do....	2,761	.80	2,208.80
Dredged material ..... do....	202	.25	50.50
Dredging ..... do....	1,000	.35	350.00
Total			29,948.09

Dike construction and repairs under contract with the United States Fidelity and Guaranty Company was continued until November 16, 1904, when, owing to cold weather, the plant was withdrawn until May 6, 1905, and was still in progress at the end of the fiscal year, when the following material had been put in place, viz:

Material.	Amount.	Price per unit.	Value.
Round piling ..... linear feet..	17,478	$0.0975	$1,703.61
Sheet piling ..... feet B. M..	177,084	.032	5,665.09
Round timber ..... linear feet..	10,027	.085	852.29
Square timber ..... feet B. M..	157,206	.032	5,030.59
Tie-rods and screw-bolts ..... pounds..	69,203	.0375	2,595.11
Driftbolts and washers ..... do....	19,594	.0375	734.77
Rubblestone ..... cubic yards..	5,859	.80	4,687.20
Quarry spalls ..... do....	3,389	.80	2,711.20
Paving stone ..... do....	2,431	1.30	3,160.30
Dredged material ..... do....	1,973	.20	394.60
Total			27,534.76

Under agreement with W. C. Flannery for putting in place a concrete footing course for repairing paved dikes the following quantity was put in place, completing 310 linear feet of footing course, viz:

Concrete:

Amount	cubic yards	69.54
Price per unit		$8.50
Value		$591.09

Dike construction and repairs are still in progress. The following table shows the character of the work, total length of dike constructed and repaired under the contracts in force, whether completed or in progress, the amount expended on each dike during the past fiscal year, and total expenditure under the contracts and agreements:

Name of dike.	When built.	Character of work.	Present condition.	Length of dike repaired.	Cost during fiscal year.	Length of dike.	Total cost 1901–1905.
				Feet.		*Feet.*	
Coxsackie Island ..	1893	Piling and filling ..	Completed .	200	.....	1,523	$420.80
Lighthouse Island.	1893	Rubblestone	....do	200	.....	2,134	552.00
Bronks Island	1895	Stone filling	....do	300	.....	5,842	175.20
West New Baltimore.	1875-76	....do	....do	1,000	$228.80	3,370	228.80
Willow Island	1899	....do	....do	100	104.00	1,200	104.00
Mulls Island, half..	1868-69	New piling	....do	2,833	.....	2,833	4,318.76
Barren Island	1871-72	New front and filling.	....do	414	414.86	1,428	973.70
Middle Coeymans .	1871-72	New piling and filling.	....do	2,488	.....	2,684	3,508.56

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Name of dike.	When built.	Character of work.	Present condition.	Length of dike repaired.	Cost during fiscal year.	Length of dike.	Total cost 1901-1906.
				Feet.		*Feet.*	
Mulls Plaat:							
Sheet pile	1901-4	All new	Completed	2,543		2,543	$12,964.91
Dike extension	1892	Stone filling	do	150		750	61.60
Schodack, half	1872	New front and filling.	do	610		610	1,214.60
Schodack (N. Y. S.)	1866-67	do	do	1,081		3,344	1,842.41
Mulls Timber	1891-92	Stone filling	do	2,529	$484.00	2,529	484.00
Upper Schodack Island, half.	1869-70	New front and filling.	do	666		714	1,471.17
Ninemile Tree	1869	do	do	647		647	1,172.26
Castleton (N. Y. S.)	1863-64	do	do	990	244.00	3,360	2,357.06
Castleton (U. S.)	1870	do	do	1,100	60.00	1,580	2,256.21
Cedar Hill:							
Poplar Island	1868-69	do	do	1,396	42.40	1,396	2,458.51
Sec. III	1868	Stone filling	do	3,585	288.40	3,585	547.20
Cow Island	1868	New front and filling.	In progress	1,806	61.68	1,850	3,274.83
Campbell Island, half.	1868	do	Completed	1,355		1,355	2,100.36
Campbell Island, single pile.	1879	Rebuilt	do	1,370	4,761.65	1,370	9,855.85
Campbell Island	1894-95	Stone filling	do	3,999		6,264	671.20
Winnies	1869	New front and filling.	do	988		2,480	1,667.52
Papscanee:							
Sec. III, extension.	1903-4	All new	do	1,643	7,222.50	1,643	15,749.39
Sec. III	1877	New front and filling.	do	2,564	3,172.64	2,564	8,745.56
Overslaugh No. 2	1837-39	Rubble and paving stone.	In progress	2,000	370.50	4,180	1,388.40
Abbey Cut	1863	New front and filling.	Completed	404		404	1,540.09
Beacon Island, half	1866	do	do	270	998.16	880	1,054.16
Beacon Island, paved.	1837-39	Rebuilt	In progress	310	1,278.02	1,237	1,367.62
Papscanee:							
Sec. II, extension.	1897	Stone filling	Completed	1,437		1,437	200.80
Sec. II	1877	New piling and filling.	do	1,506	6,427.09	1,506	6,486.29
Sec. I, extension.	1897	Stone filling	do	809		809	61.60
Sec. 1a	1877	New front and filling.	do	933	162.40	933	2,511.07
Sec. 1b	1877	do	do	1,174	1,843.77	1,174	2,951.93
Overslaugh:							
No. 1b	1837	Footing and paving.	In progress	562	744.90	562	744.90
No. 1c	1837						
Bogart Island, high.	1866	Revetment	Completed	300		1,570	249.60
		Raised and paved	do	614	3,532.83	614	3,532.83
Bogart Island	1866	New front and filling.	do	1,295	965.09	1,295	1,976.56
Small Island	1874	Sheet piling and filling.	In progress	4,805	12,885.62	4,805	24,207.02
Douws Point extension.	1878	New front and filling.	Completed	1,001		1,001	2,666.49
Douws Point	1868	New piling and filling.	do	1,615		1,615	746.56
Cuyler	1865	New front and filling.	do	50		2,798	118.40
Patroons:							
Lower Island, extension.	1903-4	All new	In progress	155		155	775.39
Lower Island, paved.	1894-5	Rubble and paving stone.	do	150		6,027	422.70
Bath	1870	Stone filling	Completed	2,000		3,486	356.00
Bath sheet pile	1873-77	Sheet piling and filling.	In progress	3,343	2,628.11	3,343	14,092.61
Patroons Island, revetment.	1839	Rubble and paving stone.	Completed	30		2,300	171.90
Base Island	1894-95	do	do	1,500	416.00	5,098	1,131.30
High	1867	Sheet piling and filling.	In progress	3,027	8,201.44	3,027	9,017.54
Hillhouse Island, revetment.	1836	Rubble and paving stone.	Completed	30		1,900	139.00
Breaker Island, revetment.	1894	Paving stone	do	10		1,900	6.50
Port Schuyler	1837	Rubblestone	do	100		2,070	73.40
Total					57,482.86		156,372.14

About 75 per cent of the work on the project has been completed.

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Ice closed navigation December 4, 1904, and remained firm all winter, except in front of Troy, from the State dam to Breaker Island, where it broke up, but remained solid above the State dam. March 24 the ice, which had been very heavy, moved from in front of Albany, and as there had been no dams formed in the early winter by the ice starting to go out and stopping somewhere near the New Baltimore or Stuyvesant, it did not stop long at any bar, and consequently formed no bad shoals, but the movement downstream of shoals formed by former ice dams outside of the channel limits, which had not been removed by dredging, still continues, and consequently the depth in the channel at several points has decreased, notably at Bath and Mulls cross-overs, at North Coeymans, and at Stonehouse bar.

The following table shows the widths and depths of the deepest navigable channel, through bars and shoals between Coxsackie and the State dam at Troy, N. Y., as developed by soundings since the opening of navigation, and for the previous year, for comparison:

Locality.	1904.		1905.	
	Width.	Depth.	Width.	Depth.
	Feet.	*Feet.*	*Feet.*	*Feet.*
Coxsackie shoal	150	11.0	120	11.5
Coxsackie light to Stuyvesant light	500	.....	400	12.0
Stonehouse bar	60	11.0	190	10.5
Willow Island shoal	450	12.0	400	12.0
Coeymans Cross-over	350	.....	350	12.0
Roah hook to North Coeymans	200	18.0	150	11.0
Mulls Cross-over	150	12.0	150	11.5
Ninemile Tree Cross-over	250	11.0	150	12.0
Castleton bar	150	11.5	160	11.5
Cedar Hill bar	100	11.5	50	11.5
Winnies bar	250	12.0	90	12.0
Stonelight shoal	80	11.5	150	11.0
Beacon Island shoal	300	12.0	550	12.0
Bogart light shoal	50	11.5	50	12.0
Douws Point Cross-over	200	12.0	200	12.0
Cuyler bar	200	11.5	150	11.5
Passenger bridge:				
East draw	25	12.0	20	12.0
West draw	100	12.0	20	12.0
West fixed span	140	12.0	140	12.0
Freight bridge:				
West draw	100	12.0	100	12.0
East draw	100	12.0	100	12.0
East fixed span	100	12.0	100	12.0
Bath Cross-over	50	11.0	150	10.0
Bath shoal	250	12.0	250	12.0
Kellogg shoal	50	11.5	30	11.5
Fishhouse shoal	250	12.0	220	12.0
Round shoal	100	11.5	50	11.5
Covills shoal	150	12.0	80	12.0
Opposite Breaker Island	230	12.0	220	12.0
Van Buren bar	150	12.0	200	12.0
Washington bar	230	12.0	150	12.0
Front of Watervliet Arsenal	200	12.0	250	12.0
Arsenal to Congress street, Troy, N. Y	350	12.0	250	
Congress street bridge:				12.0
East draw	50	12.0	70	12.0
East fixed span	170	12.0	180	12.0
Congress street to Broadway	400	11.5	250	12.0
Broadway to Delaware and Hudson bridge	50	12.0	120	12.0
Delaware and Hudson bridge:				
Draw span	25	10.0	20	12.0
East fixed span	60	12.0	100	12.0
To Hoosic street	60	11.0	70	11.0
Hoosic street to Rensselaer street	60	11.0	100	12.0
Rensselaer street to Middleburgh street	100	9.0	100	9.0
Rensselaer to Sloop lock	20	4.5	20	4.5

The above depths refer to the plane of mean low water established in 1876, except between the Delaware and Hudson Company's bridge and State dam at Troy, N. Y., where the plane established by the

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records of 1899, after the dredging had been nearly completed as far as the above bridge, is used.

A comparison of the above table of widths and depths with that for the two or three previous years shows a marked deterioration on quite a number of the bars and shoals. This deterioration can be accounted for by stating that very little dredging was done in the past season, the contracts for that class of work having been completed, and to the fact that there is steady movement downstream of the smaller shoals and that frequently shoals formed outside of the channel during ice gorges will work down and into the channel if they are not removed.

This improvement has been under the supervision of Mr. R. H. Talcott, assistant engineer, stationed at Albany.

It is proposed to apply the available balances and additional appropriation recommended approximately as follows: $10,000 to dredging at Tarrytown; $110,000 to maintenance of Hudson River; about $20,000 for rock removal near Troy, and of the balance about two-thirds for diking and one-third for dredging, all under the existing project.

Money statement.

July 1, 1904, balance unexpended		$104,455.06
Amount appropriated by river and harbor act approved March 3, 1905		203,300.00
		307,755.06
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$74,576.18	
For maintenance of improvement	9,948.59	
		84,524.77
July 1, 1905, balance unexpended		223,230.29
July 1, 1905, outstanding liabilities		14,957.30
July 1, 1905, balance available		208,272.99
July 1, 1905, amount covered by uncompleted contracts		6,479.24
Amount (estimated) required for completion of existing project		1,067,406.68
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$400,000.00	
For maintenance of improvement	70,000.00	
		470,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

APPROPRIATIONS.

July 30, 1834	$70,000.00	March 3, 1871	$40,000.00
July 2, 1836	100,000.00	June 10, 1872	40,000.00
March 3, 1837	100,000.00	March 3, 1873	40,000.00
July 7, 1838	100,000.00	June 23, 1874	40,000.00
August 30, 1852	50,000.00	March 3, 1875	40,000.00
June 26, 1864 (allotment)	33,000.00	August 14, 1876	50,000.00
June 23, 1866	50,000.00	June 18, 1878	70,000.00
March 3, 1867	305,188.00	March 3, 1879	30,000.00
July 25, 1868 (allotment)	85,000.00	June 14, 1880	20,000.00
April 10, 1869 (allotment)	98,100.00	March 3, 1881	15,000.00
July 11, 1870	40,000.00	August 2, 1882	10,000.00

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July 5, 1884	$30,000.00	July 1, 1898	$160,406.56
August 5, 1886	26,250.00	March 3, 1899	100,000.00
August 11, 1888	75,000.00	June 6, 1900	400,000.00
September 19, 1890	119,400.00	March 3, 1901	100,000.00
September 19, 1890 (balance)	30,600.00	June 13, 1902	225,000.00
July 13, 1892	187,500.00	March 3, 1905	203,300.00
March 3, 1893	500,000.00	Total	5,174,744.56
August 18, 1894	145,000.00	January 11, 1901 (repayment to appropriation)	5.40
March 3, 1895	500,000.00		
June 11, 1896	480,000.00		
June 4, 1897	475,000.00		

CONTRACTS IN FORCE.

Name of contractor: The United States Fidelity and Guaranty Company.
Date of contract: October 11, 1901.
Date of approval: November 9, 1901.
Date of commencement: On or before November 10, 1901.
Date of completion: October 31, 1902. (Time limit waived.)
For construction and repair of dikes, material to be paid for at following rates: Piles, 9¾ cents per linear foot; sheet piling and square timber, $32 per 1,000 feet B. M.; round timber, 8½ cents per linear foot; iron, 3¾ cents per pound; rubblestone and spalls, 80 cents per cubic yard; paving stone, $1.30 per cubic yard and dredging at 20 cents per cubic yard.

Name of contractor: Kirk, Driscoll & Co.
Date of contract: September 30, 1902.
Date of approval: October 30, 1902.
Date of commencement: October 1, 1902.
Date of completion: November 30, 1903.
For constructing and repairing dikes, at rates of 12 cents per linear foot for round piling, 10 cents per linear foot for round timber, $50 per 1,000 feet, B. M., for sheet piling and square timber, $1.50 per cubic yard for large rubblestone, and $1 per cubic yard for ordinary rubblestone.

Name of contractor: The Newburgh Dredging Company.
Date of contract: July 2, 1903.
Date of approval: July 16, 1903.
Date of commencement: August 20, 1903.
Date of completion: December 31, 1903. (Time limit waived.)
For dredging 120,000 cubic yards, at 25 cents.

COMMERCIAL STATISTICS.

Commerce within the limits of the improvement during the season of 1904.

Articles.	Quantity.	Value.	Articles.	Quantity.	Value.
	Tons.			*Tons.*	
Brick	95,072	$450,432.00	Ice	713,016	$1,782,540.00
Lumber and timber	614,119	17,502,391.50	Stone, cement, etc.	399,529	998,822.50
Pulp wood and wood pulp	7,787	90,909.75	Fuel	613,332	2,299,995.00
Vegetable food	293,394	10,896,653.16	Ore	45,536	227,680.00
Hay	41,307	61,960.50	Sundries	2,324	371,840.00
Manufactures	55,974	15,057,006.00	Total	3,518,545	150,893,080.41
General merchandise	632,205	101,152,800.00			

Number of passengers carried in 1904, 1,117,785.

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E 13.

IMPROVEMENT OF HARBOR AT SAUGERTIES, NEW YORK.

Detailed descriptions of the harbor and of the project for improvement are printed in the Reports of the Chief of Engineers for 1895, page 190, and 1900, pages 1518 to 1520. A sketch of the harbor is printed in the Report of the Chief of Engineers for 1904, page 1046.

Operations during the fiscal year ending June 30, 1905, consisted in the removal of a portion of a shoal which had formed along the dock front on the north side of the harbor, which was apparently largely the result of the change in the regimen of the creek, caused by the removal of the portion of the reef of rock extending north of Barclays Point. Eleven thousand cubic yards were removed under an extended contract with the Newburgh Dredging Company, of Newburg, N. Y., at 22½ cents per cubic yard, or a total cost of $2,475.01. This work was completed August 1, 1904.

The results of the dredging were to restore to a depth of 6 feet at mean low water the water front along about 1,000 linear feet of dock, and enable barges to load bluestone without shifting to other docks.

Soundings made June 5–8, 1905, do not show any material change in the condition of the channel since April, 1904, when previous survey was made.

About 10 per cent of the work proposed under the present project has been completed.

It is proposed to apply the available balance and additional appropriation recommended to the completion of the project.

Money statement.

July 1, 1904, balance unexpended		$4,421.81
Amount appropriated by river and harbor act approved March 3, 1905		5,000.00
		9,421.81
June 30, 1905, amount expended during fiscal year, for maintenance of improvement		4,638.13
July 1, 1905, balance unexpended		4,783.68
July 1, 1905, outstanding liabilities		18.43
July 1, 1905, balance available		4,765.25
Amount (estimated) required for completion of existing project		19,685.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$19,685.00	
For maintenance of improvement	5,000.00	
		24,685.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

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APPROPRIATIONS.

For first project.

July 5, 1885	$5,000
August 5, 1886	15,000
August 11, 1888	12,000
September 19, 1890	10,000
July 13, 1892	5,000
August 18, 1894	5,000
June 3, 1896	2,500
March 3, 1899	2,500
	57,000

For present project.

June 13, 1902	20,000
June 13, 1902, allotment (emergency)	3,000
March 3, 1903	5,000
Total	28,000
Total for both projects	85,000

CONTRACT IN FORCE.

Name of contractor: The Newburgh Dredging Company.
Date of contract: June 28, 1904.
Date of approval: July 12, 1904.
Date of commencement: July 13, 1904.
Date of completion: September 30, 1904.
For dredging 11,000 cubic yards, at 22½ cents per cubic yard.

COMMERCIAL STATISTICS.

Articles.	Quantity.	Value.	Articles.	Quantity.	Value.
	Tons.			*Tons.*	
Lumber and timber	2,500	$71,250	Stone, cement, sand, etc	55,000	$1,137,500
Vegetable food	500	18,570	Fuel	12,500	46,875
Hay	1,200	18,000	Sundries	3,000	480,000
Manufactures	35,000	17,500,000			
General merchandise	3,500	580,000	Total	113,200	18,832,195

E 14.

IMPROVEMENT OF HARBORS AT RONDOUT AND PEEKSKILL, NEW YORK.

(A) RONDOUT HARBOR.

Detailed descriptions of the harbor and of projects for its improvement are printed in the Reports of the Chief of Engineers for 1880, pages 494 and 495, and for 1895, pages 913 and 914. A sketch is printed in Report of the Chief of Engineers for 1903, page 884.

During the fiscal year ending June 30, 1905, under modification of the contract with Messrs P. W. Myers & Son, of Albany, N. Y.,

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entered into July 15, 1904, dredging was resumed August 18 and completed September 30, and the following quantity removed from the shoal off the east end of the south dike and between the north dike and the south dike, viz, 23,718 cubic yards, at 15½ cents per cubic yard, $3,676.29.

The result of this dredging was to deepen to 14 feet and over the area dredged to 12 feet under the original contract with Messrs. P. W. Myers & Son, and to widen the 14-foot channel at the entrance to the dikes.

The project at this place has been completed.

It is proposed to apply the available balances and additional appropriations recommended to restoring the lost depth, and also to reform the outer end of the south dike.

Money statement.

July 1, 1904, balance unexpended	$4,252.55
Amount appropriated by river and harbor act approved March 3, 1905	15,000.00
	19,252.55
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	4,252.55
July 1, 1905, balance unexpended	15,000.00
July 1, 1905, outstanding liabilities	39.61
July 1, 1905, balance available	14,960.39
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	3,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

June 10, 1872	$10,000	September 19, 1890	$5,000
March 3, 1873	20,000	July 13, 1892	5,000
June 8, 1875 (allotment)	1,000	August 18, 1894	5,000
August 14, 1876	30,000	June 3, 1896	2,500
June 15, 1878	30,000	June 13, 1902 (allotment)	2,500
August 2, 1882	2,000	June 13, 1902 (allotment)	3,800
July 5, 1884	1,000	March 3, 1905 (allotment)	15,000
August 5, 1886	2,500		
August 11, 1888	5,000	Total	140,300

CONTRACT IN FORCE.

Name of contractor: P. W. Myers & Son.
Date of contract: July 15, 1904.
Date of approval: July 29, 1904.
Date of commencement: July 29, 1904.
Date of completion: October 1, 1904.
Work to be done: Dredging 23,500 cubic yards at 15½ cents per cubic yard.
Amount to be expended: $3,642.50.

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COMMERCIAL STATISTICS FOR 1904.

Articles.	Quantity.	Value.
	Tons.	
General merchandise	150,000	$30,000,000
Brick, timber, etc	500,000	8,800,000
Ice	100,000	100,000
Stone, cement, etc	450,000	1,125,000
Coal	260,000	1,040,000
Total	1,460,000	41,065,000

(B) PEEKSKILL HARBOR.

Detailed descriptions of the harbor and of project for its improvement are printed in the Reports of the Chief of Engineers for 1895, pages 999 to 1002, and for 1897, pages 1016 and 1017. A sketch is printed in Report of the Chief of Engineers for 1903, page 885.

During the fiscal year ending June 30, 1905, nothing was done on the improvement, there being no available funds.

The project at this place has been completed.

It is proposed to apply the available funds and the additional appropriation recommended for the fiscal year 1907 to dredging where shoaling has occurred.

Money statement.

July 1, 1904, balance unexpended	$352.68
Amount appropriated by river and harbor act approved March 3, 1905	2,500.00
	2,852.68
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	352.68
July 1, 1905, balance unexpended	2,500.00
July 1, 1905, outstanding liabilities	75.68
July 1, 1905, balance available	2,424.32
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	3,000.00

APPROPRIATIONS.

June 3, 1896	$10,000
March 3, 1899	10,000
June 13, 1902 (allotment)	3,000
March 3, 1905 (allotment)	2,500
Total	25,500

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COMMERCIAL STATISTICS FOR 1904.

Articles.	Quantity.	Value.	Articles.	Quantity.	Value.
	Tons.			*Tons.*	
Brick	850	$5,100.00	Stone, cement, etc	9,651	$24,127.50
Lumber and timber	405	11,542.50	Fuel	45,467	170,501.25
Vegetable food	4,724	175,449.38	Ore	450	2,250.00
Hay	553	8,295.00	Sundries	3,152	504,320.00
Manufactures	848	424,000.00			
General merchandise	15,165	2,426,400.00	Total	81,265	3,751,985.61

E 15.

IMPROVEMENT OF WAPPINGER CREEK, NEW YORK.

Detailed descriptions of the stream and of the project for improvement are printed in the Report of the Chief of Engineers for 1893, pages 1024 and 1025. A sketch is printed in Report of the Chief of Engineers for 1904, page 1051.

During the fiscal year ending June 30, 1905, dredging was done under a contract with P. W. Myers & Son from July 30 to August 15, 1904, when the contract was completed, the following quantity having been removed from the channel: 5,463 cubic yards, at 21½ cents per cubic yard, $1,174.55.

The result of this dredging was to relieve navigation in the upper part of the creek by widening the channel to about 30 feet and restoring the depth to 8 feet, but owing to the heavy freshet which had occurred in October, 1903, and the large quantity of silt, sand, and gravel brought down and dropped in the channel the contract was completed before the proposed depth of 8 feet and width of 40 feet through the whole navigable section could be obtained.

The project has been completed.

It is proposed to apply the available balances and the additional appropriations recommended to maintenance of the improvement by dredging.

Money statement.

July 1, 1904, balance unexpended	$1,342.07
Amount appropriated by river and harbor act approved March 3, 1905	3,000.00
	4,342.07
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	1,342.07
July 1, 1905, balance unexpended	3,000.00
July 1, 1905, outstanding liabilities	57.90
July 1, 1905, balance available	2,942.10
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	5,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

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APPROPRIATIONS.

September 19, 1890	$13,000
June 13, 1902	1,500
March 3, 1905	3,000
Total	17,500

CONTRACT IN FORCE.

Name of contractor: P. W. Myers & Son.
Date of contract: January 19, 1904.
Date of approval: February 18, 1904.
Date of commencement: May 24, 1904.
Date of completion: Four months after date of commencing work.
For dredging 5,465 cubic yards, at 21½ cents per cubic yard.

COMMERCIAL STATISTICS FOR 1904.

Articles.	Quantity.	Value.	Articles.	Quantity.	Value.
	Tons.			*Tons.*	
Brick	30	$180	Stone, cement, sand, etc.	5,770	$14,425
Lumber and timber	2,000	57,000	Fuel	29,064	109,065
Hay	100	1,500	Sundries	4,064	655,040
Manufactures	18,595	6,797,500			
General merchandise	2,004	320,640	Total	56,927	7,955,975
Ice	250	625			

E 16.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

Wreck of coal barge Percie and Bertha in Hudson River at New York, N. Y.—This boat, loaded with coal, was sunk in the Hudson River off the end of West Fifty-ninth street pier some time during the month of January, 1904. Under date of July 25, 1904, the department of docks and ferries of New York City reported the wreck as a menace to navigation and requested its removal. After due investigation and inquiry it was learned that John Quinn was the reputed owner of the boat, and an order was sent to him to remove the boat and cargo without delay. After the lapse of thirty days, nothing having been heard from Quinn, public notices, dated August 1, 1904, were issued inviting bids for the removal of the wreck, to be opened August 10. Two bids were received, for $543 and $625, respectively. Both were rejected as being excessive, and new notices were issued, dated August 18, inviting bids, to be opened August 29. The lowest bid received was from John F. Baxter, who agreed to dispose of the wreck for $530. This received the approval of the Department September 1, 1904, an allotment of the amount being made. The removal of the wreck was completed October 6, 1904, at a total cost of $530. Final report was submitted October 11, 1904.

Wrecks of two unknown boats in Harlem River, New York.—One of

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these was a canal boat sunk in the Harlem River near the foot of One hundred and forty-seventh street about three years ago and abandoned by its owners. The other was an old schooner sunk in the Harlem River just above Washington Bridge, opposite to West One hundred and eighty-fifth street, six or seven years ago and abandoned by its owners. The first wreck was reported by the department of docks and ferries of New York City under date of August 30, 1904, and a request made for its removal. The other was found on September 6. Public notices, dated September 16, 1904, were issued inviting proposals for their removal, to be opened September 26. Three bids were received, the lowest being that of John F. Baxter, to remove and dispose of the wrecks for $778. This received the approval of the Department October 3, 1904, an allotment of the amount being made. The removal of the wrecks was completed at a total cost of $778, and a final report was submitted November 5, 1904.

Wreck of unknown schooner in Great South Bay, New York.—This wreck was sunk in the channel in Great South Bay opposite to Browns Point. Under date of April 28, 1905, it was reported to the Department as a menace to navigation by the Lewis Blue Point Oyster Cultivation Company and a request made for its removal. An examination of the wreck was made on May 10, 1905, and a recommendation submitted asking that an allotment of $100 be made for its removal, which would be done under the provisions of section 19 of the river and harbor act of March 3, 1899. The allotment was made May 13, 1905. A circular letter dated May 25, 1905, was sent to various parties, asking bids for its removal.

One bid was received from the Merritt & Chapman Derrick and Wrecking Company to remove the wreck for $750, which was considered excessive and was rejected. The wreck was broken up with dynamite by the use of steamer *Sentinel* and employees of this office, so as to be no longer a menace to navigation, on June 24, 1905, at a cost of $100.

E 17.

PRELIMINARY EXAMINATION AND SURVEY OF FLUSHING BAY, NEW YORK.

[Printed in H. Doc. No. 98, 58th Cong., 3d sess.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, December 10, 1904.

SIR: I have the honor to submit herewith, for transmission to Congress, reports dated January 31, 1903, by Col. S. M. Mansfield, Corps of Engineers, and June 21, 1904, by Col. Amos Stickney, Corps of Engineers, upon preliminary examination and survey, respectively, authorized by the river and harbor act approved June 13, 1902, of Flushing Bay, New York, " with a view to repairing, completing, or

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removing the dike in said bay and extending the channel to Ireland [Irland] Mills."

These reports have been referred for consideration by the Board of Engineers for Rivers and Harbors, as required by law, and attention is respectfully invited to the Board's report of the 1st instant in tenth indorsement herewith, which concludes as follows:

After careful consideration the Board has arrived at the following conclusions:

The extension of the existing improvement to Irland Mills does not seem to be warranted either by present or prospective demands of commerce. The Board, however, is of the opinion that the projected 6-foot channel can advantageously be extended from the Broadway Bridge to the Main Street Bridge, though with a width of 100 feet instead of 200 feet between the bridges.

As to the dike, a study of the soundings and experience at other places tend to show that, except possibly at its inner (shore) end, it is not an essential part of the improvement. It does not appear, however, that at the present time the dike is a serious menace to navigation, and the Board therefore recommends that it be left as it is until it can be seen from further developments whether that part of the channel along the dike is maintained any better than that portion of the channel beyond the dike, and that then it be removed or repaired and extended, as developments may indicate best.

In view of what precedes, the Board recommends as desirable the further improvement of Flushing Bay, New York, by the United States, in accordance with a modified project which shall provide for a channel 200 feet wide and 6 feet deep at low water, from Long Island Sound to the Broadway Bridge, and for a channel of the same depth and 100 feet wide from the Broadway Bridge to the Main Street Bridge, by means of dredging, at an estimated cost of $23,857.90, and that no work toward repairing, completing, or removing the dike be undertaken at present.

I concur in the views and recommendations of the Board.

Very respectfully,

A. MACKENZIE,
Brig. Gen., Chief of Engineers, U. S. Army.

Hon. WM. H. TAFT,
Secretary of War.

PRELIMINARY EXAMINATION OF FLUSHING BAY, NEW YORK.

UNITED STATES ENGINEER OFFICE,
New York City, January 31, 1903.

GENERAL: Pursuant to instructions contained in Department letter of June 23, 1902, I have the honor to submit herewith the following report on a preliminary examination of "Flushing Bay, with a view to repairing, completing, or removing the dike in said bay and extending the channel to Ireland Mills."

Flushing Bay is on the north shore of Long Island, about 14 miles by water from the Battery, New York City. It is about 1 mile wide and 2 miles long. The bottom is of soft mud, nearly level, the depth in the original channel being not much greater than elsewhere. The town of Flushing is on the east bank of Flushing Creek, just above the head of the bay. In 1861 a depth of 5 feet at low water was reported in the channel leading up to Flushing. A map of Flushing Bay is printed in the Report of the Chief of Engineers for 1889, page 732.

Flushing Creek is a small tidal stream extending southwardly from Flushing Bay, and navigable at high tide for about 2 miles from the head of the bay. Irland Mills is situated on this creek about 6,000

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feet from its mouth. Four bridges cross this creek—first, the Flushing Bridge, near the bay; second and third, bridges of the Long Island Railroad, and, fourth, Strong's Causeway Bridge, situated about 2 miles above the lower bridge. All the bridges are provided with draws, with a least clear opening of 30 feet, and navigation at high tide extends to a point just above Strong's Causeway Bridge. The first three bridges are between the mouth of the creek and Irland Mills.

The original project for improving Flushing Bay, adopted in 1879, provided for the building of 16,700 feet of diking to create a tidal basin intended to fill and discharge through the main channel, thus maintaining a least channel depth of 6 feet, mean low water, after once dredging. Estimated cost, $173,500. The project was modified in 1888, omitting part of the diking, and again in 1891, limiting the same to one dike on the west side of the channel 4,663 feet long, besides dredging and maintaining a channel 6 feet deep, mean low water, up to the lower bridge at Flushing. The mean rise of the tide is 7.1 feet, thus making a navigable channel at high water of about 13 feet.

Work under this project began in 1879, and covered the construction of 3,057 linear feet of dike at the head of the bay. As much opposition to the project was manifested, particularly by the residents and property owners on the west side of the bay, further work on the dike was suspended until 1889, when it was repaired and extended 1,606 linear feet, making its total length 4,663 feet. Appropriations made in the mean time were expended in making and maintaining a channel of the required dimensions by means of dredging.

In 1890 petitions were sent to the Secretary of War protesting against further work on the dike and against the dumping of dredged material in the bay west of the same, in consequence of which, and upon the recommendation of Col. D. C. Houston, Corps of Engineers, June 8, 1891, the project was modified, and all subsequent appropriations were expended toward maintaining the channel by dredging. See Report of the Chief of Engineers for 1892, page 723.

On June 30, 1901, the dike, which had cost about $33,000 to construct, was in poor condition, and since then the outer part, 1,606 feet long, left partly completed in 1891, has been nearly destroyed by storm and ice. A small light at the outer (north) end of the dike, maintained by the Light-House Department, prevents the dike in its present condition from being a serious menace to local navigation. The dredged channel, carried to a depth of 9 feet in order to secure 6 feet, was in good condition and had an available depth at that time of over 6 feet, but it was less than the projected width. The total amount expended in dredging is about $90,000.

Colonel Houston, in report dated September 5, 1888, says:

> Independent of the local opposition, I am doubtful of the effect of the proposed tidal basin; it is not certain that the ebb current will follow the line of the desired channel.

He was of the opinion at that time that the removal of the dike was unnecessary.

On August 13, 1900, Maj. E. H. Ruffner, Corps of Engineers, submitted a report[a] on the utility of this improvement, to which attention is invited.

Since the improvement of Flushing Bay was commenced, the limits

[a] Not printed.

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of New York City have been extended so as to include the bay, and a park is projected on its west shore. It would seem that the riparian owners on that shore should have the same use of the improved channel as those on the east shore and have a free and unobstructed passage to any part on the west shore. This would be impossible with a dike extending through the bay having a channel only on one side of it. The maintenance of a light is an expense which will be done away with on the removal of the dike and navigation will be benefited by having the bay open and unobstructed.

It is estimated that the cost of removing the present dike will be somewhere between $10,000 and $12,000. The unappropriated balance of the original estimated cost of the improvement is $50,500, which would probably be sufficient to remove the dike and maintain a channel 6 feet in depth and of sufficient width for the next twenty years.

Experience from the attempts to improve the channels in Huntington Harbor and in Canarsie channel, Jamaica Bay, favors the improvement of broad, open, tidal bays or harbors by making and maintaining channels therein by dredging, and that dikes are of questionable utility.

From the above consideration it is recommended that the incomplete, dilapidated, and virtually abandoned dike in Flushing Bay be removed so as to leave the bay free and unobstructed, the part to be removed first being the outer or north portion, 1,606 feet long, which was left partly completed in 1891, and which has since been nearly destroyed by storms and ice.

The question as to extending the improvement up Flushing Creek to Irland Mills has not before been considered, and all work heretofore done has been confined to the channel through the bay up to the first bridge across the creek. Inquiries recently made by this office have developed the fact that considerable commerce passes up the creek, amounting to about 69,250 tons yearly, carried in vessels which draw when loaded 14 feet. These vessels can only navigate at extreme high tide. Docks have been erected along the creek between the lower bridge and Irland Mills by dealers in coal, lumber, feed, and grain. Four of these docks are now in use above the bridge.

The river and harbor act of June 13, 1902, contained an appropriation of $39,500 for "improving harbors at Port Jefferson, Huntington, Glencove, Flushing Bay, Canarsie Bay, and Sag Harbor, New York," of which $2,000 was allotted to Flushing Bay. A project for the expenditure of this amount was submitted by this office July 14, 1902, and approved by the Chief of Engineers August 5, 1902. It proposed to expend the amount in redredging the channel for maintenance whenever it becomes necessary.

The total commerce of Flushing Bay and Creek since 1895 is reported as follows:

	Tons.		Tons.
1895	150,376	1900	177,575
1896	80,820	1901	200,473
1897	163,395	1902	186,000
1899	158,755		

The principal articles transported are coal, building materials, dyewoods, logwood extracts, and farm produce, amounting in value to about $1,818,600. The vessels are steamers, tugs, sailing vessels, and barges, drawing from 6 to 14 feet when fully loaded. The total num-

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ber of trips made last year was 1,418. About 45 per cent of the tonnage for 1902 passed up the creek above the bridge.

In my opinion Flushing Creek is worthy of improvement by the General Government, and I therefore report in favor of extending the channel to Irland Mills. If this view is concurred in by the Department, I would suggest that a survey be made, and that the sum of $400 be allotted for the purpose. This survey will enable me to make an estimate for removing the dike, dredging the channel where necessary through the bay, and extending the channel to Irland Mills.

Very respectfully, your obedient servant,

S. M. MANSFIELD,
Colonel, Corps of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. A.

[First indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
February 14, 1903.

Respectfully referred to the Board of Engineers for Rivers and Harbors constituted by Special Orders, No. 24, Headquarters, Corps of Engineers, series of 1902, for consideration and recommendation, as required by section 3 of the act of June 13, 1902.

Report of August 13, 1900, by Maj. E. H. Ruffner, Corps of Engineers, is herewith.

By command of Brig. Gen. Gillespie:

A. MACKENZIE,
Colonel, Corps of Engineers.

[Second indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., March 11, 1903.

Respectfully returned to the Chief of Engineers, United States Army.

The Board of Engineers for Rivers and Harbors has given due consideration to the within report of the district officer.

In the opinion of the Board the present and reasonably prospective commerce involved is such as to render this locality worthy of a moderate improvement, provided such improvement can be made at reasonable cost.

The Board therefore recommends that there be made an allotment of $400 for a survey and estimate of cost, as recommended by the district officer.

For the Board:

H. F. HODGES,
Major, Corps of Engineers,
Senior Member Present.

[Third indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
March 14, 1903.

Respectfully submitted to the Secretary of War.

This is a report on preliminary examination of Flushing Bay, New York, authorized by the river and harbor act of June 13, 1902.

Inviting attention to the report of the Board of Engineers for Rivers

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and Harbors in the preceding indorsement, I recommend that a survey of the locality, as proposed, be authorized.

A. MACKENZIE,
Acting Chief of Engineers.

[Fourth indorsement.]

WAR DEPARTMENT,
March 23, 1903.

Approved as recommended by the Acting Chief of Engineers.

WM. CARY SANGER,
Assistant Secretary of War.

[Tenth indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., December 1, 1904.

Respectfully returned to the Chief of Engineers, United States Army.

The Board of Engineers for Rivers and Harbors has given consideration to the further reports of the district officer contained in eighth indorsement[a] hereon, and in an additional report, dated June 21, 1904, accompanying.

The existing project for the improvement of Flushing Bay, adopted March 3, 1879, and modified September 19, 1888, provides for making and maintaining a channel 6 feet deep and 200 feet wide at mean low water up to the lower bridge at Flushing, and for building a dike 4,663 feet long on the west side of the channel in Flushing Bay to protect it from filling. The estimated cost of the work was $173,500. There had been expended up to June 30, 1903, $122,540.53.

It was originally intended that the dike should create a tidal basin in the bay, and it was expected that by means of the flow and ebb of the tides a channel would be formed and maintained.

The original project was never fully carried out. Work was suspended on the dike in 1891 before its completion because of opposition by adjacent property owners. A gap of about 1,000 feet wide was left at the shore or upper end, and the outer 1,600 feet was only partially built. As a result of the incomplete work the object of providing a tidal basin was never fully effected. An examination of the map discloses an irregular channel of the projected depth, but of much less than the projected width.

The questions presented in the act of June 13, 1902, and now under consideration, are—

First. Shall the dike be repaired, completed, or removed?

Second. Shall the channel be extended to Irland Mills?

In second indorsement hereon the Board expressed the opinion that the commerce involved is such as to render this locality worthy of a moderate improvement, provided such improvement can be made at reasonable cost. The amount of commerce is reported as follows:

	Tons.		Tons.
1899	158,755	1901	200,473
1900	177,575	1902	186,000

amounting in value to about $1,800,000 in 1902. Of this amount about 68,000 tons passes above the Broadway Bridge (the upper end of the present project) and about 34,000 tons passes above the Main Street Bridge. It appears, therefore, that the total traffic affected by the

[a] Not printed.

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improvement is considerable, but that only about 20 per cent of it applies to that portion of the river above the Main Street Bridge in the vicinity of Irland Mills, while about 40 per cent of it utilizes the stretch between the Broadway and Main Street bridges.

The district officer expresses the opinion that on account of the small amount of commerce passing above the Main Street Bridge and the slight desire evinced for an improved channel, he does not consider the improvement above that bridge desirable at this time.

With reference to the dike he expresses the opinion that it should be retained and modified, and that the channel should be extended to the Main Street Bridge with a width of 100 feet between the bridges. The estimated cost of this work, with the projected channel depth of 6 feet, is given at $69,512.90.

After careful consideration the Board has arrived at the following conclusions:

The extension of the existing improvement to Irland Mills does not seem to be warranted either by present or prospective demands of commerce. The Board, however, is of the opinion that the projected 6-foot channel can advantageously be extended from the Broadway Bridge to the Main Street Bridge, though with a width of 100 feet instead of 200 feet between the bridges.

As to the dike, a study of the soundings and experience at other places tend to show that, except possibly at its inner (shore) end, it is not an essential part of the improvement. It does not appear, however, that at the present time the dike is a serious menace to navigation, and the Board therefore recommends that it be left as it is until it can be seen from further developments whether that part of the channel along the dike is maintained any better than that portion of the channel beyond the dike, and that then it be removed or repaired and extended, as developments may indicate best.

In view of what precedes, the Board recommends as desirable the further improvement of Flushing Bay, New York, by the United States, in accordance with a modified project which shall provide for a channel 200 feet wide and 6 feet deep at low water, from Long Island Sound to the Broadway Bridge, and for a channel of the same depth and 100 feet wide from the Broadway Bridge to the Main Street Bridge, by means of dredging, at an estimated cost of $23,857.90, and that no work toward repairing, completing, or removing the dike be undertaken at present.

For the Board:

D. W. LOCKWOOD,
Lieut. Col., Corps of Engineers,
Senior Member of the Board.

SURVEY OF FLUSHING BAY, NEW YORK.

UNITED STATES ENGINEER OFFICE,
New York, N. Y., June 21, 1904.

GENERAL: I have the honor to submit the following report upon the survey of Flushing Bay and Creek. A preliminary report upon this locality was made by my predecessor, Col. S. M. Mansfield, Corps of Engineers (now brigadier-general, retired), in accordance with the

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provisions in the river and harbor act of June 13, 1902, requiring a preliminary examination of Flushing Bay, with a view to repairing, completing, or removing the dike in said bay and extending the channel to Irland Mills.

The preliminary report of Colonel Mansfield was referred by the Chief of Engineers to the Board of Engineers for Rivers and Harbors, which, in an indorsement of March 11, 1903, stated:

> In the opinion of the Board the present and reasonably prospective commerce involved is such as to render this locality worthy of a moderate improvement, provided such improvement can be made at reasonable cost.
>
> The Board therefore recommends that there be made an allotment of $400 for a survey and estimate of cost, as recommended by the district officer.

The action taken upon the above was the assignment to me of the duty of making a survey and estimate of cost of improvement, and allotting therefor the sum of $400. In the letter[a] of the Chief of Engineers, dated March 26, 1903, assigning the duty to me, it was stated, after quoting the above opinion of the Board:

> It is desired that your report be submitted in duplicate as required, and that it contain an expression of opinion, based upon the results of the survey, as to the extent of improvement at this locality justified by the commercial interests, present and prospective, involved.

The survey was placed under the supervision of First Lieut. J. R. Slattery, Corps of Engineers. Field work was carried on between the dates of May 23 and June 27, 1903, but owing to press of work and small force in this office, the plotting was delayed until late in the year.

The questions presented in the act of June 13, 1902, are: First, as to what should be done with the dike, and, second, should the channel (presumably the existing channel) be extended to Irland Mills? In the preliminary report of Colonel Mansfield, submitted before the survey was made, it was recommended that the dike be removed and the channel extended to Irland Mills. From the investigations and survey, I think it advisable that the dike should be retained, and modified; and, from the statement of Lieutenant Slattery of the small amount of commerce passing above the Main Street Bridge, and the slight desire evinced for an improved channel, I consider the question of improvement above that bridge as one that is not urgent at this time, and that might be left until a later date.

The map[b] of the survey is transmitted herewith, and shows a channel having considerable variation in depths. Along the Flushing front the depths vary from 8.5 to 20 feet, and from the mouth of the creek to the end of the dike a narrow channel, with a central depth of 8 to 9 feet, is found, and this depth is decreased by a foot or two from the end of the dike to East River.

The estimate of cost of items referred to in paragraph 18 of Colonel Mansfield's report is as follows:

For removing dike	$12,000.00
Dredging 6-foot channel, 200 feet wide, through the bay from East River to Broadway Bridge on the creek, 76,162 cubic yards, at 28 cents	21,325.36
Contingencies, 10 per cent	2,132.54
	23,457.90
Annual cost of maintenance	2,500.00

[a] Not printed.

[b] Not reprinted; printed in House Document No. 98, Fifty-eighth Congress, third session.

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Dredging 6-foot channel, 100 feet wide, lower bridge to Main Street Bridge, 1,212 cubic yards, at 30 cents	$363.60
Contingencies, 10 per cent	36.40
	400.00
Annual cost of maintenance	100.00
Dredging 6-foot channel, 100 feet wide, Main Street Bridge to Irland Mills, 10,981 cubic yards, at 30 cents	3,294.30
Contingencies, 10 per cent	329.43
	3,623.73
Annual cost of maintenance	600.00
Total cost	39,481.63
Annual cost of maintenance	3,200.00

As heretofore stated, I do not recommend the removal of the dike nor the present extension of the channel improvement above Main Street Bridge.

The history of the improvement at this locality shows that the original plan of forming a tidal basin in the bay to produce a current through the bay channel was abandoned; and while the dike along a considerable part of the channel through the bay was constructed, it served as scarcely more than a guide for navigation, as the upper end was left at a distance of about 1,000 feet from the shore, thus permitting the flow of the tide coming out of the creek upon the ebb to be divided, much of it passing around the head of the dike, and thus greatly reducing the velocity along the channel side of the dike. Notwithstanding this, the dike has had some effect in keeping the water deep enough to make a well-defined channel.

An examination of the map shows that the tidal flow in the creek where the water is confined maintains a channel of considerably greater navigable capacity than that through the bay. There has been considerable opposition manifested heretofore to the presence of the dike by those not particularly interested in maintaining a channel into Flushing Creek. In order that I might learn just how much weight should be attached to this opposition, interviews were held with the owners found upon their property, and circular letters were addressed to all other owners of property on the bay shore whose addresses could be found (copies inclosed). But few replies have been received, and those that are unfavorable to the maintenance and extension of the dike are based on trivial grounds. The following synopsis shows the opinions expressed:

Name and locality.	Opinion.
A. M. Ryon, Flushing Creek.	Removal of dike would be a mistake, as velocity in channel is increased by dike.
Business Men's Association of Flushing.	Passed resolution, "The retention of the dike is the only means of keeping the channel from filling up." Wm. H. Kent, captain of steamer L. Boyer, the only boat making regular trips to Flushing, concurred in above resolution.
G. J. Talleur, Corona	I do not think the removal of the dike would be worth the money spent
Harway Dyewood and Extract Manufacturing Co., Flushing.	Dike should be thoroughly repaired and lengthened at both ends.
C. W. Copp, Flushing	Should be either repaired or removed; no opinion as to which.
New York and Queens Electric Light and Power Co., Long Island City.	Dike should be extended and repaired or completed.
E. Platt Stratton, College Point.	Interest of all concerned will be best served by removal of dike, particularly the southern end, in order that a proper approach could be made to a proposed (not recently) bridge. Understood that the purpose of the dike had been abandoned.

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Name and locality.	Opinion.
Dr. R. C. F. Combes, Corona..	Remove the dike as unsightly and of no account.
E. L. Baylies, Corona.....	Proposed extension would tend to increase the deposit of mud in the bay and interfere with bathing and boating.
Wm. A. Sands, Corona.....	Remove the dike as an injury to the bay, it having caused the bay to fill up.
P. J. Mara, Flushing	Do.
Thomas Skeuse, Flushing ...	Retain the dike to keep the mud now west of the dike out of the channel.
Louis Fisher, Corona.....	Opposes the extension; keeping the tide out of the bay would tend to increase the deposit of mud and interfere with his business of boat-building and keeping.
Fred Wenzel, Corona.....	Remove the dike, let the mud from the bay flow into the channel, dredge the channel, and so continue until the entire bay has been carried out by the dredging.
A. W. Pertsch, Corona	No objection to extension of dike southeastward.
Seawanhaka Boat Club, Corona.	No objection to extension of dike unless it would cause the western side of the bay to shallow.
C. L. Sicardi	(Representing the owners of 3,000 feet of water front on the west side of bay.) Withdraws all objection and favors the proposed improvement.

In my opinion, a dike through the bay is necessary for the maintenance of the channel, unless considerable dredging is to be repeated at short intervals, especially if this channel is to be made and maintained of sufficient depth to materially improve the commercial facilities of the region about the bay and creek. I therefore consider it advisable to thoroughly repair the dike, building it up to 1 foot above high water, and to extend it from the upper end to connect with the shore. This, with the dredging up to Main Street Bridge, would provide a channel 6 feet deep, 200 feet wide, through the bay, and 100 feet wide from lower bridge to Main Street Bridge, and I believe it would be fairly permanent, costing very little for maintenance.

The range of tide is about 7 feet, and it is believed that the velocity of flow, due to this variation of water level in filling and emptying twice each day the tidal basin of Flushing Creek, would maintain considerable depth in a confined channel through the bay.

The estimate of cost is:

Repairing and raising existing dike	$31,655.00
Extending dike to the shore, 1,000 feet, at $14 per linear foot	14,000.00
Dredging	23,857.90
Total	69,512.90

This work would perhaps accomplish all that would be properly included under the inquiry of Congress, but I am of the opinion that a deeper channel should be provided to meet the demands of the present and prospective commerce.

The instructions of the Chief of Engineers required an expression of opinion, based upon the results of the survey, as to the extent of improvement at this locality justified by the commercial interests, present and prospective, involved. The great growth of the city of New York, which now includes the shores of Flushing Bay and Creek, produces a constantly increasing demand for more facilities for handling water-borne commerce. The great value of water front along the older portions of the city makes it desirable for new enterprises to locate where it can be done at less expense. A channel with only 6 feet of depth does not present facilities for handling commerce in vessels of any considerable size.

In Lieutenant Slattery's report, two estimates are presented for improvement up to Main Street Bridge, one for a channel 100 feet

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wide and 12 feet deep at mean low water from East River up to the Broadway Bridge, with a diminished channel of 100 feet width and 8 feet depth from Broadway Bridge to Main Street Bridge. The cost was estimated at $87,204.87, and for maintenance $6,000 per year. The second estimate was for a channel of same dimensions as above, except that the depth from East River to Broadway Bridge was reduced to 10 feet, the estimate of cost being $41,653.83, and for maintenance $4,000 per year. Including the repairing and extension of the dike the estimates would be:

For channel 100 feet wide, 12 feet deep at mean low water, to Broadway Bridge, and 8 feet deep from Broadway Bridge to Main Street Bridge:	
Dike work	$45,655.00
Dredging	87,204.87
Total	132,859.87
For channel 100 feet wide, 10 feet deep at mean low water, to Broadway Bridge, and 8 feet deep from Broadway Bridge to Main Street Bridge:	
Dike work	45,655.00
Dredging	41,653.83
Total	87,308.83

With the dike modified as proposed, the maintenance of either channel to the end of the dike would be a matter of small annual cost, as the confined tidal flow would probably keep it pretty well scoured out. Some dredging would probably be required in the open bay from the end of the dike to East River, which I would estimate at about $3,000 per annum. This could be largely reduced by extending the dike about 4,000 feet. The extension of the dike 4,000 feet at the lower end it is estimated would cost $56,000, which, added to the above estimates, would require for a complete improvement for a 12-foot channel, $188,859.87; for a 10-foot channel, $143,308.83.

The establishment of a harbor line parallel to the dike, at a distance of 400 or 500 feet from it, would afford ample opportunity for numerous docks from College Point to Flushing.

Under present conditions it is my opinion that the extent of improvement at this locality, justified by the commercial interests involved, would be to make the 10-foot channel to Broadway Bridge, thence to Main Street Bridge an 8-foot channel, with modifications of dike, at the estimated cost of $87,308.83, with a view to a future extension of the dike about 4,000 feet and deepening of channel to 12 feet up to the Broadway Bridge.

The report of Lieutenant Slattery is transmitted herewith.

Very respectfully, your obedient servant,

AMOS STICKNEY,
Colonel, Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

REPORT OF LIEUT. J. R. SLATTERY, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
New York, N. Y., January 7, 1904.

COLONEL: I have the honor to report as follows on the survey of Flushing Bay and Creek:

2. The field work was limited to a survey of the creek and improved channel

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through the bay. The map accompanying this report was compiled from the field notes of recent survey and maps on file in this office.

3. Flushing Bay is a shallow bay about 1 mile wide and 2 miles long, lying on the north side of Long Island, about 14 miles from the Battery, New York City. The bottom of the bay and creek is soft mud. The mean rise of the tide is 7.1 feet.

4. The first project for this improvement was adopted March 3, 1879, and an appropriation for the work was made. The project contemplated diking to form a large tidal basin and dredging a channel from the Broadway Bridge in Flushing to the 6-foot curve in the bay. This channel it was thought would be maintained by the flow of water from the tidal basin. The estimated cost was $173,500. This project was subsequently modified in 1888, to omit a part of the diking, and again in 1891, when 4,663 feet of diking had been built, to omit all further diking and to count on maintaining the channel by dredging alone. A channel 8 feet deep and 100 feet wide was dredged with the view of obtaining a 6-foot channel. The 6-foot channel now varies in width from 50 to over 100 feet. Throughout its length there is a narrow channel with deeper water. A study of the soundings seems to indicate that the dike does not have any effect in maintaining the channel. The channel beyond the dike has maintained itself about as well as that part of channel along the dike. The creek consists of a series of pools separated by bars.

5. A channel 12 feet deep at mean low water and 100 feet wide, from the 12-foot curve in the Sound to the Broadway Bridge, and thence 8 feet deep and 100 feet wide to Irland Mills, would meet the present needs of nearly all business interests now using the bay and creek. The commerce, as reported in the annual reports of the Chief of Engineers, amounted to 158,755 tons in 1899, 177,575 tons in 1900, 200,473 tons in 1901, and 186,000 tons in 1902. From inquiries made of all interested parties whom I could find, I should estimate the commerce in the creek above the Broadway Bridge at about 68,000 tons. Only about half of this amount passes up beyond the Main Street Bridge. I do not consider that the small amount of commerce passing above the Main Street Bridge warrants the improvement being carried above that point. The desire for the improvement beyond this point is slight, and what desire there is is based more on the hope of causing factories to locate there than on any present actual needs. As there still remains plenty of room for factories below this point, I believe that the improvement between Main Street Bridge and Irland Mills should not be undertaken at the present time.

6. The following estimate is for a channel 12 feet deep and 100 feet wide, at mean low water, from the 12-foot curve in the Sound to the Broadway Bridge, and a channel 8 feet deep and 100 feet wide, at mean low water, thence to the Main Street Bridge.

For the removal of 276,192 cubic yards of mud between the 12-foot curve in Sound and the Broadway Bridge, at 28 cents	$77,333.76
For the removal of 6,478 cubic yards of mud between the Broadway and Main Street bridges, at 30 cents	1,943.40
Contingencies, 10 per cent	7,927.71
Total	87,204.87

For maintenance, $6,000 per year.

7. This seems to be quite the maximum limit to which the locality is now worthy of improvement by the United States.

8. To continue the 8-foot channel to Irland Mills would necessitate the removal of 27,159 cubic yards of mud in addition to the amounts above estimated. The cost of removing this is estimated at $8,962.47. The total estimate for carrying the improvement to this point is, therefore, $96,167.34.

9. The cost of the removal of the dike is estimated at $12,000.

10. While a study of the channel seems to indicate that the dike does not serve in the least to maintain the channel, I would recommend that for the present it be left as it is (being lighted and buoyed so as not to endanger navigation) until it can be seen from further developments whether that part of the channel along the dike is maintained any better than that portion of the channel beyond the dike, and that then it be removed or repaired and extended as developments may indicate best.

11. A channel 10 feet deep and 100 feet wide up to the Broadway Bridge, and thence 8 feet deep and 100 feet wide up to the Main Street Bridge, would meet the present needs of most of the interested concerns. It, however, would fail to meet the needs of the Harway Dyewood and Extract Company, which appears to be one of the concerns that make the greatest use of the improvement.

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12. The following is the estimated cost of the channel described in paragraph 11:

For removing 128,299 cubic yards of mud between the 10-foot curve in Sound and the Broadway Bridge, at 28 cents	$35,923.72
For removing 6,478 cubic yards of mud between Broadway and Main Street bridges, at 30 cents	1,943.40
	37,867.12
Contingencies, 10 per cent	3,786.71
Total	41,653.83

Maintenance, $4,000 per year.

13. If continuing contracts should be authorized for entire work, the above estimates could be reduced 10 per cent.

Very respectfully, your obedient servant,

J. R. SLATTERY,
First Lieut., Corps of Engineers.

Col. AMOS STICKNEY,
Corps of Engineers, U. S. Army.

CIRCULAR LETTERS ADDRESSED TO CERTAIN RIPARIAN OWNERS ALONG THE LINE OF THE PROPOSED IMPROVEMENT.

(A.)

UNITED STATES ENGINEER OFFICE,
New York City, August 22, 1903.

SIR: The question as to the further improvement of Flushing Bay and the continuation of the improvement up to Irland Mills, and the repair or removal of the breakwater, is about to be taken up in this office. Will you please favor me with your opinion as to what further improvement, if any, is needed, what depth and width of channel is needed, to what point the improvement should be carried, and what amount of commerce would be benefited thereby.

An early reply is requested.

Very respectfully,

J. R. SLATTERY,
First Lieut., Corps of Engineers.

(B.)

UNITED STATES ENGINEER OFFICE,
New York City, May 6, 1904.

SIR: A project is under consideration by this office for the extension of the dike in Flushing Bay southeastward to join the shore.

The object of this is to confine the tidal flow into and out of Flushing Creek to the navigable channel through the bay to assist in maintaining the depth, which under present conditions constantly deteriorates.

Please inform me if you know of any valid objection to such extension of the dike which ought to weigh against the maintenance of the channel.

Very respectfully,

AMOS STICKNEY,
Colonel, Corps of Engineers.

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E 18.

MODIFICATION OF HARBOR LINES AT GREENPORT HARBOR, NEW YORK.

NEW YORK, *February 10, 1904.*

DEAR SIR: Inclosed you will please find a petition of Mr. Edwin D. Tuthill and Mr. Shepherd J. Higbee, relative to the modification of the harbor line of Greenport Harbor. Please refer this matter to the proper officer and notify me what disposition is made of it.

Very truly, yours,

HERBERT L. FORDHAM.

The SECRETARY OF WAR.

[Second indorsement.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS, U. S. ARMY,
Washington, February 13, 1904.

Respectfully referred to Col. Amos Stickney, Corps of Engineers, for report.

To be returned.

By command of Brig. Gen. Mackenzie:

H. F. HODGES,
Major, Corps of Engineers.

[Third indorsement.]

U. S. ENGINEER OFFICE,
New York, June 21, 1904.

Respectfully returned to the Chief of Engineers, United States Army, inviting attention to my report of this date.

AMOS STICKNEY,
Colonel, Corps of Engineers.

[Eighth indorsement.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS, U. S. ARMY,
Washington, February 4, 1905.

Respectfully returned to the Secretary of War.

This is a request for modification of the existing harbor lines at Greenport Harbor, N. Y., approved by the War Department in 1894.

The matter has been referred to the local engineer officer, by whom it has been given thorough investigation, including the making of a survey, holding a public hearing, etc.

While the desired changes are proposed by certain individuals, they appear to be unobjectionable to the general navigation interests of the locality, and are recommended by the local officer.

The proposed modifications are shown on the accompanying tracing,[a] as are also the lines as originally adopted.

Concurring in the views of the local officer, I recommend that these modifications be approved; and also, for convenience in office

[a] Not printed.

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use, that the whole system of lines shown on this tracing be approved to supersede the harbor-line chart as approved January 5, 1894.

The chart has been prepared for signature by the Secretary of War.

A. MACKENZIE,
Brig. Gen., Chief of Engineers, U. S. Army.

[Ninth indorsement.]

WAR DEPARTMENT, *February 8, 1905.*

Approved as recommended by the Chief of Engineers.
Chart approved and returned herewith.

ROBERT SHAW OLIVER,
Assistant Secretary of War.

PETITION OF MESSRS. EDWIN D. TUTHILL AND SHEPHERD J. HIGBEE.

Your petitioners, Edwin D. Tuthill and Shepherd J. Higbee, doing business under the firm name of Tuthill & Higbee, in the village of Greenport, county of Suffolk, and State of New York, hereby respectfully call the attention of the honorable the Secretary of War to the fact that your petitioners are the owners of valuable upland adjacent to a portion of the waters of Greenport Harbor, and that the present harbor line of said harbor, as established by the War Department, affects the said property of your petitioners very injuriously; that your petitioners have had conversations with the various residents of the village of Greenport, and have found a general sentiment in favor of modifying the said harbor line, not only in that portion above described, but also in certain other portions thereof.

Your petitioners therefore respectfully request the honorable the Secretary of War to refer this matter to the proper officer to the end that necessary proceedings may be had to modify the said harbor line so as to make it acceptable to the residents of the village of Greenport, and to the persons engaged in commerce who use Greenport Harbor.

Dated, Greenport, N. Y., February 8, 1904.

EDWIN D. TUTHILL,
SHEPHERD J. HIGBEE,
Petitioners.

The SECRETARY OF WAR.

REPORT OF COL. AMOS STICKNEY, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
New York City, June 21, 1904.

GENERAL: I have the honor to submit the following report upon the petition of Edwin D. Tuthill and Shepherd J. Higbee, transmitted by letter of Herbert L. Fordham, dated February 10, 1904, for a modification of the harbor lines at Greenport Harbor, New York, referred to me for report by indorsement of your office, dated February 13, 1904.

A public hearing was held at Greenport by my assistant, First Lieut. E. I. Brown, Corps of Engineers, on March 28, 1904, to give an opportunity for those interested to express their views upon the subject. Lieutenant Brown's report,[a] dated April 6, 1904, is transmitted herewith. The changes in the harbor lines requested are shown on the blueprint[a] transmitted with Lieutenant Brown's report. The changes requested appear to me to be objectionable in the following particulars:

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[a] Not printed.

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The advancement of the bulkhead line on the east side of the harbor near the breakwater, as proposed, would permit the building of solid structures in a manner to injuriously affect the ebb and flow of the tide in the harbor and cause eddies and deposits. The proposed advancement of the bulkhead and pierhead lines on the west side of the harbor would contract more than is necessary the entrance into the inner basin, which is none too wide. The object of the advancement there is to cover the boatways, which have been established for many years.

After correspondence and interviews with parties interested, I have to recommend such changes as will, I believe, be acceptable. These changes are shown on the tracing[a] transmitted herewith, and the description of the lines as they would be with the proposed changes is appended.

Very respectfully, your obedient servant,

AMOS STICKNEY,
Colonel, Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

DESCRIPTION OF THE HARBOR LINES FOR GREENPORT HARBOR, NEW YORK, INCLUDING A PORTION OF THE APPROVED LINES AND PROPOSED NEW LINES.

[Bearings are magnetic and are referred to the center line of the Joshuas Point breakwater, which bears N. 29° 06′ W., and S. 29° 06′ E.]

No. of course.	Pierhead lines.	Bulkhead lines.
	Beginning at a point in the center line of the breakwater at high-water mark at its outer end, and running thence—	
1*a*	N. 47° 04′ W. a distance of 1,011 feet; thence—	Coincident with pierhead lines.
1*b*	N. 84° 54′ W. a distance of 248 feet; thence—	In lieu of 1*b* and 1*c*: N. 47° 04′ W. a distance of 1,083 feet to same point on old course No. 1.
1*c*	N. 37° 21′ W. a distance of 900 feet to a point on old approved course No. 1, at a distance of 1,400 feet from the center line of the breakwater; thence—	
1	N. 56° 35′ W. for the remaining 500 feet of the course; thence—	
2	N. 73° 55′ W. a distance of 225 feet to the entrance to Sterling Basin; thence—	
3	N. 41° 11′ W., crossing the sand spit on the east side of the entrance to Sterling Basin, a distance of 195 feet; thence—	
4	N. 48° 49′ E. a distance of 400 feet; thence—	
5	N. 41° 11′ W. a distance of 1,200 feet; thence—	
6	S. 48° 49′ W. a distance of 600 feet; thence—	Coincident with pierhead lines.
7	S. 41° 11′ E., passing along the west side of the entrance to Sterling Basin and running a total distance of 1,455 feet; thence—	
8*a*	S. 70° 20′ E. a distance of 320 feet; thence—	
8*b*	S. 33° 35′ E. a distance of 143 feet; thence—	
9*a*	S. 1° 53′ E. to the southeasterly corner of Fordham's dock, a distance of 298 feet; thence—	
10	S. 27° 18′ W. a distance of 310 feet; thence—	
11	S. 18° 30′ E. on a line straight away from the outer corner of the jog in the southerly side of Fordham's dock, a distance of 815 feet; thence—	In lieu of 11 and 12: S. 27° 18′ W. being a continuation of course 10, 1,290 feet.
12	S. 65° 55′ W. and in line with a point on the breakwater at a distance of 750 feet from its outer end, the same being the beginning of old course No. 1, a distance of 855 feet; thence—	
13	Still S. 65° 55′ W., passing the steamboat dock 15 feet away and running to a point near the 12-foot curve, 60 feet out from the easterly face of the railroad dock, a distance of 1,185 feet; thence—	Coincident with pierhead lines.
14	S. 24° 32′ W., passing the railroad dock about parallel to its outer face and following approximately the 12-foot curve for a distance of 1,000 feet.	

[a] Not printed.

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E 19.

MODIFICATION OF HARBOR LINES ON EAST RIVER, NEW YORK, BETWEEN EAST THIRTY-SECOND AND EAST THIRTY-SEVENTH STREETS, NEW YORK CITY.

THE LONG ISLAND RAILROAD COMPANY,
OFFICE OF THE CHIEF ENGINEER,
Jamaica, N. Y., November 5, 1904.

DEAR SIR: The Long Island Railroad Company has under contemplation the improvement of its ferry facilities at East Thirty-fourth street, borough of Manhattan, city of New York, at which point about 17,000,000 people are handled annually.

With the pierhead line as at present established, adopted in October, 1903, by the Secretary of War, it will be practically impossible for us to provide and construct racks of sufficient length to protect our ferry boats; also, to enable us to lengthen out our bridges from 45 feet to 70 feet.

On behalf of the Long Island Railroad Company, therefore, I respectfully petition that the present pierhead line as adopted October, 1903, be modified from the north line of East Thirty-second street to the south line of East Thirty-seventh street, as shown on tracing forwarded herewith.

On this same plan I have had indicated in red the outline of our proposed improvements, the existing structures being shown in black.

If any further information is desired, will you kindly advise,

Yours, respectfully,

THE LONG ISLAND RAILROAD COMPANY,
By J. R. SAVAGE, *Chief Engineer.*

THE SECRETARY OF WAR.

[Second indorsement.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS, U. S. ARMY,
Washington, November 8, 1904.

Respectfully referred to Col. Chas. R. Suter, Corps of Engineers, for consideration and report by the New York Harbor Line Board.

To be returned.

FREDERIC V. ABBOT,
Acting Chief of Engineers.

[Third indorsement.]

NEW YORK HARBOR LINE BOARD,
ARMY BUILDING,
New York City, November 18, 1904.

Respectfully returned to the Chief of Engineers, inviting attention to the report of the New York Harbor Line Board in this matter, dated the 17th instant.

AMOS STICKNEY,
Colonel, Corps of Engineers,
Senior Member Present.

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[Fourth indorsement.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS, U. S. ARMY,
Washington, November 23, 1904.

Respectfully returned to the Secretary of War.

Request is made on behalf of the Long Island Railroad Company for a modification of the existing pierhead line on the west shore of East River, between East Thirty-second and East Thirty-seventh streets, borough of Manhattan, city of New York, to admit of certain contemplated improvements of the ferry facilities of said company.

The matter has been referred to the New York Harbor Line Board, from whose report of the 17th instant, herewith, it appears that in the opinion of the Board the proposed change will not injuriously affect the navigation interests of the harbor of New York.

Concurring in the views of the Board, I recommend that the request be granted and that the modified pierhead line described in the Board's report and delineated on the accompanying tracing[a] be approved.

Should this action meet with the concurrence of the Secretary of War, I further recommend that the Secretary indicate his approval on the report and tracing, both of which have been prepared for his signature.

A. MACKENZIE,
Brig. Gen., Chief of Engineers, U. S. Army.

REPORT OF THE NEW YORK HARBOR LINE BOARD.

HARBOR LINE BOARD,
New York City, November 17, 1904.

GENERAL: The New York Harbor Line Board has considered the application of the Long Island Railroad Company for modification of the pierhead line on East River, New York City, between Thirty-second and Thirty-seventh streets, referred to it by your indorsement of the 8th instant, and has the honor to recommend that the application be granted, as, in the opinion of the Board, the proposed change will not injuriously affect the navigation interests of the harbor.

Accompanying this report is a tracing,[a] on which the line as modified is indicated and which is described as follows:

Beginning at a point in the pierhead line, approved by the Secretary of War April 25, 1890, said point being 235 feet from the bulkhead line, measured along the prolongation of the southerly side of East Thirty-second street, thence northerly in a straight line to a point in the prolongation of the northerly side of East Thirty-second street, 632.46 feet from the easterly side of First avenue; thence northerly in a straight line to a point in the pierhead line approved by the Secretary of War October 21, 1903, said point being in the prolongation of the southerly side of East Thirty-seventh street, 579.54 feet from the easterly

[a] Not printed.

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side of First avenue; thence northerly with the pierhead line, as modified and approved by the Secretary of War October 21, 1903.

Respectfully submitted.

CHAS. R. SUTER,
Colonel, Corps of Engineers.
AMOS STICKNEY,
Colonel, Corps of Engineers.
W. L. MARSHALL,
Lieut. Col., Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

[First indorsement.]

WAR DEPARTMENT,
November 23, 1904.

Approved.

ROBERT SHAW OLIVER,
Acting Secretary of War.

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APPENDIX F.

IMPROVEMENT OF NEW YORK HARBOR, OF BAY RIDGE, RED HOOK, AND BUTTERMILK CHANNELS, NEW YORK; ENLARGEMENT OF GOVERNORS ISLAND, NEW YORK.

REPORT OF LIEUT. COL. W. L. MARSHALL, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1905, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. New York Harbor, New York.
2. Bay Ridge and Red Hook channels, New York Harbor.
3. Buttermilk Channel, New York.
4. Enlargement of Governors Island, New York Harbor.
5. Removing sunken vessels or craft obstructing or endangering navigation.

HARBOR LINES.

6. Ellis Island, New York Harbor, New York.

UNITED STATES ENGINEER OFFICE,
New York City, July 20, 1905.

GENERAL: I have the honor to submit herewith annual report upon works of river and harbor improvement in my charge for the fiscal year ending June 30, 1905.

Very respectfully, your obedient servant,

W. L. MARSHALL,
Lieut. Col., Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

F 1.

IMPROVEMENT OF NEW YORK HARBOR, NEW YORK.

The title "Improvement of New York Harbor" has been applied to the improvement of the channels of the main entrance from the sea.

A general description of the harbor, of the different channels of the main entrance, and of the projects for improvement is printed in the Annual Report of the Chief of Engineers for 1901, pages 1285–

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1287. A map of the harbor is printed in the Annual Report for 1903, page 914.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1905.

Maintenance.—At the beginning of the year the United States dredging steamer *Gedney* was at work at the west end of Gedney channel removing small shoals which had formed at either side of the channel. August 8 she was temporarily transferred to Bayside channel to deepen certain small shoals on the north side of the channel near buoy B 2. September 17 she returned to Gedney channel to remove shoals along the edge of channel between buoys 3 and 5. October 18 she was moved to Main Ship channel to excavate the mud bank washed into the west edge of the channel between buoys 3 and 5, where she worked until January 21, when she was laid up on account of the severity of the weather. Repairs were made and work was resumed April 13, and up to June 30, 1905, the dredge was at work in the north half of Bayside channel from buoy 2 to about 2,000 feet west of the Swash channel range. In this vicinity the shoals, so far as determined by surveys, are very small and slight, but more vessels report touching bottom here than in any other part of the channel. It is probable that, with a straight course of nearly 4 miles, much of which is 40 feet deep or more, they run at higher speed and consequently settle down to greater draft.

The total amount dredged by the *Gedney* during the fiscal year was:

	Cubic yards.
From the west side of Gedney channel	67,619
From the north side of Bayside channel, near buoy B 2	61,474
From the south side of Gedney channel, between buoys G 3–G 5	39,693
From the west side of Main Ship channel, between buoys C 3–C 5	39,203
From the north half of Bayside channel, west of buoy 2	107,429
Total	315,418

The working time and lost time during the year were as follows:

	Days.
Actual working, parts of 192 days, equivalent to	147
Work prevented by weather (fog, storm, etc.)	53½
Laid up on account of severity of winter	21
Occupied in general repairs during winter and early spring	47
Occupied in minor repairs	14
Lost, other causes, accident, coaling, etc	23½
Sundays and holidays	59
Total	365

Ambrose channel.—Under contract: The contractor's two suction dredges, *Thomas* and *Mills*, were at work during the entire year until June 27, and excepting about one month in the winter occupied in installing new pumps, their work has been upon the bar at the outer end of the channel and has been almost wholly limited to the south half of the channel in a section extending from 6,000 to 11,000 feet northwestward from the original 40-foot curve.

The amount of material dredged during the fiscal year is 2,914,440 cubic yards, making a total amount since the beginning of work of 14,858,571 cubic yards. The contractor's dredges make very con-

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siderable overdepths, the latest examination (made in May, 1905) showing several holes more than 50 feet deep. Under the terms of the contract material taken from below 40 feet depth is not to be paid for, and a preliminary computation, based on the plat of the recent examination, shows that the total amount of such overdepth dredging in May was, approximately, 1,950,000 cubic yards scow measurement.

The channel of 40 feet depth has been made 1,750 feet wide or more for the first 4,000 feet from the outer end; thence for 2,000 feet farther it has been made 1,350 feet or more in width, the width gradually decreasing to 750 feet at 8,000 feet from the outer end. There is yet no continuous depth of 40 feet more than 8,400 feet up the channel. The deep water has been carried through the crest of the bar, which was at 4,000 to 5,000 feet inside the original 40-foot curve and was 15 to 16 feet deep, and the depths in advance of the cut are generally 22 feet or more.

The contract for this improvement was entered into with Mr. Andrew Onderdonk, who associated with himself other men and formed the Metropolitan Dredging Company for the purpose of building a plant and operating it under the contract. It is understood that Mr. Onderdonk had a minor interest in the company. Various rumors have been current of lack of harmony in the management of the company, and immediately upon his death, June 21, the President of the company informed me that he would withdraw the dredges from the work. He did this June 27, since which date the plant has been idle and the crew discharged. Representatives of the contractor's estate say that they expect shortly to be able to arrange for continuing work under the contract.

United States dredges: In order to open the improved channel to navigation at an earlier date than would be possible with the contractor's dredges only, it was decided, in 1903, that the United States should build and operate two suction dredges. These dredges, the *Manhattan* and *Atlantic*, were built under direction of Maj. J. C. Sanford, Corps of Engineers, by the Maryland Steel Company, at Sparrows Point, Md. The *Manhattan* was sent to New York Harbor October 31, 1904, and was operated under Major Sanford's direction until February 7, 1905, when she was turned over to me. The *Atlantic* reached this harbor April 1, 1905, and was transferred to me June 9, 1905.

These dredges have operated on the north side of the channel, mainly in a section from 9,000 to 16,000 feet from the outer end of the channel. Up to the close of the fiscal year they removed 499,375 cubic yards of sand, mud, and stones.

Considerable delays have been met with in adjusting parts of the dredges to the particular work they have to perform; principally as to length and character of steel suction pipes, character of rubber suctions, opening in drag, alteration and repair of pumps, etc. As a result the dredges are only now getting in condition to show what they are capable of.

The plan under which the improvement is being carried on is to open first, and as soon as possible, a channel 1,000 feet wide and at least 35 feet deep, so that ships which can use the present channel via Sandy Hook only by waiting for high water or with danger of grounding may have a limited channel of greater depth than now.

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With this in view, work has been done mainly in the south half of the channel across the outer bar and on the north half inside the bar, with a cross-over cut making an easy bend, because such a channel can be made more quickly than a continuous cut through one side only. And for the same reason the immediate removal of shoals which have over 35 feet depth is not insisted upon.

The total amounts dredged from Ambrose channel up to June 30, 1905, are as follows:

	Cubic yards.
By the contractor's dredges, *Thomas* and *Mills*	14,858,571
By the United States dredges *Manhattan* and *Atlantic*	499,375
By the United States dredge *Gedney*, in 1903	188,963
Total	15,546,909

The amount of work so far completed is estimated as about 33 per cent of the amount required to complete the project.

The examination made in May, 1905, shows a probable slow filling of the deep areas of 45 feet or over which were dredged two years or more ago. The very deep holes of over 59 feet, made in the spring of 1902, filled to from 45 to 48 feet within a few months and have not appeared on recent surveys. The deep areas dredged within a year show no noticeable changes, and the shoal spots of 35 feet depth or over only such slight changes as may be within limits of accuracy of soundings. There is a possible channel of 24 feet depth across the bar now, and a channel of 22 feet depth entirely across with 800 feet minimum width.

The river and harbor act of 1905 contained a provision that—

the Secretary of War may cause to be removed the rock or obstruction in North River, New York Harbor, near pier numbered one, to a depth of forty feet at mean low tide; and for such removal he is authorized to divert a sum not exceeding twenty thousand dollars from the amounts heretofore appropriated or authorized for the improvement of Ambrose channel in said harbor, in addition to the amounts heretofore diverted or appropriated for such removal.

This, with the balance remaining from the provision of the joint resolution of July 1, 1902, made a total of $44,450.25 available for this work. After duly inviting and receiving proposals, a contract for removal of the rock to 40 feet depth was entered into with Mr. J. D. Miller, under date of June 5, 1905. The contractor is making preparations to begin the work at once.

PRESENT CONDITION OF IMPROVEMENT.

The improved channels to the sea by way of Sandy Hook have a full depth of 30 feet at mean low water, with width of 1,000 feet or more, except at places where shoaling has occurred along the channel banks, reducing the width to between 800 and 1,000 feet, the shoals being from 26 to 30 feet deep and generally of soft mud. These shoals are removed from time to time by the United States dredge *Gedney* before they become large enough to affect navigation seriously.

The condition of Ambrose channel is as described above. This channel has been cut through the shoalest part of the outer bar, and has now a depth of over 21 feet for varying widths.

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PROPOSED OPERATIONS.

It is proposed to apply the funds available for maintenance to removing shoals in the improved channels, restoring and maintaining the projected depth and width; and to apply the funds for Ambrose channel to extending the channel, with width of about 1,000 feet and depth of at least 35 feet, until a navigable channel of that depth and width is completed; and to apply the funds provided for removal of rock near pier 1, or pier A, to making a clear depth of 40 feet over the obstruction.

In the present unsettled condition as to future operations under the contract for dredging Ambrose channel, it is impracticable to make an estimate with any accuracy of the funds required for continuing the improvement up to June 30, 1907.

If work is resumed under the contract, it is anticipated that about 7,000,000 cubic yards of material may be removed from June 30, 1905, to June 30, 1907, at a cost of 9 cents per cubic yard; the United States dredges *Manhattan* and *Atlantic* will work for twenty-four months each at probable average cost, including repairs and alterations, of about $7,000 each per month; the United States dredge *Gedney* may possibly be spared from other work for an aggregate of twelve months.

For contract work	$630,000
For United States dredges *Manhattan* and *Atlantic*	336,000
For United States dredge *Gedney*	35,000
For contingencies of operation and supervision	85,000
Total	1,086,000

The available funds June 30, 1905, are $821,102.61, exclusive of outstanding indebtedness; therefore the additional appropriation which would be required for the fiscal year ending June 30, 1907, would be $264,897.39.

This estimate should be subject to revision after it can be ascertained whether the dredges heretofore employed by the contractor are to resume work under the contract or not. Should different plans be adopted for continuing the work a complete change of the estimates may be necessary.

Money statements.

GENERAL IMPROVEMENT.

July 1, 1904, balance unexpended		$22,412.70
Amount appropriated by river and harbor act approved March 3, 1905		75,000.00
Amount allotted from appropriation for maintenance of river and harbor improvements, act of April 28, 1904		15,000.00
		112,412.70
June 30, 1905, amount expended during fiscal year, for maintenance of improvement		31,094.93
July 1, 1905, balance unexpended		81,317.77
July 1, 1905, outstanding liabilities		1,480.86
July 1, 1905, balance available		79,836.81

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Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	$25,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

AMBROSE CHANNEL.

July 1, 1904, balance unexpended		$815,775.48
Amount appropriated by sundry civil act approved March 3, 1905		715,510.00
Amount received on account of damage by New York, New Haven and Hartford Railroad car float		549.95
		1,531,835.43
June 30, 1905, amount expended during fiscal year:		
For works of improvement—		
By Colonel Marshall	$284,300.70	
By construction of dredges by Major Sanford	400,407.04	
Allotted to removal of obstruction in North River	20,000.00	
		704,707.74
July 1, 1905, balance unexpended:		
Colonel Marshall	821,102.61	
Major Sanford	6,025.08	
		827,127.69
July 1, 1905, outstanding liabilities:		
Colonel Marshall	148,424.90	
Major Sanford	999.50	
		149,424.40
July 1, 1905, balance available		677,703.29
July 1, 1905, amount covered by uncompleted contracts		2,678,767.38
Amount (estimated) required for completion of existing project		1,221,490.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905		265,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.		

OBSTRUCTION IN NORTH RIVER.

July 1, 1904, balance unexpended	$24,450.25
Amount appropriated by river and harbor act approved March 3, 1905	20,000.00
	44,450.25
June 30, 1905, amount expended during fiscal year, for works of improvement	43.20
July 1, 1905, balance unexpended	44,407.05
July 1, 1905, amount covered by uncompleted contracts	40,000.00

CONEY ISLAND CHANNEL.

Amount allotted from appropriation for maintenance of river and harbor improvements, act of April 28, 1904	$8,000.00
June 30, 1905, amount expended during fiscal year, for works of improvement	15.20
July 1, 1905, balance unexpended	7,984.80
July 1, 1905, amount covered by uncompleted contracts	7,200.00

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Appropriations for improving New York Harbor have been made as follows:

Application.	Date.	Amount.
For Gedney channel, dredging, via Sandy Hook	July 5, 1884	$200,000.00
For New York Harbor	Aug. 5, 1886	750,000.00
Do	Aug. 11, 1888	380,000.00
Do	Sept. 19, 1890	160,000.00
Do	July 13, 1892	170,000.00
Do	Aug. 18, 1894	75,000.00
Do	June 3, 1896	60,000.00
Do	Mar. 3, 1899	100,000.00
Do	June 6, 1900	1,500.00
Do	June 13, 1902	50,000.00
Do	Apr. 28, 1904	15,000.00
Do	....do	15,000.00
Do	Mar. 3, 1905	75,000.00
		2,051,500.00
Received from other sources		28,024.52
Total		2,079,524.52
For East (Ambrose) channel, dredging	Mar. 3, 1899	1,000,000.00
Do	Mar. 3, 1901	120,000.00
Do	June 28, 1902	150,000.00
Do	Mar. 3, 1903	733,000.00
Do	Apr. 28, 1904	50,000.00
Do	Mar. 3, 1905	715,510.00
Total		2,778,510.00
Amount diverted for removal of rock in North River, by joint resolution of July 1, 1902, and by river and harbor act of March 3, 1903		45,000.00
		2,733,510.00
Received from other sources		1,828.95
Aggregate		2,735,338.95

CONTRACTS IN FORCE DURING THE FISCAL YEAR ENDING JUNE 30, 1905.

With Andrew Onderdonk, of New York, N. Y., for excavating in East (Ambrose) channel, New York Harbor, and removing about 42,500,000 cubic yards of material, at a rate of 9 cents per cubic yard; date of contract, May 12, 1899; approved by the Chief of Engineers May 24, 1899; supplemental articles of agreement dated July 18, 1901, July 14, 1902, February 24, 1904, and May 25, 1905; approved by the Secretary of War August 5, 1901, August 8, 1902, March 5, 1904, and June 14, 1905, providing for beginning work July 1, 1901, instead of May 24, 1900; for making payments when the rate of excavation is 4,000,000 yards per year, instead of 9,600,000 yards; that as a condition precedent to payments no excavation is required for the period from August 1, 1903, to December 1, 1903; the United States to have the right to further the rate of progress at any time and with any plant which can be obtained; and as a condition precedent to payments, that instead of a specific amount it is required that the dredges shall be kept at work; date of expiration of contract indefinite, depending upon appropriations of Congress.

With John D. Miller, of New York, N. Y., for removal or rock off Pier A, North River, New York Harbor; date of contract, June 5, 1905; approved by the Chief of Engineers June 17, 1905; time of completion March 1, 1906; contract price $40,000.

With the W. H. Beard Dredging Company, New York, N. Y., for dredging Coney Island channel; date of contract, April 27, 1905; approved by the Chief of Engineers May 13, 1905; time of completion September 16, 1905; approximate quantity 20,000 cubic yards, at 36 cents per cubic yard.

COMMERCIAL STATISTICS.

The following statements concerning foreign commerce of the port of New York is compiled from the annual report of the Chamber of Commerce of New York for the year 1904–5. It comprises only imports from and exports to foreign countries for the year ending June 30, 1904, and does not include

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domestic, coastwise, and local traffic. Vessels trading with domestic ports are not required to take out clearance papers, and no statistics of their carrying trade are accessible.

The leading articles of import into the United States at the port of New York for the year ending June 30, 1904, were sugar, tea, coffee, cloths and dress goods, leather and leather goods, tin, rubber, and tobacco, which, with other miscellaneous imports, aggregated about 4,216,000 tons, valued at $600,171,033. The value of such imports for all other ports of the United States, taken together, was $390,916,338.

The leading articles of export were cotton, breadstuffs and other provisions, oils, tobacco, metals, and manufactures, which, with miscellaneous items, aggregated about 5,476,000 tons, valued at $602,103,775. The value of such exports for all other ports of the United States together for the same year was $950,258,093.

Statement of the number and gross tonnage of all vessels belonging to the port of New York, June 30, 1903.

	Number.	Tonnage.
Sailing vessels	1,283	222,356
Steam vessels	1,418	826,984
Canal boats	224	28,479
Barges	1,284	312,925
Total	4,209	1,460,694

From the records of the New York and New Jersey pilot commissioners the following data concerning deep-draft vessels crossing Sandy Hook bar have been compiled for the calendar year 1904:

Draft.	Outward.		Inward.	
	Number of vessels.	Number of trips.	Number of vessels.	Number of trips.
32 feet and over	2	2	.....	.....
31 feet and under 32 feet	6	13	.....	.....
30 feet and under 31 feet	17	58	.....	.....
29 feet and under 30 feet	41	97	1	2
28 feet and under 29 feet	47	143	6	20
27 feet and under 28 feet	79	198	13	56
Total	.....	511	.....	78

The total number of vessels of 27 feet draft or over is 114.

The maximum draft of ships leaving the harbor in 1904 was 32 feet 6 inches; the maximum draft of ships entering was 29 feet 6 inches. Ships are of greater draft when outward bound than when coming in, having a full supply of coal and generally carrying heavier freights.

Before the improvement of Gedney channel vessels drawing 27 feet or over could cross the bar at extreme high tide only.

F 2.

IMPROVEMENT OF BAY RIDGE AND RED HOOK CHANNELS, NEW YORK HARBOR.

These channels on the east side of New York Harbor are designed, under the existing project for making them 40 feet deep at mean low water and 1,200 feet wide, to afford a deep-water approach to the wharves along the South Brooklyn shore.

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OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1905.

Under the continuing contract for making the channels 1,200 feet wide and 40 feet deep, dredging was in progress during the year, except in January and February and parts of December and March. The total amount dredged during the year was 2,038,227 cubic yards, of which 1,370,567 cubic yards were dredged from Red Hook channel, and 667,660 cubic yards from Bay Ridge channel.

Red Hook channel, under a previous contract made 400 feet wide and 26 feet deep, was made 700 feet wide up to within 1,000 feet of its junction with Buttermilk channel, the added width being made from 30 to 40 feet deep, and shoals at the lower end of the old channel were taken out.

Bay Ridge channel was widened to 800 feet width, with full depth of 30 feet and over, and with a channel depth of 35 feet in the clear, except at the lower end, now being dredged, where the natural depth is from 32 to 40 feet.

The total amount dredged under the contract is 8,917,643 cubic yards. Of this amount it was estimated in October, 1904, that 624,920 cubic yards were dredged from below 40 feet depth, and therefore not to be paid for. Since October very little overdepth dredging has been done.

PRESENT CONDITION OF IMPROVEMENT.

Bay Ridge channel has now a depth of 30 feet or more, with width of 800 to 1,100 feet, with a channel from 35 to 40 feet deep and about 600 feet wide, except over the bar at the lower end of the channel, where the natural depth is about 33 feet, and the channel of over 35 feet depth is but about 100 feet wide.

Red Hook channel had an available depth of 26 feet for 400 feet wide made under a previous contract. Below Erie Basin this channel has been widened about 200 feet and partly deepened to over 30 feet, but the available depth for navigation is yet very little over 26 feet.

PROPOSED OPERATIONS.

It is proposed to continue widening and deepening Bay Ridge and Red Hook channels under the continuing contract for completion of the project.

The estimated amount which will be required to meet obligations under the contract for the fiscal year ending June 30, 1907, is $250,000. It is estimated that the total amount excavated up to that date may be about 15,000,000 cubic yards, which at the contract price would cost $1,500,000. Appropriations already made for this project amount to $1,249,000, and the difference is believed to be sufficient to pay all obligations which will become due by June 30, 1907.

These channels are in the collection district of New York, of which New York City is the port of entry. The nearest light-house is the Statue of Liberty Enlightening the World, on Bedloe Island, about 1½ miles west. The nearest work of defense is Fort Columbus, Governors Island, New York Harbor.

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Money statement.

July 1, 1904, balance unexpended	$435,091.60
Amount appropriated by sundry civil act approved March 3, 1905	200,000.00
	635,091.60
June 30, 1905, amount expended during fiscal year, for works of improvement	207,187.79
July 1, 1905, balance unexpended	427,903.81
July 1, 1905, outstanding liabilities	94,450.40
July 1, 1905, balance available	333,453.41
July 1, 1905, amount covered by uncompleted contracts	1,370,628.70
Amount (estimated) required for completion of existing project	1,251,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	250,000.00

Appropriations for improving Bay Ridge and Red Hook channels, New York Harbor, have been made as follows:

For previous projects.

Application.	Date.	Amount.
Dredging	Mar. 4, 1881	$40,000
Do	Aug. 2, 1882	20,000
Do	July 5, 1884	5,000
Do	Aug. 5, 1886	7,500
Do	Aug. 11, 1888	60,000
Do	Sept. 19, 1890	160,000
Do	July 13, 1892	198,600
Do	Aug. 18, 1894	150,000
Do	June 3, 1896	[a] 530,000
Do	June 4, 1897	
Do	July 1, 1898	
Total		[b] 1,171,100

[a] These three appropriations, aggregating $680,000, were applied under continuing contract to dredging Bay Ridge, Red Hook, and Buttermilk channels. It is estimated that about $530,000 were applied to Bay Ridge and Red Hook channels.
[b] This total includes small sums applied to dredging in Gowanus Canal, the amounts of which are not definitely known.

For present project of 1899.

Application.	Date.	Amount.
Dredging	Mar. 3, 1899	$100,000
Do	June 6, 1900	262,000
Do	Mar. 3, 1901	140,000
Do	June 28, 1902	100,000
Do	Mar. 3, 1903	272,000
Do	Apr. 28, 1904	175,000
Do	Mar. 3, 1905	200,000
Total		1,249,000

CONTRACT IN FORCE.

For excavating Bay Ridge and Red Hook channels, 1,200 feet wide and 40 feet deep at mean low water, removing 22,000,000 cubic yards, more or less, at 10 cents per cubic yard, measured in scows.

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Name of contractors: Hughes Bros. & Bangs, of Syracuse, N. Y.

Date of contract: July 31, 1899; supplemental contract, dated May 7, 1902, provides for beginning work November 1, 1901, instead of May 14, 1900; also, supplemental contract, dated July 28, 1903, requiring rate of 200,000 yards per month from April 1 to December 31, 1903; also supplemental contract, dated March 3, 1904, requiring the full employment of the plant, instead of a stated amount of excavation, as a condition of payment. All the supplemental contracts provide for charging costs of administration against the contractor for any excess of time over that contemplated in the original agreement.

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1904.

	Approximate amount.	Estimated value.
Bay Ridge channel, Ninety-second to Twenty-eighth streets:	*Tons.*	
Receipts	995,430	$45,487,145
Shipments	506,224	26,420,561
Total	1,501,654	71,907,706

Red Hook channel has no commercial docks except those in Erie Basin, and it has been impracticable to get data as to amounts of freight. The number of vessels entering and leaving for the purpose of discharging or carrying cargoes is reported as 318.

The above includes only freight received and shipped at docks. In addition about 3,000,000 tons of freight pass through these channels to and from Gowanus Creek and Canal. Other freights pass through to various destinations, the amount of which there is no means of estimating.

It is impracticable to secure accurate data of the amounts of freight handled in the various parts of New York Harbor, records being not generally kept. The statement as to Bay Ridge channel was compiled with care and is believed to be more accurate than that of previous years, which gave larger figures.

F 3.

IMPROVEMENT OF BUTTERMILK CHANNEL, NEW YORK HARBOR.

The improvement of this channel was begun in 1880. In 1896 it was consolidated with the improvement of Bay Ridge and Red Hook channels under a project for making them 36 feet deep, completed in 1899. Since then it has been considered separately.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1905.

At the beginning of the year a contract for dredging was in progress, under a project which provided for making this channel 30 feet deep at mean low water along its eastern side for a width as great as the appropriation of $90,000, made in 1902, would permit.

Dredging was continued until April 4, 1905, when the contract and the project were completed. During the fiscal year 192,412 cubic yards of material were removed, making the total of excavation under the contract 310,000 cubic yards.

The eastern part of the channel was made 30 feet deep at mean low water for a width of 800 feet, extending from deep water just below Wall street ferry to deep water southwest of Red Hook, a total length

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of 1½ miles, in which, however, there were several areas where the natural depth was 30 feet or over. Below Hamilton avenue ferry the excavated material was very hard, mostly gravel and clay; above Hamilton avenue it was mainly coarse sand, easy to excavate; on the west side of the channel, above Hamilton avenue and opposite pier No. 20, a pocket of rather stiff black mud was found, extending about 700 feet north and south in the channel.

PRESENT CONDITION OF IMPROVEMENT.

Buttermilk channel has been dredged 30 feet deep for a width of 800 feet throughout its entire length; an additional width of 200 feet on the west side was made 26 feet deep under a contract completed in 1899; the latter depth has shoaled at the north end to depths of about 24 feet. The navigable depth of the channel is 30 feet at mean low water.

PROPOSED OPERATIONS.

The project for improvement is completed and no further work is contemplated. Small amounts of dredging may be required from time to time for maintenance, but it is too early yet to estimate the amount and cost.

The New York Tunnel Company is engaged in constructing a tunnel under the East River, the eastern end of which crosses Buttermilk channel, entering the Brooklyn shore between piers 17 and 18. This tunnel is laid out with insufficient natural roof covering, so that the air, under pressure, has blown up through the roof, and under a permit from the Secretary of War the company proposes to deposit stiff clay at certain points along the course of the tunnel. It is proposed to require the company to maintain a gas buoy or vessel carrying lights over such deposits as reduce the navigable channel depths and to restore the full depth upon completion of the tunnel.

Money statement.

July 1, 1904, balance unexpended	$63,723.99
June 30, 1905, amount expended during fiscal year, for works of improvement	62,500.00
July 1, 1905, balance unexpended	1,223.99

Appropriations for improving Buttermilk channel, New York Harbor, have been made as follows:

For previous projects.

Application.	Date.	Amount.
Dredging	June 14, 1880	$80,000
Do	Mar. 4, 1881	60,000
Do	Aug. 2, 1882	60,000
Do	July 5, 1884	10,000
Do	Aug. 5, 1886	56,250
Do	Aug. 11, 1888	100,000
Do	July 13, 1892	100,000
Do	Aug. 18, 1894	50,000
Do	June 3, 1896	[a] 150,000
Do	June 4, 1897	
Do	July 1, 1898	
Received from other sources		100
Total		646,350

[a] Part of three appropriations for improving Bay Ridge, Red Hook, and Buttermilk channels, aggregating $680,000, of which it is estimated about $150,000 was applied to Buttermilk channel.

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For project of 1902.

Application.	Date.	Amount.
Dredging	June 13, 1902	$90,000

COMMERCIAL STATISTICS.

Statistics for the calendar year 1904 have not been collected in detail.

In 1899 the amount of freights received and shipped was 16,587,000 tons, valued at $658,384,823. It was carried in 45,849 vessels, of various drafts up to 29 feet and tonnage up to 6,800 tons. Details are printed in the Annual Report of the Chief of Engineers for 1900, page 1468.

The present commerce of Buttermilk channel is about the same in amount as the commerce of 1899.

F 4.

ENLARGEMENT OF GOVERNORS ISLAND, NEW YORK HARBOR.

This project was adopted under authority of the sundry civil act of March 3, 1901, and consists in enlarging the island by reclaiming land under water on the shoal southwest of the island, inclosing the enlargement by a sea wall, building a dock on the north shore of the island, and deepening the approach to the dock, and constructing buildings for military uses.

The parts of this work assigned to the Engineer Department were the enlargement proper, with sea wall, estimated to cost $885,000, the new dock and refitting an old dock, estimated at $115,000, and dredging to the dock, estimated at $100,000; total estimated cost, $1,100,000.

The original plan for reclaiming 82 acres of land under water was extended to 101 acres by approval of the Secretary of War. No increase in the estimated cost appears necessary as yet.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1905.

1. Riprap bulkhead.—This is a substructure, built to about 2 feet above low-water level, with top width of 12 to 15 feet, designed to support a masonry wall inclosing the extension of the island. At the beginning of the year 6,166 linear feet of this bulkhead had been built, and a contract was in force for its extension. During the year 45,933 tons of riprap were placed in the bulkhead, building 629 linear feet of that work. A gap about 352 feet wide was left at the south end of the inclosure to admit scows bringing material for the embankment, and the floor of this gap was covered with about 4 feet of stone (up to 16 feet depth, mean low tide) to prevent its scouring out by the currents. The contract was completed November 5, 1904.

The total length of completed bulkhead is 6,795 feet. The total length, including the gap left open, is about 7,147 feet.

A small schooner has been hired and anchored near the lower end of the North River bulkhead, which carries warning lights by night and upon which a fog bell is rung in thick weather.

2. Embankment behind bulkhead.—During the year work has been continued under contract, and 105,792 cubic yards of material have

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been brought into the inclosure, of which 105,394 yards were of sand or other hard filling (class 1) and 398 yards were of similar materials containing not to exceed 50 per cent of mud. The contractors have had a dipper dredge and a pump at work most of the year, endeavoring to build up the embankment, but progress has been slow and far from satisfactory. The dredge has not lift enough to place material above high-water level, and the pump throws such a large proportion of water that she washes down much of her own bank. In August further deliveries of the softer material of class 2 were refused, and the area for work was limited to 800 feet distance from the old sea wall. Since the masonry sea wall on the east side of the extension has been finished, the pump has been depositing sand over against this wall, and the progress is slightly improved. The amount of material now in the embankment above low water is estimated at 185,082 cubic yards, an increase over the amount at the beginning of the fiscal year of 85,312 cubic yards, which does not include the material that has subsequently washed back below water. During part of January and all of February work was suspended on account of ice, and in February the inclosure froze over solidly.

3. Masonry sea wall.—At the beginning of the year a contract was in force for building about 4,500 linear feet of masonry sea wall upon the bulkhead, the wall to consist of a bed of rubble masonry or concrete 7 feet wide extending from 0.2 foot to 1.7 feet above mean low water, with a granite wall of uncoursed ashlar, 5 feet wide at bottom and 3 feet wide at the top, which was to be 10.4 feet above mean low water. Work was begun on the Buttermilk channel side of the inclosure in August, and at the close of the fiscal year that side had been completed as far as contemplated under the contract and the North River side had been begun. The Buttermilk channel wall began at a point 7.7 feet back from the angle of the old sea wall (it being necessary to relay so much of the old wall), and extended a total length of 2,188 feet at the coping, the foundation being 27 feet farther. Work has been begun on the North River side at the Castle Williams wall, and 243 linear feet of sea wall have been built, excepting the coping. The total length of wall built under the contract is 2,195 feet at the coping course and 2,681 feet at the foundation, the equivalent completed length as estimated for purpose of payment being 2,565 feet. Careful levelings show no evidence of any settlement in the wall as far as built, although for more than half its length the riprap was placed on a rather soft bottom.

The existing contract provides for building about 4,500 linear feet of sea wall, which was practically the length of completed riprap bulkhead when the contract was entered into. After the bulkhead was extended, proposals were invited for an extension of the masonry wall about 2,050 feet.

PRESENT CONDITION OF WORK.

Following is the condition of the several items included in the project and assigned to the Engineer Department:

1. Building new dock and refitting old dock; completed, August, 1902.
2. Dredging at new dock; completed, July, 1902. During the dredging a small ledge rock was uncovered which was removed in July, 1903.
3. Riprap bulkhead around enlargement of the island; to be about 7,147 feet long; 6,795 feet completed, a gap about 352 feet wide being left for bringing

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material for the embankment; the bulkhead may be reckoned as about 93 per cent completed.

4. *Masonry sea wall on bulkhead.*—Projected length about 7,180 feet, including parts of old wall removed and gap to be left open for embankment; completed, 2,565 feet, or about 35 per cent.

5. *Embankment within sea wall.*—Estimated amount of material required, about 4,500,000 cubic yards in place, of which 2,000,000 yards would be above mean low water. Up to June 30, 1905, 1,688,338 cubic yards (scow measure) have been delivered, of which only 185,082 cubic yards in place and above low-water level. This work is far behind every other part of the project, being estimated as about one-tenth completed.

PROPOSED OPERATIONS.

The available funds will be sufficient to complete the sea wall, excepting the gap, and to complete the present contract for embankment. Efforts are being made to devise some method for additional work on the embankment, which shall not interfere with the existing contract. Unless some satisfactory method can be developed no further appropriation will be needed for the fiscal year ending June 30, 1907.

Money statement.

July 1, 1904, balance unexpended	$482,060.50
Amount appropriated by sundry civil act approved March 3, 1905	100,000.00
	582,060.50
June 30, 1905, amount expended during fiscal year, for works of improvement	97,575.74
July 1, 1905, balance unexpended	484,484.76
July 1, 1905, outstanding liabilities	89,639.48
July 1, 1905, balance available	394,745.28
July 1, 1905, amount covered by uncompleted contracts	71,739.48
Amount (estimated) required for completion of existing project	175,000.00

The appropriations made for this work, as far as relates to the Engineer Department, are as follows:

Sundry civil act March 3, 1901 ($260,000), allotted to Engineer Department	$200,000
General deficiency act of July 1, 1902	200,000
Sundry civil act of March 3, 1903	150,000
Sundry civil act of April 28, 1904	200,000
Sundry civil act of March 3, 1905	100,000
Total	850,000

CONTRACTS IN FORCE.

Building embankment:
- Name of contractor: New York Filling Company, New York City.
- Date of contract: December 24, 1902.
- Date of approval: January 12, 1903.
- Date of completion: Indefinite.

Building stone sea wall:
- Name of contractor: Humphrey Toomey, Guilford, Conn.
- Date of contract: June 22, 1904.
- Date of approval: July 14, 1904.
- Date of beginning: August 1, 1904.
- Date of completion: November 1, 1905.

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F 5.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

Canal boat in Hudson River, off Pier 3.—Late in the afternoon of August 18, 1904, a canal boat was reported adrift in the Hudson River, and investigation showed that it was a worthless hulk, abandoned, and floating about 500 feet off pier 3, a crowded part of the harbor where the derelict was a dangerous obstruction to navigation, the more so as twilight was coming on. A tug was employed to remove it from the channel without delay, as an emergency action which was subsequently approved by the Chief of Engineers and allotment for removal was made. The wreck was removed and deposited at Rikers Island, where it was examined September 9, 1904.

There were no marks remaining by which it could be identified; the name had been carefully scraped off before the boat was first found.

The total cost of removal and disposal of the wreck was $124.

Schooner Hattie V. Kelsey.—This three-masted schooner, with cargo of soft coal, came into collision with another vessel on the night of September 14, 1904, and was damaged so that she sank in 22 feet depth of water on the edge of South channel. A letter from her owner stated that the schooner was abandoned, and a lighted buoy was placed near her by the Light-House Department.

An allotment of $5,200 was made for her removal, after prices had been invited and received, and a written contract for the work was entered into with the Merritt & Chapman Derrick and Wrecking Company, providing for lifting the wreck bodily and taking it away at a cost of $6,174, and for purchase of the hull and cargo for $1,200, to be deducted from the price for removal.

The location is very exposed, and the contractors were delayed by high seas and storms. Finally when they succeeded in getting cables under the vessel, the hull broke in parts. One large section, heavy and waterlogged, was sunk at sea. The rest of the parts were deposited at the contractor's dock at Staten Island. Practically all of the wreck was accounted for by the parts taken up, but they were so many that a final examination by dragging was made December 12, 1904. No other parts could be found.

Fishing schooner, Eva R.—This small vessel filled and sunk during a squall May 4, 1905, and during a subsequent storm dragged for a quarter of a mile and sunk in Ambrose channel in about 26 feet of water. The wreck was a source of danger to the dredges employed in Ambrose channel.

Allotment of $225 was made for removal. The wreck was lifted May 9, 1905, and disposed of by grounding at high water in the contractor's private berth at Stapleton.

Nothing of value was found upon the wreck.

Raft of timbers in Buttermilk channel.—This was an abandoned raft of worthless timbers found adrift in Buttermilk channel September 9, 1904. It was of little value and was dangerous to navi-

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gation. It was taken in charge by the United States steamer *Manisees*, towed to Stapleton, Staten Island, and beached at high water. It was subsequently broken up and carried away for firewood.

Removal involved no cost to the United States.

F 6.

MODIFICATION OF HARBOR LINES AROUND ELLIS ISLAND, NEW YORK HARBOR, NEW YORK.

DEPARTMENT OF COMMERCE AND LABOR,
OFFICE OF THE SECRETARY,
Washington, September 12, 1904.

SIR: I have the honor to return herewith War Department map in relation to Ellis Island, New York Harbor, recently transmitted to this Department, having indicated thereon in purple lines the additional space required in order to carry out the existing plans for the construction of a new island.

I also inclose a copy of a communication addressed by Alfred Brooks Fry, chief engineer and superintendent of United States public buildings, New York, to the commissioner of immigration at that port, which sets forth in detail the necessity for the additional space mentioned. It is requested that both the harbor lines board and the riparian commission be advised by telegraph of the approval by you of the extension shown on said map, as the riparian commission meets on the 14th instant, and it is earnestly desired that said commission may then pass upon the subject.

This Department will also appreciate the courtesy of a compliance by your Department with the request of Chief Engineer Fry for two duplicates of the map.

Respectfully,

LAWRENCE O. MURRAY,
Acting Secretary.

THE SECRETARY OF WAR.

[Second indorsement.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, September 12, 1904.

Respectfully returned to the Secretary of War.

The Department of Commerce and Labor requests a modification of the existing harbor lines around Ellis Island by extending the said lines southwesterly a distance of 465 feet.

It appears from the indorsement of Col. Charles R. Suter, Corps of Engineers, president of the New York harbor line board, on the accompanying letter of the 2d instant from the riparian commission of New Jersey, that the proposed extension is unobjectionable. I there-

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fore recommend that the existing harbor lines be modified as shown in purple on the accompanying map,[a] which has been prepared for the signature of the Secretary of War.

A. MACKENZIE,
Brig. Gen., Chief of Engineers, U. S. Army.

WAR DEPARTMENT, *September 12, 1904.*

Approved as recommended by the Chief of Engineers in the preceding indorsement.

ROBERT SHAW OLIVER,
Acting Secretary of War.

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[a] Not printed.

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APPENDIX G.

IMPROVEMENT OF RIVERS AND HARBORS IN NORTHEASTERN NEW JERSEY.

REPORT OF COL. W. R. LIVERMORE, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1905, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Passaic River, New Jersey.
2. Arthur Kill, or Staten Island Sound, New York and New Jersey, and channel between Staten Island and New Jersey.
3. Woodbridge Creek, New Jersey.
4. Raritan Bay, New Jersey.
5. Keyport Harbor, Matawan Creek, Raritan, South, and Elizabeth rivers, Shoal Harbor and Compton Creek, and Cheesequake Creek, New Jersey.
6. Shrewsbury River, New Jersey.
7. Manasquan (Squan) River, New Jersey.

HARBOR LINES.

8. Arthur Kill and Newark Bay at Elizabethport, New Jersey.
9. Arthur Kill at Elizabethport, New Jersey.
10. Arthur Kill at Smoking Point, Rossville, Staten Island, New York.

ENGINEER OFFICE, UNITED STATES ARMY,
New York, N. Y., July 26, 1905.

GENERAL: I have the honor to transmit herewith the annual reports upon the works of river and harbor improvement under my charge * * * in New Jersey for the fiscal year ending June 30, 1905.

* * * * * * *

Very respectfully, your obedient servant,

W. R. LIVERMORE,
Colonel, Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

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G 1.

IMPROVEMENT OF PASSAIC RIVER, NEW JERSEY.

Detailed descriptions of this river and of the projects for its improvement are printed in the Annual Report of the Chief of Engineers for 1900, pages 177 and 1530 to 1552, and a condensed history is contained in current summary.

OPERATIONS DURING THE PAST FISCAL YEAR.

Dredging for maintenance under the emergency contract in force with R. B. Rodermond, dated September 15, 1903, was in progress at the close of the fiscal year and nearly completed; the work done is given in detail in Report of the Chief of Engineers for 1904. Work under this contract was continued until July 13, inclusive, and the contract was completed on July 16, upon which date the contractor finished depositing the dredged material.

The amount of material (gravel and sand) removed in July was 2,896 cubic yards, and in addition 1.17 cubic yards of bowlders were taken out. The work accomplished in July was the extension of one cut on Lime Kiln bar 825 feet, with width of 25 feet, and depth of about 8½ feet at mean low water. The total amount of material removed under the contract is 17,488 cubic yards and four bowlders aggregating 1.59 cubic yards, divided as follows:

Location.	Material removed	Area of channels dredged.
	Cu. yds.	*Feet.*
Between Center and Bridge Street bridges	8,259	190 by 100 570 by 200
Between Bridge Street and Delaware, Lackawanna and Western bridges	450	175 by 50
Between Delaware, Lackawanna and Western and Clay Street bridges	780	190 by 100
Just below Center Street Bridge	1,014	200 by 50
Rutherford Park bar, near bridge	1,684	350 by 75
Belleville bar, mouth of Second River	[a] 719	300 by 50
Lime Kiln bar	[b] 4,682	1,450 by 20 to 25
Total	[c] 17,488	

[a] Including 1 bowlder, 0.42 cubic yard.
[b] Including 3 bowlders, 1.17 cubic yards.
[c] Including 4 bowlders, 1.59 cubic yards.

The material dredged at Newark was dumped at sea, and that dredged from Lime Kiln, Belleville, and Rutherford Park bars was deposited inside of the Belleville and Rutherford dikes.

Under the contract in force with Kirk, Driscoll & Co., dated March 1, 1904, dredging was in progress at the close of the last fiscal year, and 109,765 cubic yards of material had been removed. Work under this contract was continued to December 15, when it was suspended on account of cold weather and ice in the river, which closed navigation and stopped the work.

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Table showing progress of dredging in Passaic River under contract in force with Kirk, Driscoll & Co., during the year, and approximate areas dredged and completed under project of June 13, 1902.

[This does not include the small amount of work done under contract of P. Sanford Ross (Incorporated), which is described below.]

Sec.	Sectional description. Location.	Length.	Amount removed in fiscal year 1905.	Area dredged in fiscal year 1905.	Total amount removed under contract.	Total area dredged under contract.	Proportion of section completed.
		Yards.			*Cu. yds.*	*Yards.*	
1	Deep water in Newark Bay to Lehigh Valley Railroad Bridge	3,400	13,470	13 by 485	34,722	13 by 1,313	0.10
2	Lehigh Valley Railroad Bridge to Newark and New York Railroad Bridge	3,000	95,699	67 by 2,250	95,699	67 by 2,250	.75
3	Newark and New York Railroad Bridge to Newark Plank Road Bridge	1,230	37,643	44 by 867	94,447	67 by 1,230	All.
4	Plank Road Bridge to Pennsylvania Railroad freight bridge	1,400			19,851	67 by 466	.33
5	Pennsylvania Railroad freight bridge to Jackson Street Bridge	3,530	49,751	27 by 900 and 8 by 1,300.	49,751	27 by 900 and 8 by 1,300.	.15
6	Jackson Street Bridge to Pennsylvania Railroad Market Street Bridge	660					
7	Pennsylvania Railroad Market Street Bridge to Center Street Railroad Bridge	660	18,248	27 by 660	18,248	27 by 660	.40
8	Center Street Railroad Bridge to Bridge Street highway bridge	530	7,289	27 by 97 and 7 by 530.	19,147	27 by 530	.40
9	Bridge Street Bridge to Delaware, Lackawanna and Western Railroad Bridge	260					
10	Delaware, Lackawanna and Western Railroad Bridge to Clay Street highway bridge.	460					
11	Clay Street Bridge to New York, Lake Erie and Western Railroad Bridge	430					
12	New York, Lake Erie and Western Railroad Bridge to Nairn Linoleum Works	1,100					
13	Nairn Linoleum Works to Montclair and Greenwood Lake Railroad Bridge	2,000					
	Total	18,060	222,100		331,865		

The dredging in the areas worked upon has been carried to the depth required for forming a channel of the projected depth of 12 feet at mean low water. An allowance of from 1 to 2 feet for overdepth in dredging is usually required to leave full 12 feet. All the dredged material was disposed of by the contractor by depositing it in the east side of the river, in section 4, whence it was pumped ashore on the marsh to make useful land between the Passaic and Hackensack rivers.

At the close of the fiscal year work under this contract had not been resumed, but it was resumed a few days later.

Under advertisement of September 10 proposals were opened on October 11, 1904, for further dredging under the project of June 13, 1902, and the bid of P. Sanford Ross (Incorporated), the lowest of four bids received, to do the work at 19.8 cents per cubic yard, was recommended for acceptance. This recommendation was approved by the Department, and a contract, dated November 12, 1904,

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was entered into. Under this contract dredging of a channel from the center of Newark Bay to the west shore of same for disposal of material under their contract commenced on March 29, and was completed in June. Work on this channel for dumping will require maintenance from time to time.

Dredging under this contract was commenced on June 23 and has been in progress since that date. Two dredges have been employed, one in Newark Bay and the other in the Passaic River, in the vicinity of Lister's wharf, which is located between the freight bridge of the Pennsylvania Railroad and the Jackson street highway bridge. The amount of material removed to the close of the year was 9,247 cubic yards, of which 8,226 yards were removed from Newark Bay and the remainder, 1,021 yards, from the Passaic River. The dredging in Newark Bay was commenced at the angle in the proposed channel, about halfway between the Lehigh Valley Railroad bridge and deep water in the bay.

Project for expenditure of the appropriation of $75,000 made by the sundry civil act approved March 3, 1905, was submitted on May 22 and approved on May 26. It provides for payments for dredging under contract.

On June 30 a project was submitted for the expenditure of $40,000, under the river and harbor act of March 3, 1905, and for the balance of funds on hand from allotments of May 23, 1903, and June 26, 1904.

About four-fifths of the work proposed under the old project above the Montclair and Greenwood Lake Railroad bridge had been completed, and about one-fifth of the work proposed under the new project had been completed on June 30, 1905.

It is proposed to apply the available funds and the additional appropriation recommended to continuing work under the new project and completing the old project in the upper part of the river.

Money statement.

July 1, 1904, balance unexpended		$177,827.94
Amount appropriated by sundry civil act approved March 3, 1905		75,000.00
Amount appropriated by river and harbor act approved March 3, 1905		40,000.00
		292,827.94
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$43,414.66	
For maintenance of improvement	2,743.22	
		46,157.88
July 1, 1905, balance unexpended		246,670.06
July 1, 1905, outstanding liabilities		7,552.55
July 1, 1905, balance available		239,117.51
July 1, 1905, amount covered by uncompleted contracts		163,375.34
Amount (estimated) required for completion of existing project		76,274.60
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$76,274.60	
For maintenance of improvement	15,000.00	
		91,274.60

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

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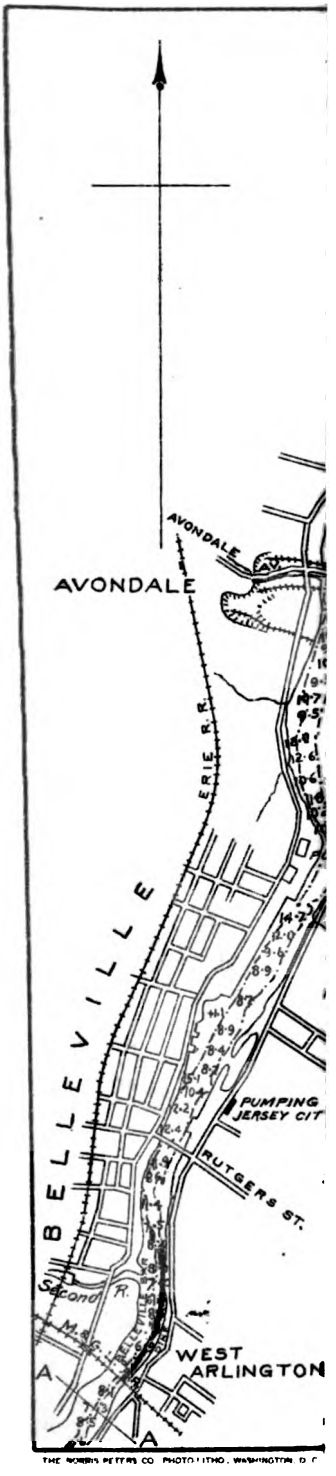

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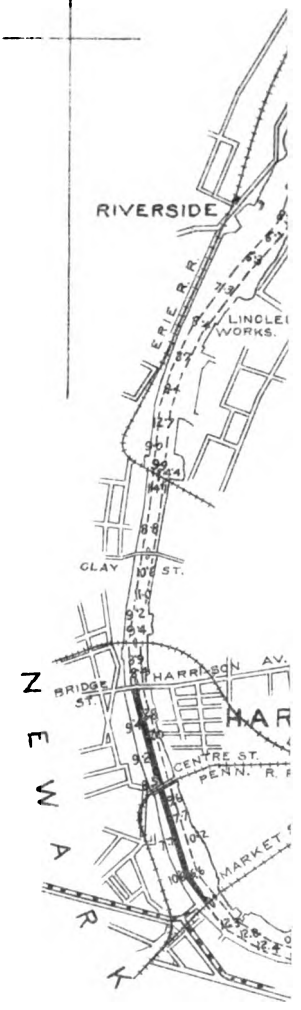

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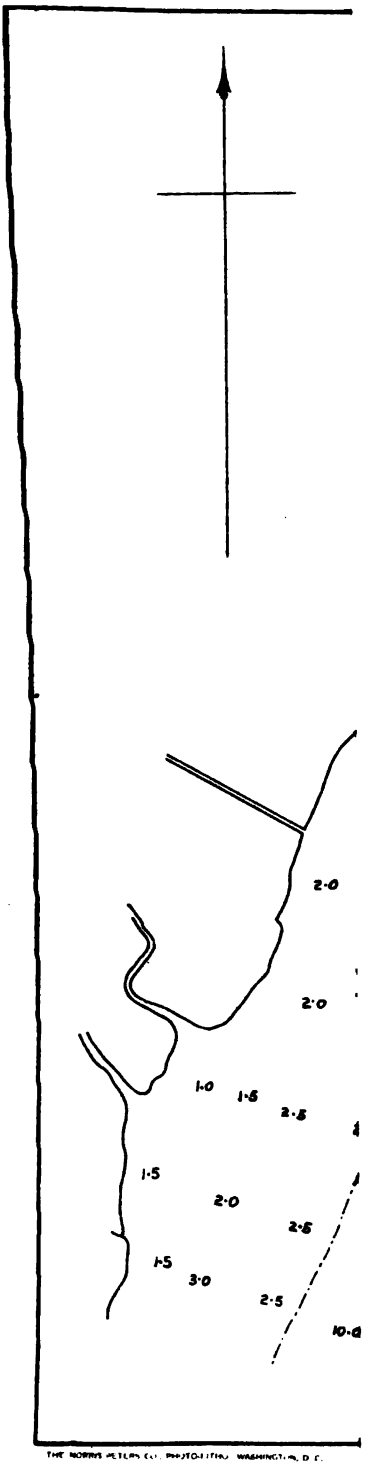

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APPROPRIATIONS.

For previous projects.

June 10, 1872	$25,000	
March 3, 1873	25,000	
June 23, 1874	20,000	
March 3, 1875	20,000	
August 10, 1876	10,000	
June 18, 1878	10,000	
March 3, 1879	2,000	
June 14, 1880	32,000	
March 3, 1881	50,000	
August 2, 1882	50,000	
July 5, 1884	28,000	
August 5, 1886	26,250	
August 11, 1888	35,000	
September 19, 1890	45,100	
June 13, 1892	45,000	
August 18, 1894	15,000	
June 3, 1896	15,000	
March 3, 1899	15,000	
June 6, 1900 (allotment)	10,000	
June 6, 1900 (allotment)	[a] 1,000	
		$479,350

For present project.

June 13, 1902	75,000	
June 13, 1902 (allotment—maintenance)	10,000	
March 3, 1903	100,000	
March 3, 1905	75,000	
March 3, 1905	40,000	
		300,000
Total for both projects		779,350

ABSTRACTS OF CONTRACTS IN FORCE.

Name of contractor: R. B. Rodermond.
Date of contract: September 15, 1903.
Date of commencement: October 3, 1903.
Date of completion: January 23, 1904; time of completion waived.
Dredging 17,000 cubic yards of material, more or less, at 50 cents per cubic yard, scow measurement. Removal of bowlders at $8 per cubic yard, solid measurement. Contract was completed on July 16, 1904.

Names of contractors: Kirk, Driscoll & Co.
Date of contract: March 1, 1904.
Date of approval: March 26, 1904.
Date of commencement: April 18, 1904.
Date of completion: September 6, 1905.
Dredging about 500,000 cubic yards of material at 15 cents per cubic yard, scow measurement, at a rate of not less than 30,000 cubic yards per month.

Name of contractors: P. Sanford Ross (Incorporated).
Date of contract: November 12, 1904.
Date of approval: November 26, 1904.
Date of commencement: March 1, 1905.
Date of completion: April 9, 1908.
Dredging about 707,000 cubic yards of material at 19.8 cents per cubic yard, scow measurement, at a rate of not less than 25,000 cubic yards per month.

[a] Returned to Treasury.

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COMMERCIAL STATISTICS.

Freight received and shipped by water, 1904 (estimated).

[Furnished by courtesy of the board of trade of the city of Newark, N. J.]

Articles.	Tons.	Estimated value.
Building materials	836,018	$5,786,731
Ores and metals	167,691	24,235,049
Fertilizers	68,824	800,000
Coal	177,397	1,245,146
Chemicals	7,650	165,000
Miscellaneous merchandise	825,000	98,250,780
To and from Hackensack River	485,362	4,368,258
Total	2,567,942	134,850,964

Statement showing number of vessels of all kinds, by months, passing through the Passaic River drawbridge of the Central Railroad Company of New Jersey, for the year ending December 31, 1904.

[Furnished by Mr. Jos. O. Osgood, chief engineer, Central Railroad Company of New Jersey.]

Month.	Steamers.	Schooners.	Barges.	Sloops.	Catboats.	Rafts.	Launches.	Total.
January	81	.....	18	.....	.....	.....	.....	99
February	80	.....	18	.....	.....	.....	.....	98
March	1,052	36	402	17	5	.....	.....	1,512
April	1,392	.....	360	62	8	.....	2	1,824
May	1,797	86	633	139	58	8	.....	2,716
June	552	39	262	65	83	.....	2	953
July	4,729	164	669	393	195	4	.....	6,154
August	2,218	78	702	328	204	2	6	3,538
September	687	65	309	92	15	.....	3	1,171
October	1,384	108	621	128	9	4	15	2,269
November	1,277	118	634	68	.....	10	.....	2,107
December	808	188	401	20	.....	5	.....	1,422
Total	16,057	882	5,029	1,312	527	28	28	28,863

The commerce is carried on in sail and steam vessels, canal boats, and barges, drawing from 4½ to 16 feet.

The following statement of commerce entered at the United States customhouse, port of Newark, has been furnished through the courtesy of the collector of customs, Newark, N. J.

Vessels entered and cleared.

	Foreign.		Domestic.		Tonnage tax collected.
	Entered.	Cleared.	Entered.	Cleared.	
Year ended June 30, 1901	82	81	15	2	$481.83
Year ended June 30, 1902	88	72	31	5	472.92
Year ended June 30, 1903	106	60	26	15	1,302.96
Year ended June 30, 1904	74	112	22	12	1,079.04
Ten months ended April 30, 1905	76	124	17	8	824.28

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Value of imports and exports.

	Exports.			Imports.		
	Domestic.	Foreign.	Total.	For consumption.	For warehouse.	Total.
Year ended June 30, 1901	$142,423	$1,080,870	$1,223,293	$372,060	$6,379,707	$6,751,737
Year ended June 30, 1902	121,452	980,165	1,101,617	142,336	4,672,093	4,814,429
Year ended June 30, 1903	139,478	606,061	745,539	212,031	3,930,377	4,142,408
Year ended June 30, 1904	219,272	1,195,796	1,415,068	118,132	4,253,298	4,371,430
Ten months ended April 30, 1905	223,685	3,487,679	3,711,364	175,189	3,482,844	3,658,033

G 2.

IMPROVEMENT OF ARTHUR KILL, OR STATEN ISLAND SOUND, NEW YORK AND NEW JERSEY, AND CHANNEL BETWEEN STATEN ISLAND AND NEW JERSEY.

(A) ARTHUR KILL, OR STATEN ISLAND SOUND.

Detailed descriptions of this waterway and of the projects for its improvement are printed in the Annual Report of the Chief of Engineers for 1900, pages 178 and 1525 to 1530, and a condensed history is contained in current summary.

OPERATIONS DURING THE PAST FISCAL YEAR.

At the close of the last fiscal year dredging on this improvement was in progress, under contract of William H. Taylor, and 98,529 cubic yards of material had been removed from the channel south and west of Shooters Island. No work is required under this contract during the winter seasons between December 20 and March 1. Dredging under contract was continued to December 31, when it was suspended for the winter; it was resumed on April 3, 1905, and was in progress at the close of the fiscal year ending June 30, 1905.

The amount of material dredged during the fiscal year was 560,888 cubic yards. The material was mud, sand, gravel, and clay, and it was dumped at sea. For the greater part of the season of 1904 three dredges were employed; two dredges have been at work this season.

The total amount of material removed under this contract is 659,417 cubic yards, and the work done thus far has been confined to that stretch of the channel lying between Staten Island and Shooters Island, and west of Shooters Island, to a point opposite east end of United States dike, off Howland Hook, N. Y. An area of about 6,800 feet in length and 150 to 300 feet in width has been dredged over. A portion of this area has not been dredged to grade, viz, 21 feet at mean low water, but will be so dredged before new work proceeds further. It is expected that this area will soon become navigable for one-half of the projected width of 300 feet, after which the channel will be continued with partial width down the Arthur Kill, and some additional work may be done at the lower end of the project.

Project for expenditure of the appropriation of $70,000 made by the sundry civil act approved March 3, 1905, was submitted on April 22 and approved on April 28. This project provides for expenditure of the appropriation for dredging in continuing contract in force.

About one-sixth of the work proposed had been accomplished up to June 30, 1905.

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It is proposed to apply the available funds and further appropriations to dredging for the completion of the improvement in accordance with the adopted project.

Money statement.

July 1, 1904, balance unexpended	$244,736.67
Amount appropriated by sundry civil act approved March 3, 1905	70,000.00
	314,736.67
June 30, 1905, amount expended during fiscal year, for works of improvement	88,274.97
July 1, 1905, balance unexpended	226,461.70
July 1, 1905, outstanding liabilities	16,890.25
July 1, 1905, balance available	209,571.45
July 1, 1905, amount covered by uncompleted contracts	425,586.30
Amount (estimated) required for completion of existing project	376,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	100,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

June 13, 1902	$100,000
March 3, 1903	150,000
March 3, 1905	70,000
Total	320,000

COMMERCIAL STATISTICS.

Name of contractor: William H. Taylor.
Date of contract: October 14, 1903.
Date of approval: October 27, 1903.
Date of commencement: November 26, 1903.
Date of completion: Indefinite; dependent upon appropriations.
Dredging about 3,535,000 cubic yards of material, at 14.8 cents per cubic yard, scow measurement.

COMMERCIAL STATISTICS.

Freight received and shipped by water, 1903.

[Statistics for 1904 were asked for but not received.]

Articles.	Tons.	Estimated value.
Coal	7,034,299	$27,716,654
Clay products	353,890	2,662,638
Building materials, etc	1,180,097	7,855,541
Ores and metals	488,481	90,084,011
Chemicals and fertilizers	372,891	6,260,109
Oils	45,736	1,308,082
Machinery and manufactures	226,080	14,697,905
General merchandise	1,815,996	116,521,056
Total	11,512,420	267,046,086

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The above statement is compiled from individual reports representing a large percentage of the total tonnage reported.

In the foreign and coastwise trade no report for 1904 has been received. During 1902, in the foreign trade, 42 vessels entered and 48 cleared; in the coastwise trade 86 entered and 75 cleared.

The freight is carried in barges, canal boats, and steam and sailing vessels, drawing from 5 to 23 feet of water.

(B) CHANNEL BETWEEN STATEN ISLAND AND NEW JERSEY, NEW YORK AND NEW JERSEY.

Detailed descriptions of this waterway and of the projects for its improvement are printed in the Annual Report of the Chief of Engineers for 1897, pages 1130 to 1132, and a condensed history is contained in the current summary.

Nothing has been done on this improvement during the fiscal year ending June 30, 1905.

A description of the last work done is contained in the Annual Report of the Chief of Engineers for 1904, page 1137.

Project for expenditure of the balances of former appropriations and that made by the river and harbor act approved March 3, 1905, was submitted to the Department on June 17 and approved June 23, 1905.

It is estimated that all work contemplated under this project has been practically completed once.

It is proposed to apply the available funds and the additional appropriation recommended to maintaining the channel between Staten Island and New Jersey.

Money statement.

July 1, 1904, balance unexpended	$3,287.92
Amount appropriated by river and harbor act approved March 3, 1905	10,000.00
	18,287.92
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	.45
July 1, 1905, balance unexpended	18,287.47
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	10,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of river and harbor act of 1899.

APPROPRIATIONS.

June 23, 1874	$50,000	July 13, 1892 [a]	$5,000
August 14, 1876	10,000	July 13, 1892	15,000
June 18, 1878	15,000	August 18, 1894 [a]	4,500
June 14, 1880	29,000	August 18, 1894	6,000
August 2, 1882	40,000	June 3, 1896 [b]	13,000
July 5, 1884	10,000	March 3, 1899	32,000
August 5, 1886	15,000	June 13, 1902 [b]	10,000
August 11, 1888 [a]	10,000	March 3, 1905	10,000
August 11, 1888	15,000		
September 19, 1890 [a]	7,000	Total	311,500
September 19, 1890	15,000		

[a] Appropriation for improving Arthur Kill, New York and New Jersey—removal of Steep Point.

[b] Includes $5,000 for Lemon Creek.

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COMMERCIAL STATISTICS.

[Statistics for 1904 were asked for but not received.]

Freight received and shipped by water, 1903.

This commerce includes that of Arthur Kill, and amounted to 14,129,678 tons; estimated value, $327,477,738.

LEMON CREEK.

The following information regarding statistics for 1904 was received through courtesy of Mr. Joseph C. Seguine:

"The principal industry at present is the preparation and sale of oysters. This business for the year 1904 reached the sum of about $350,000, which was operated by a plant, consisting of boats, etc., of $275,000. The above stream is very essential, as oysters planted in Princess Bay are prepared for shipment in Lemon Creek. This is on a limited scale, owing to there not being sufficient water to permit the sloops, steamers, etc. (drawing from 3½ to 6 feet and averaging from 4 to 40 tons capacity), to navigate at all tides.

"There is also a coal and masons' material yard, which does a business of $30,000 per annum, using schooners and canal boats of a capacity of from 80 to 200 tons.

"There is a boat-building concern, doing a business of $8,000 per year, and the Standard Oil Company has an agency on said creek to supply boats with gasoline and other oils."

G 3.

IMPROVEMENT OF WOODBRIDGE CREEK, NEW JERSEY.

Detailed descriptions of this creek and of the projects for its improvement are printed in the Annual Report of the Chief of Engineers for 1900, page 1552, and a condensed history is contained in current summary.

OPERATIONS DURING THE PAST FISCAL YEAR.

Under date of September 7 an allotment was made by the Department and the examination was made and report upon same submitted on November 12, together with an estimate for restoring the dredged channel. In accordance with that report the Department on November 23 allotted the sum of $7,500 for the proposed emergency work and requested that a project for the expenditure of that allotment be submitted, and a project was submitted on December 17 and approved on December 21, 1904. The work was advertised under ten-day public notice, dated January 18, 1905, and the bid of P. Sanford Ross (Incorporated), dated January 30, the only one received, to do the proposed emergency dredging at 24 cents per cubic yard was rejected, as it was thought that a lower bid could be obtained. On February 6 Mr. Ross submitted a proposal to do the work at 22 cents per cubic yard. This proposal was forwarded to the Department with report, dated February 13, 1905, and recommended for acceptance. Acceptance of this proposal was approved on February 16, and an emergency contract, dated March 11, 1905, was entered into for the proposed work.

It provides for the removal of 29,500 cubic yards of material. Operations under this contract were commenced on April 10 by the

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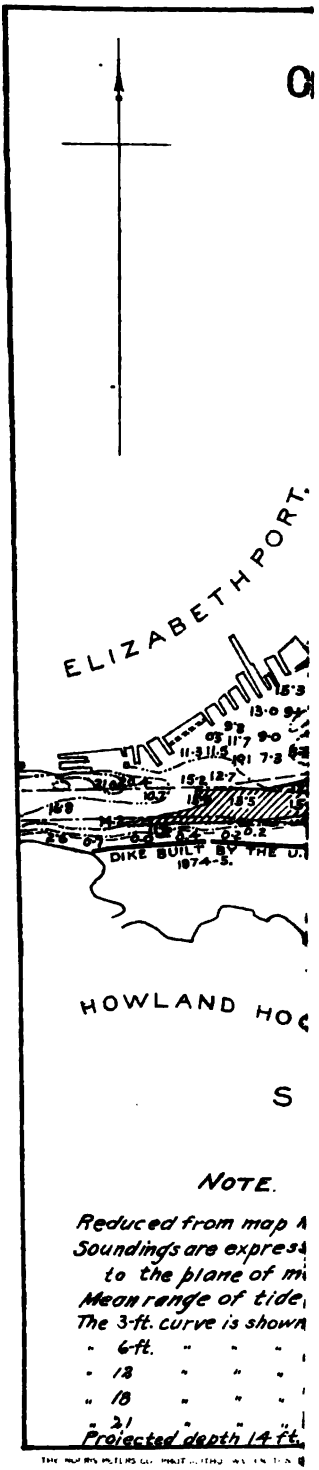

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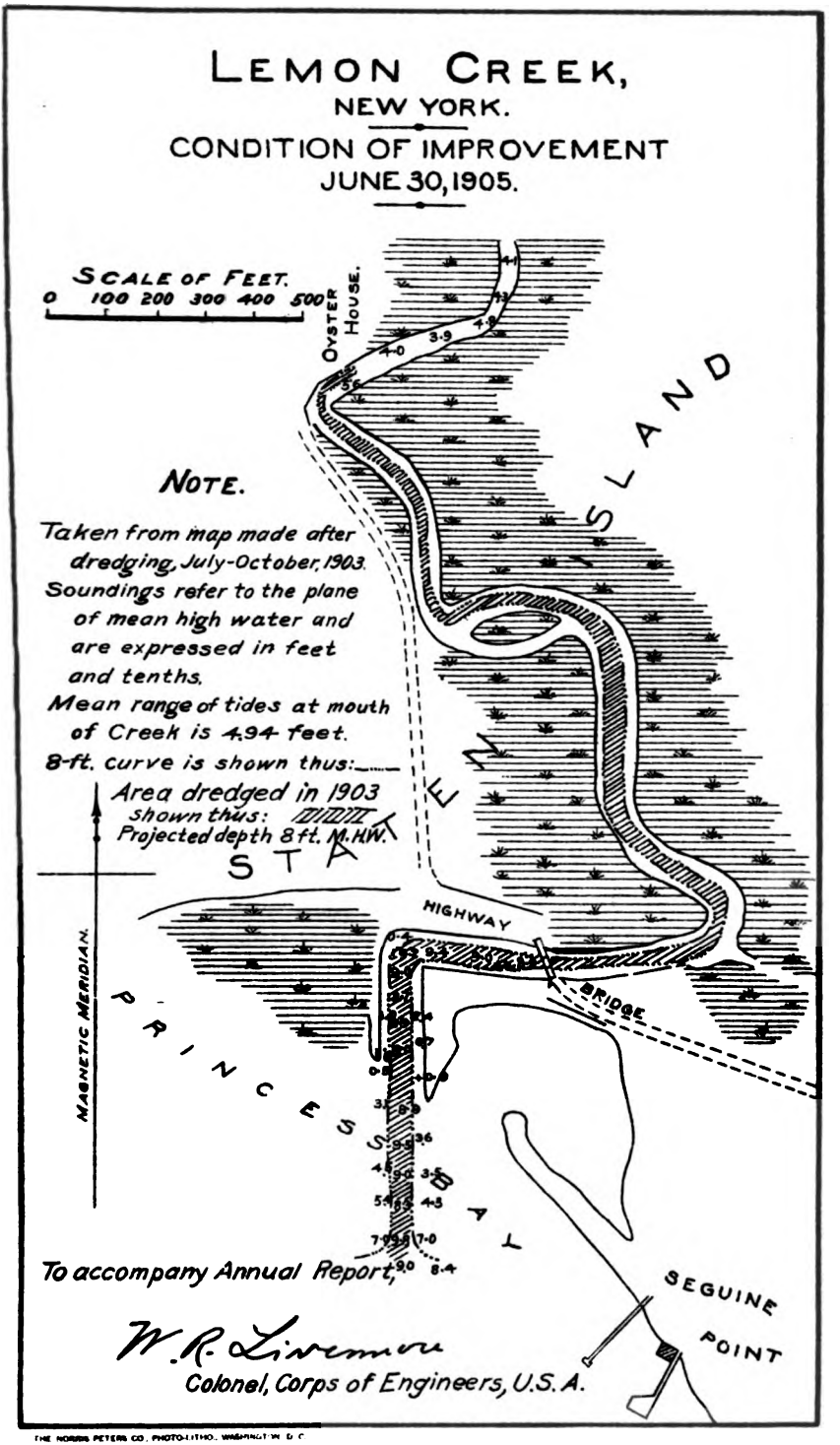

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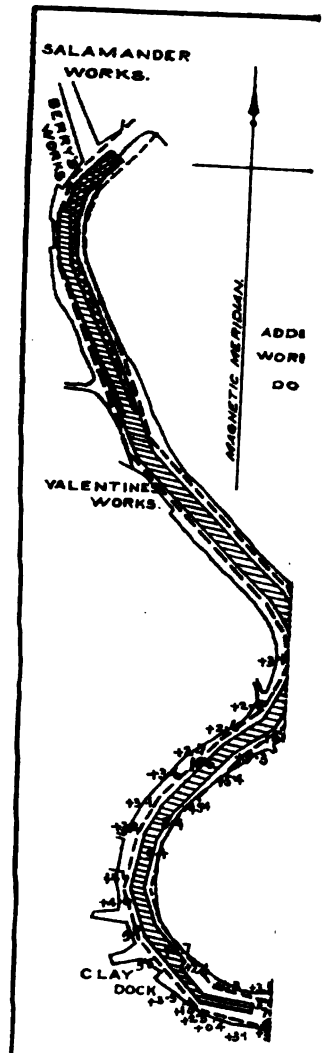

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pumping dredge, but the actual excavation of material was not begun until about April 15. The work has been in progress since that date. The excavation is done with a scoop dredge. The material is placed in scows, towed to the pump and dumped, and afterwards pumped ashore on marsh land on the south side of the creek, in the vicinity of Valentine's dock. At the close of the year the total amount of material removed and estimated for under this contract was 21,799, and the channel had been restored to projected dimensions for a length of about 3,000 feet, extending up the creek from the vicinity of the clay docks.

Project for expenditure of the appropriation of $6,000, made by the river and harbor act, approved March 3, 1905, was submitted on May 22 and approved on May 26, 1905. This project provides for expenditure of appropriation for dredging in maintaining and continuing improvement.

About two-sevenths of the work proposed under the present project has been completed.

It is proposed to apply the available funds and the additional appropriation recommended to the completion and maintenance of the project.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1905	$6,000.00
Amount allotted from appropriation for maintenance of river and harbor improvements, act of April 28, 1904	7,750.00
	13,750.00
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	3,498.57
July 1, 1905, balance unexpended	10,251.43
July 1, 1905, outstanding liabilities	2,109.46
July 1, 1905, balance available	8,141.97
July 1, 1905, amount covered by uncompleted contracts	1,694.22
Amount (estimated) required for completion of existing project	19,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:	
For works of improvement $19,000.00	
For maintenance of improvement 5,000.00	
	24,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

For previous project.

March 3, 1879	$4,000
June 14, 1880	5,000
March 3, 1881	5,000
August 2, 1882	5,000
Total	19,000

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For present project.

June 13, 1902	$10,000
April 28, 1904 (allotment for survey)	250
April 28, 1904 (allotment)	7,500
March 3, 1905	6,000
Total	23,750
Total for both projects	42,750

ABSTRACT OF CONTRACT IN FORCE.

Name of contractor: P. Sanford Ross, Incorporated.
Date of contract: March 11, 1905.
Date of commencement: April 10, 1905.
Date of completion: August 1, 1905.
Dredging 29,500 cubic yards of material, more or less, at 22 cents per cubic yard, scow measurement.

COMMERCIAL STATISTICS.

Freight received and shipped by water, 1904.

Articles.	Tons.	Estimated value.
Received:		
Tin scrap	20,000	$300,000
Coal	22,000	70,500
Stone	24,000	60,000
Clays	15,000	37,500
Sawdust	3,000	3,000
Brick	1,600	4,850
Shipped:		
Steel scrap	10,000	160,000
Fire, building, and hollow brick, tile, etc	42,919	343,684
Fire clay, etc	21,794	64,124
Sundries	5,000	100,000
Total	165,313	1,143,658

Vessels engaged in above commerce.

Class.	Number.	Number of trips.	Draft when loaded.	Tonnage.
			Feet.	
Steamers	3	3	5 to 6	0 to 100
Sail vessels	8	429	5 to 13	40 to 275
Barges, etc	6	391	4 to 13	100 to 400
Total	17	823		

G 4.

IMPROVEMENT OF RARITAN BAY, NEW JERSEY.

Detailed description of this bay and of the projects for its improvement are printed in the Annual Report of the Chief of Engineers for 1897, pages 1142 and 1143, and a condensed history is contained in the current summary.

Nothing has been done on this improvement during the fiscal year ending June 30, 1905. A description of the last work done is

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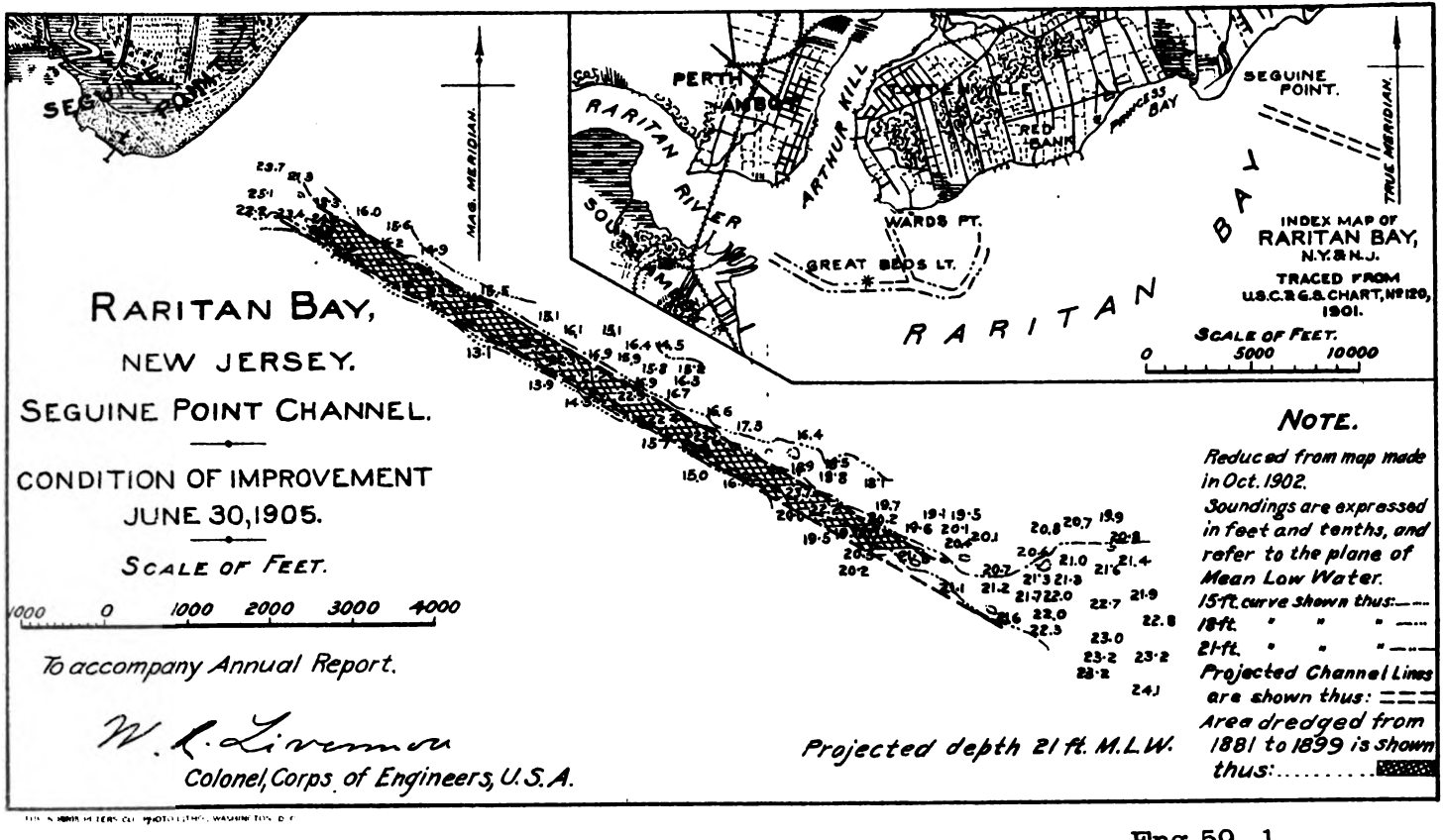

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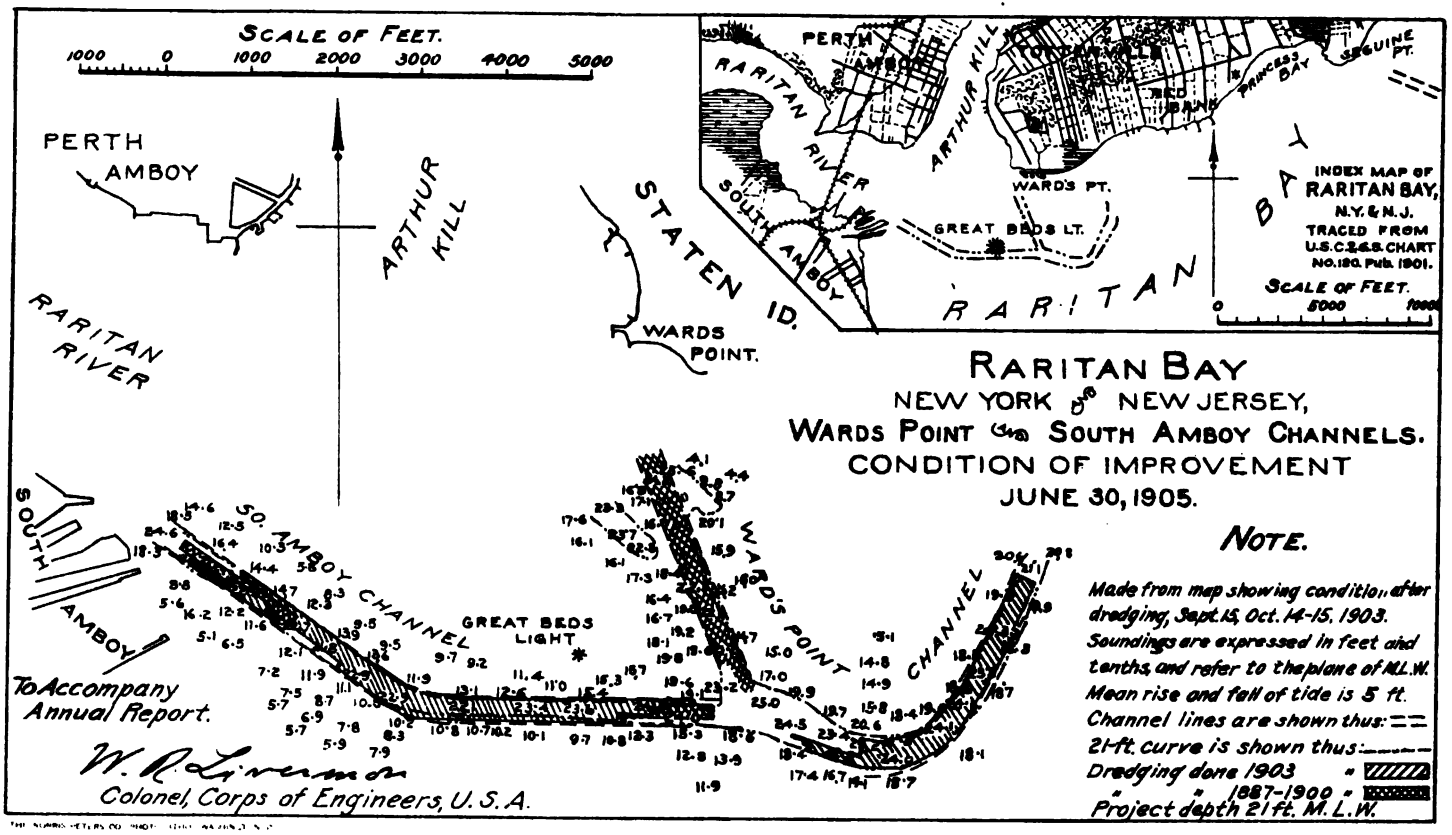

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contained in Annual Report of the Chief of Engineers for 1904, page 1141.

Project for expenditure of appropriation of $50,000 for dredging, made by the river and harbor act approved March 3, 1905, was submitted to the Department on April 22, and was approved on April 28, 1905. The preparation of specifications for dredging was in progress at the close of the fiscal year.

The channels to be dredged under the approved project as it now stands for this improvement have been practically completed once, but owing to continual shoaling they are never in a completed condition, so that dredging for maintenance is always necessary.

It is proposed to apply the additional appropriation recommended to maintenance of the improvement.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1905	$50,000.00
July 1, 1905, balance unexpended	50,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905, for maintenance of improvement	20,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1890.	

APPROPRIATIONS.

March 3, 1881	$50,000	August 18, 1894	$40,000
August 2, 1882	50,000	June 3, 1896	75,000
July 5, 1884	20,000	March 3, 1899	65,000
August 5, 1886	37,500	June 13, 1902	45,000
August 11, 1888	25,000	March 3, 1905	50,000
September 19, 1890	40,000		
July 13, 1892	40,000	Total	537,500

COMMERCIAL STATISTICS.

Freight received and shipped by water, 1903.

[Statistics for 1904 were asked for, but not received.]

Articles.	Tons.	Estimated value.
Received:		
Ores and metals	86,662	$16,161,789
Clay products	162,198	667,383
Chemicals and fertilizer	72,845	1,201,959
Oils	5,487	156,928
Building materials, etc.	363,940	2,400,762
Coal	69,659	673,632
Copper	16,460	3,950,040
Manufactures	95,205	4,810,467
General merchandise	329,184	19,019,809

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Freight received and shipped by water, 1903—Continued.

Articles.	Tons.	Estimated value.
Shipped:		
Coal	2,271,362	$9,013,121
Ores and metals	59,487	10,675,562
Clay products	178,073	2,081,621
Chemicals and fertilizer	53,625	852,155
Oils	9,335	286,981
Building materials, etc	351,164	2,157,999
Copper	21,319	5,116,560
Manufactures	39,536	2,143,268
General merchandise	298,613	20,492,419
Total	4,484,152	101,842,455

Vessels engaged in commerce for 1902.

[No reports for 1903 or 1904 have been received.]

Class.	Number of trips.	Draft when loaded.	Tonnage.
		Feet.	
Steamers	10,020	7 to 23	50 to 1,000
Sail vessels	15,050	8 to 23	8 to 800
Barges, etc	44,309	7 to 23	100 to 2,000
Total	69,379		

G 5.

IMPROVEMENT OF KEYPORT HARBOR, MATTAWAN CREEK, RARITAN, SOUTH, AND ELIZABETH RIVERS, SHOAL HARBOR AND COMPTON CREEK, AND CHEESEQUAKE CREEK, NEW JERSEY.

(A) KEYPORT HARBOR.

Detailed descriptions of this harbor and of the project for its improvement are printed in the Annual Report of the Chief of Engineers for 1897, pages 1147 to 1149, and a condensed history is contained in the current summary.

OPERATIONS DURING THE PAST FISCAL YEAR.

In compliance with instructions contained in Department letter dated May 5, 1904, report and estimate of allotment of $5,000 for Keyport Harbor, from river and harbor appropriation of April 28, 1904, for restoration of channel, were submitted on May 13, and under date of May 31, 1904, the Secretary of War made an allotment of the amount requested from the appropriation for emergencies in river and harbor act of June 13, 1902.

Under this allotment proposals for dredging by eleven-day public notice were opened on September 10, and the bid of The International Contracting Company, the lowest of five bids received, to do the required work for 19 cents per cubic yard, scow measurement, was duly accepted, and an emergency contract dated September 26, 1904, was entered into. Dredging under this contract was commenced on October 25 and continued until November 7, upon which date the total

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amount of material required to be removed under the contract had been reached. Soundings taken after dredging showed that the bottom was very uneven and that the work was unsatisfactory. The contractor then dragged heavy I beams with a tug up and down the dredged area for about two days, after which the work was again sounded and found to be much more even and the work was accepted. The bottom was soft mud. The total amount removed under the contract was 23,968 cubic yards, and the total work accomplished consisted in restoring the channel to 8 feet depth through its shoalest parts for a length of 1,800 feet, with width of 100 feet between the 8-foot curve in Raritan Bay and the New York and Freehold Railroad wharf, and for a length of 1,400 feet, with width of 50 feet, between the latter wharf and the steamboat wharf at Keyport.

The funds available were insufficient to fully restore the projected channel depth throughout the whole length of the improvement, but the worst shoals were removed, making the available depth through the channel at the close of work about 7 feet at mean low water.

This improvement is included in the consolidated appropriation of $50,000 made by the river and harbor act approved March 3, 1905, from which allotment of $5,000 has been made for this work.

About three-fourths of the work proposed under the present project has been completed.

It is proposed to apply the available funds and the additional appropriation recommended to the completion and maintenance of the improvement in accordance with the adopted project.

Money statement.

July 1, 1904, balance unexpended		$5,000.00
Amount appropriated by river and harbor act approved March 3, 1905 (allotment)		5,000.00
		10,000.00
June 30, 1905, amount expended during fiscal year, for maintenance of improvement		5,000.00
July 1, 1905, balance unexpended		5,000.00
Amount (estimated) required for completion of existing project		9,975.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$9,975.00	
For maintenance of improvement	5,000.00	
		14,975.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

APPROPRIATIONS.

August 2, 1882	$30,475	June 13, 1902 (allotment; maintenance)	$5,000
July 13, 1892	5,000	March 3, 1905 (allotment)	5,000
August 18, 1894	5,000		
June 3, 1896	2,500	Total	60,475
March 3, 1899	2,500		
June 13, 1902 (allotment)	5,000		

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ABSTRACT OF EMERGENCY CONTRACT IN FORCE.

Name of contractor: The International Contracting Company.
Date of contract: September 26, 1904.
Date of commencement: October 25, 1904.
Date of completion: January 24, 1905.
Dredging about 23,000 cubic yards of material, at 19 cents per cubic yard, scow measurement. This contract was completed on November 7, 1904.

COMMERCIAL STATISTICS.

Freight received and shipped by water, 1904.

[Statement by Geo. Wright Campbell, secretary New York and New Jersey Steamboat Company.]

Articles.	Tons.	Estimated value.
Received:		
General merchandise	15,000	$600,000
Manure and fertilizer	7,000	28,000
Coal and lumber	6,000	.....
Shipped:		
Farm produce	30,000	1,200,000
Fish and shellfish	12,000	120,000
Total	70,000	1,948,000

Vessels engaged in above commerce.

Class.	Number.	Number of trips.	Draft when loaded.	Tonnage.
			Feet.	
Steamers	4	1,120	7 to 9	200 to 500
Sail vessels	60	.....	4 to 12	50 to 300
Barges, etc	125	.....	.....	75 to 350
Total	189	1,120		

To the above should be added the commerce of Matawan Creek, New Jersey, as it passes in and out through Keyport Harbor.

(B) MATAWAN CREEK.

Detailed description of this creek and of the project for its improvement are printed in the Annual Report of the Chief of Engineers for 1897, page 1145, and a condensed history is contained in the current summary.

OPERATIONS DURING THE PAST FISCAL YEAR.

In compliance with instructions contained in Department letter dated May 5, 1904, report and estimate of allotment of $3,000 for Matawan Creek from river and harbor appropriation of April 28, 1904, for restoration of channel were submitted on May 13, and under date of May 31, 1904, the Secretary of War made an allotment of the amount requested from the appropriation for emergencies in river and habor act of June 13, 1902.

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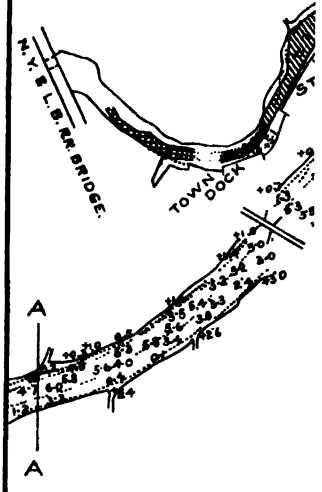

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

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Under this allotment an offer from Messrs. T. G. Smith & Co. (Incorporated), dated July 11, to do the required work for 24.9 cents per cubic yard, prism measurement, was accepted, and an emergency contract, dated July 29, 1904, for the removal of about 10,000 cubic yards at the price named was entered into. Excavation under this contract was commenced on August 9. The work was done by the direct pumping method, and the pump required frequent repairs and new appliances. The contract was completed on October 7, and the total amount of material removed was 9,050 cubic yards.

The work accomplished under the contract consisted in restoring the channel between the steamboat wharf and the dock of the Pennsylvania Clay Company to a depth of about 4 feet at mean low water for a length of 1,700 feet and bottom width of 40 feet and top width of about 50 feet. At the close of this emergency work the projected depth of 4 feet at mean low water could be carried from Keyport Harbor to the steamboat wharf at Matawan, which is the present head of navigation, and about 1,000 feet below the railroad bridge, which limits the project.

This improvement is included in the consolidated appropriation of $50,000 made by the river and harbor act approved March 3, 1905, from which allotment of $3,000 has been made for this work.

About two-thirds of the work proposed under the project has been completed.

It is proposed to apply the available funds and the additional appropriation recommended to the completion and maintenance of the improvement in accordance with the adopted project.

Money statement.

July 1, 1904, balance unexpended		$3,000.00
Amount appropriated by river and harbor act approved March 3, 1905 (allotment)		3,000.00
		6,000.00
June 30, 1905, amount expended during fiscal year:		
For maintenance of improvement	$2,684.39	
Deposited to credit of Treasurer United States	315.61	
		3,000.00
July 1, 1905, balance unexpended		3,000.00
Amount (estimated) required for completion of existing project		12,120.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$12,120.00	
For maintenance of improvement	3,000.00	
		15,120.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

APPROPRIATIONS.

March 3, 1881	$15,000	June 13, 1902 (allotment)	$3,000
August 2, 1882	6,000	June 13, 1902 (allotment) (maintenance)	[a] 3,000
September 19, 1890	2,500	March 3, 1905 (allotment)	3,000
July 13, 1892	9,620		
August 18, 1894	3,000	Total	51,120
June 3, 1896	3,000		
March 3, 1899	3,000		

[a] $315.61 returned to Treasury.

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ABSTRACT OF CONTRACT IN FORCE.

Name of contractors: T. G. Smith & Co. (Incorporated).
Date of contract: July 29, 1904.
Date of commencement: August 8, 1904.
Date of completion: October 7, 1904.
Dredging about 10,000 cubic yards of material, at 24.9 cents per cubic yard, prism measurement. This contract was completed on October 7, 1904.

COMMERCIAL STATISTICS.

Freight received and shipped by water, 1904.

[Statement furnished by George Wright Campbell, secretary New York and New Jersey Steamboat Company.]

Articles.	Tons.	Estimated value.
Received:		
Fertilizer	10,000	$40,000
Shells and lime	7,500	.....
Shipped:		
Farm produce	100	4,000
Brick	12,000	30,000
Total	29,600	74,000

Vessels engaged in above commerce.

Class.	Number.	Number of trips.	Draft when loaded.	Tonnage.
			Feet.	
Steamers	1	12	7½	500
Sail vessels	1	20	6	150
Barges, etc	.....	60	6	50-300
Total	2	92		

(C) RARITAN RIVER.

Detailed descriptions of this river and of the projects for its improvement are printed in the Annual Reports of the Chief of Engineers for 1897, pages 1136 to 1139, for 1900, page 1505, and a condensed history is contained in current summary.

OPERATIONS DURING THE PAST FISCAL YEAR.

At the close of the last fiscal year, under allotment of $20,000 from the consolidated appropriation of $43,000 made by the river and harbor act approved June 13, 1902, and in accordance with project for its expenditure approved September 10, 1902, dredging was in progress under contract with Messrs. Rogers & O'Brien, dated March 24, 1903, for the removal of 72,000 cubic yards of material, at 25 cents per cubic yard, and 69,251 cubic yards had been removed.

Dredging for maintenance of improvement under the contract in force was continued on July 1, and the contract was completed on that date. The amount of material (sand and gravel) dredged in July was 720 cubic yards, and the work done consisted in making a

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third cut 250 feet in length and 32 feet in width at Bishops Point, with a depth of 11 feet at mean low water.

The summary of work done thus far under this contract is as follows:

Location.	Cubic yards removed.	Area dredged.	Depth at mean low water.
		Feet.	
1. Middle ground	18,229	1,600 by 100	12
2. Red Root Creek	2,478	600 by 50	7
3. Channel off Bloomfield's wharf between stakes and middle ground	2,297	250 by 100	12
4. Rocky reach	4,419	700 by 60	10½ to 11
5. Martin's reach, off Martin's dock	18,883	1,800 by 96	10 to 11
6. Martin's reach, upper part, and first bend above	15,990	2,800 by 32 to 64	10 to 11
7. Bishops Point	7,675	1,000 by 64 250 by 32	10 to 11
Total	69,971		

All the dredged material was pumped ashore above high-water mark on or near the banks of the river or behind dikes in the vicinity of the dredged areas.

An examination of the dredged channel was made in July and soundings platted during the month of August.

This improvement is included in the consolidated appropriation of $50,000 made by the river and harbor act approved March 3, 1905, from which allotment of $22,000 has been made for this work.

About two-thirds of the work contemplated under the project has been completed.

Details in reference to progress made upon this improvement and estimates for its completion may be found in the Annual Report of the Chief of Engineers for 1900, pages 180 and 1505.

To maintain the work already done an annual appropriation of $10,000 is considered necessary. The available funds and the additional appropriation recommended will be applied to widening the channel between Whitehead's dock and New Brunswick and to maintenance work.

Money statement.

July 1, 1904, balance unexpended		$7,375.64
Amount appropriated by river and harbor act approved March 3, 1905 (allotment)		22,000.00
Received from sale of condemned property		1.15
		29,376.79
June 30, 1905, amount expended during fiscal year, for maintenance of improvement		5,141.22
July 1, 1905, balance unexpended		24,235.57
Amount (estimated) required for completion of existing project		373,392.68
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$50,000.00	
For maintenance of improvement	10,000.00	
		60,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

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APPROPRIATIONS.

June 18, 1878	$200,000	July 13, 1892	$40,000
March 3, 1879	60,000	August 18, 1894	20,000
June 14, 1880	100,000	June 3, 1896	20,000
March 3, 1881	25,000	March 3, 1899	20,000
August 2, 1882	25,000	June 13, 1902 (allotment)	20,000
July 5, 1884	35,000	March 3, 1905 (allotment)	22,000
August 5, 1886	26,250		
August 11, 1888	50,000	Total	713,250
September 19, 1890	50,000		

December 16, 1904, received from sale of condemned property $1.15

ABSTRACT OF CONTRACT IN FORCE.

Name of contractors: Rogers & O'Brien.
Date of contract: March 24, 1903.
Date of approval: May 7, 1903.
Date of commencement: June 1, 1903.
Date of completion: December 1, 1903; time of completion waived.
Dredging 72,000 cubic yards of material, more or less, at 25 cents per cubic yard, scow measurement. This contract was completed on July 1, 1904.

COMMERCIAL STATISTICS.

Freight received and shipped by water, 1903.

[Statistics for 1904 were asked for but not received.]

Articles.	Tons.	Estimated value.
Coal	82,878	$951,080
Clay, ores, sand, etc	304,537	1,221,567
Lumber	12,777	242,763
Fertilizer	7,594	43,111
Brick, conduit, fireproofing, etc	436,321	2,474,788
Copper	37,779	9,066,600
Manufactures	32,488	617,272
Shellfish	2,391	2,189
Miscellaneous merchandise	103,660	4,732,408
Total	1,020,420	19,351,778

Vessels engaged in above commerce.

Class.	Number of trips.	Draft when loaded.	Tonnage.
		Feet.	
Steamers	2,943	5 to 11	110 to 300
Sail vessels	3,869	4 to 17	50 to 1,000
Barges, etc	7,324	4 to 12	75 to 750
Total	14,136		

(D) SOUTH RIVER.

Detailed description of this river and of the projects for its improvement are printed in the Annual Report of the Chief of Engineers for 1897, page 1139, and a condensed history is contained in the current summary.

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Areas dredged in 1903 show

" " 1882-1900 "

Projected depth 4 to 8 ft.

To accompany Annual Repor

W. H. Liver

Colonel, Corps of

THE WORRIS PETER CO. LITHO. WASHINGTON D.C.

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Nothing has been done on this improvement during the fiscal year ending June 30, 1905. The channel dredged in the preceding fiscal year was sounded in July, 1904.

This improvement is included in the consolidated appropriation of $50,000 made by the river and harbor act approved March 3, 1905, from which allotment of $5,000 has been made for this work.

A description of the last work done is contained in Annual Report of the Chief of Engineers for 1904, page 1148.

About three-eighths of the work contemplated under this project has been completed.

Details as to the progress made in carrying out this project may be found in the Annual Reports of the Chief of Engineers for 1900, page 181, and for 1901, page 1237.

The additional appropriation recommended will be applied to continuing the improvement and maintenance work.

Money statement.

July 1, 1904, balance unexpended		$534.80
Amount appropriated by river and harbor act approved March 3, 1905 (allotment)		5,000.00
		5,534.80
June 30, 1905, amount expended during fiscal year, for maintenance of improvement		534.80
July 1, 1905, balance unexpended		5,000.00
Amount (estimated) required for completion of existing project		98,975.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$50,000.00	
For maintenance of improvement	5,000.00	
		55,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

APPROPRIATIONS.

For previous project.

March 3, 1871	$15,000	
March 3, 1873	5,000	
		$20,000

For present project.

June 14, 1880	$40,000	
March 3, 1881	6,000	
August 2, 1882	10,000	
August 5, 1886	5,000	
August 11, 1888	5,000	
September 19, 1890	5,000	
July 13, 1892	7,000	
August 18, 1894	5,000	
June 3, 1896	5,000	
March 3, 1899	5,000	
June 13, 1902 (allotment)	5,000	
March 3, 1905 (allotment)	5,000	
		103,000
Total for both projects		123,000

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COMMERCIAL STATISTICS.

Freight received and shipped by water, 1904.

Articles.	Tons.	Estimated value.
Received:		
Coal	16,079	$73,984
Fertilizer	9,900	11,325
Sand	3,000	3,000
Shipped:		
Brick conduit, flue lining, fireproofing, etc	233,457	907,654
Sand and clay	30,190	31,428
Total	292,626	1,027,371

Vessels engaged in above commerce.

Class.	Number.	Number of trips.	Draft when loaded.	Tonnage.
			Feet.	
Steamers	1	125	7½ to 8½	100 to 150
Sail vessels	27	669	5 to 13	75 to 450
Barges, etc	36	610	6½ to 9	150 to 1,750
Total	64	1,404		

A new transportation line has been established by the McGirr Transportation Company.

(E) ELIZABETH RIVER.

Detailed description of this river and of the project for its improvement are printed in the Annual Report of the Chief of Engineers for 1897, page 1134, and a condensed history is contained in the current summary.

Nothing has been done on this improvement during the fiscal year ending June 30, 1905.

This improvement is included in the consolidated appropriation of $50,000 made by the river and harbor act approved March 3, 1905, from which allotment of $5,000 has been made for this work.

A description of the last work done is contained in the Annual Report for 1904, page 1150.

About two-thirds of the work contemplated under this project has been completed.

The additional appropriation recommended will be applied to maintenance and completion of improvement in accordance with the adopted project.

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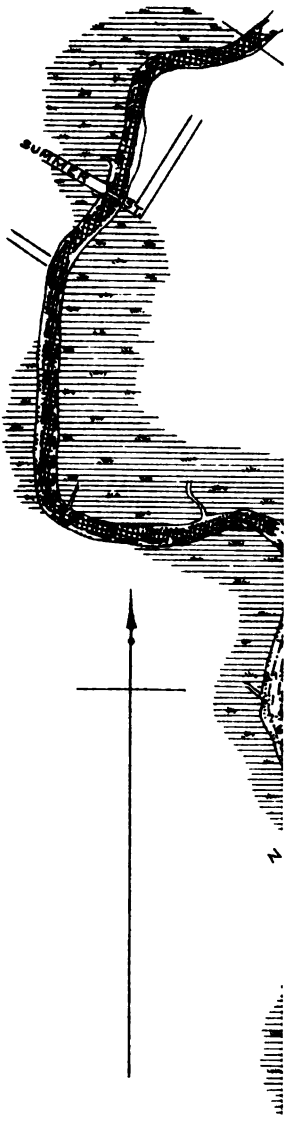

To accompany Annual Re

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Colonel, Corps

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Money statement.

Amount appropriated by river and harbor act approved March 3, 1905 (allotment)	$5,000.00
July 1, 1905, balance unexpended	5,000.00
Amount (estimated) required for completion of existing project	16,160.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:	
For works of improvement $16,160.00	
For maintenance of improvement 5,000.00	
	21,160.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

March 3, 1879	$7,500	August 18, 1894	$3,000
June 14, 1880	7,500	June 3, 1896	3,160
March 3, 1881	4,000	June 13, 1902 (allotment)	2,000
August 2, 1882	8,000	March 3, 1905 (allotment)	5,000
September 19, 1890	5,000		
July 13, 1892	5,000	Total	50,160

COMMERCIAL STATISTICS.

Freight received and shipped by water, 1904.

[Statement by merchants located on river.]

Articles.	Tons.	Estimated value.
Received:		
Rags and tar	6,612	$54,996
Sand, brick, and stone	13,480	38,040
Coal and gas coal	7,400	24,400
Chemicals	383	3,537
Lumber	4,800	59,850
Clams and oysters	3,000	1,000
Shipped:		
Chemicals	43	4,611
Fertilizer	18	280
Lumber	600	7,200
Total	36,336	193,894

Vessels engaged in above commerce.

Class.	Number.	Number of trips.	Draft when loaded.	Tonnage.
			Feet.	
Steamers		80	5 to 10	150
Sail vessels	11	284	4 to 9	25 to 85
Barges, etc.	12	161	4 to 10	100 to 500
Total	23	505		

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(F) SHOAL HARBOR AND COMPTON CREEK.

Detailed description of this locality and of the project for its improvement are printed in the Annual Report of the Chief of Engineers for 1897, page 1150, and a condensed history is contained in the current summary.

Nothing was done owing to lack of funds. The last work done was authorized by the river and harbor act approved June 13, 1902, and was completed on June 12, 1903. About one-quarter of the work proposed under this project has been completed.

This improvement is included in the consolidated appropriation made by the river and harbor act approved March 3, 1905, from which an allotment of $5,000 has been made for this work.

The additional appropriation recommended will be applied to continuing and maintaining the improvement.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1905 (allotment)		$5,000.00
July 1, 1905, balance unexpended		5,000.00
Amount (estimated) required for completion of existing project		47,130.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$47,130.00	
For maintenance of improvement	5,000.00	
		52,130.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

APPROPRIATIONS.

September 19, 1890	$5,000	June 13, 1902 (allotment)	$8,000
July 13, 1892	3,000	March 3, 1905 (allotment)	5,000
August 18, 1894	3,000		
June 3, 1896	5,000	Total	37,000
March 3, 1899	8,000		

COMMERCIAL STATISTICS.

Freight received and shipped by water, 1904.

[Statements by Capt. Thomas W. Collins, Vernon S. Vail, and T. Gibson, Port Monmouth, N. J.]

Articles.	Tons.	Estimated value.
Received:		
Fertilizer	3,100	$8,300
Coal	900	4,400
Fish and clams	4,069	67,200
General merchandise	1,000	75,000
Shipped:		
Farm produce	15,000	350,000
Fish and clams	3,861	393,700
Fish scrap	500	12,500
Fish oil and grease	140	5,250
Total	28,570	906,350

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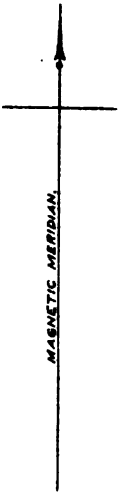

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THE HORRIS PETERS CO., PHOTO-LITHO. WASHINGTON D.

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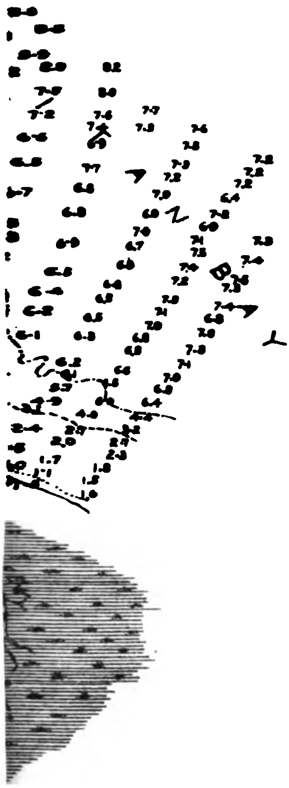

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Vessels engaged in above commerce.

Class.	Number.	Number of trips.	Draft when loaded.	Tonnage.
			Feet.	
Steamers	3	338	4 to 7	20 to 200
Sail vessels	70	36,400	1 to 7	1 to 175
Barges, etc	10	160	5 to 7	3 to 500
Power boats	110	46,400	1 to 5	1 to 30
Total	193	83,298		

The number of passengers carried by Steamer *Wm. V. Wilson* during 1904 was about 2,000.

(G) CHEESEQUAKE CREEK.

Detailed description of this waterway and of the projects for its improvement are printed in the Annual Report of the Chief of Engineers for 1886, pages 763 to 765, and a condensed history is contained in current summary.

Nothing has been done on this improvement during the fiscal year ending June 30, 1905.

This improvement is included in the consolidated appropriation of $50,000 made by the river and harbor act approved March 3, 1905, from which allotment of $5,000 has been made for this work.

Description of last work done is contained in Annual Report of the Chief of Engineers for 1886, page 763.

About four-ninths of the work contemplated under this project has been completed.

The additional appropriation recommended will be applied to maintenance and completion of improvement in accordance with the adopted project.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1905 (allotment)		$5,000.00
July 1, 1905, balance unexpended		5,000.00
Amount (estimated) required for completion of existing project		50,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$50,000	
For maintenance of improvement	2,000	
		52,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

APPROPRIATIONS.

June 14, 1880	$20,000
March 3, 1881	5,000
August 2, 1882	15,000
March 3, 1905 (allotment)	5,000
Total	45,000

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COMMERCIAL STATISTICS.

The commerce of the creek is principally in brick, clay, and farm produce, and amounted in 1886 to about 50,000 tons, valued at about $216,000.

Freight received and shipped by water, 1904.

[Statement by Mr. John B. Collins, Keansburg, N. J.]

Articles.	Tons.	Estimated value.
Received:		
Manure	5,000	$7,000
Shipped:		
Produce	5,000	90,000
Clay	15,000	25,000
Sand	10,000	10,000
Total	35,000	132,000

Vessels engaged in above commerce.

Class.	Number of trips.	Draft when loaded.	Tonnage.
		Feet.	
Steamers	150	7 to 8	25 to 325
Barges, etc		6 to 7	150 to 200

G 6.

IMPROVEMENT OF SHREWSBURY RIVER, NEW JERSEY.

Detailed descriptions of this river and of the projects for its improvement are printed in the Annual Reports of the Chief of Engineers for 1897, pages 1152 and 1155; for 1900, page 185, and a condensed history is contained in current summary.

OPERATIONS DURING THE PAST FISCAL YEAR.

The work done thus far under the appropriation of $75,000 of June 13, 1902, is explained in detail on page 1153 of the Annual Report of the Chief of Engineers for 1904.

Under proposals opened June 10, 1904, contracts for dredging were entered into with the Newburgh Dredging Company, dated June 28, 1904, for the removal of about 100,000 cubic yards of material, at 23 cents per cubic yard, from the main stem; and with Walter H. Gahagan, dated July 1, 1904, for the removal of about 60,000 cubic yards, at 23 cents per cubic yard, from the north and south branches. The required rate of work on these contracts was 20,000 cubic yards per month; no work was required between December 1 and March 1.

The plant used by the Newburgh Dredging Company consists of a scoop dredge, a pump for pumping dredged material direct from scows to place of deposit, and the usual scows and a tugboat, etc. Most of the material excavated under this contract was pumped on the United States reservation behind dike B, Sandy Hook peninsula.

The plant used by Mr. Gahagan, except during the month of June,

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1905, when the plant of the Newburgh Dredging Company was used, consisted of a large centrifugal pump, with the usual pontoons and pipe lines for pumping direct from point of excavation to place of deposit of material, and a tugboat. Material excavated under this contract was placed on low lands behind bulkheads or dikes in the vicinity of the location of dredged areas.

Dredging under contract with the Newburgh Dredging Company was commenced on July 28, and continued until November 12, when it was suspended, owing to the collapse of the pumping plant which was engaged in pumping material ashore. No further work was done under the contract in 1904, as the pump was hauled off for repairs and the contractor decided to lay up the plant for the winter. The winter was of unusual severity and duration, and resumption of work was delayed until April 15, at which time it was resumed and continued under a waiver of time limit. The total amount of material removed under this contract was 103,413 cubic yards, and the total area dredged, all in the main entrance channel, partly maintenance work, has been about 5,000 feet in length and from 150 to 300 feet in width, and the depth made was about 7 feet at mean low water. Considerable deterioration occurred in this channel during the progress of the work last season and this season, and parts of the area mentioned required to be redredged. This part of the project from the entrance to Highlands bridge, which provides for a channel 300 feet in width and 6 feet deep at mean low water, has been practically completed under this contract.

Preliminary arrangements for dredging under contract with Walter H. Gahagan were commenced on July 16, when the plant arrived and the setting of pipe line was commenced. Excavation of material was begun on August 4 and was continued to November 30, when it was suspended for the winter. The depth made by the pump throughout this contract was from 6½ to 10 feet, but no estimate was made for material removed below the plane of 7 feet at mean low water. The total amount of material removed under the contract at that time had been 26,255 cubic yards and the channels at Reeves channel, lower and upper crossovers, and Oceanic Bridge were completed to widths of from 150 to 200 feet. The project in the north branch was then considered completed. Work under this contract was resumed on April 1 and continued under a waiver of time limit to the end of the fiscal year, at which time the contract had been nearly completed, and the additional work accomplished this season was as follows: Thirty-five thousand two hundred and twenty-one cubic yards of material were removed from the south branch; two areas of shoals each of 1,000 feet in length and from 50 to 150 feet in width were dredged at the bend at Seabright and vicinity, completing the project at that locality; and three areas of shoals aggregating 1,950 feet in length were dredged between the junction of the north and south branches and the Seabright Bridge. The widths made were about 120 feet, nearly completing the project in the south branch. The total amount of material removed under this contract to the end of the fiscal year was 61,476 cubic yards.

Project for expenditure of the appropriation of $20,000 made by the river and harbor act of March 3, 1905, was submitted on May 22 and approved on May 25. This project provides for dredging, for completion of the project, and maintenance this season.

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All of the work contemplated under the present project has been nearly completed. Work is still required for maintaining the channels and dikes.

It is proposed to apply the available balance and the appropriation recommended to completion and maintenance of improvement in accordance with the project.

Money statement.

July 1, 1904, balance unexpended		$46,469.72
Amount appropriated by river and harbor act approved March 3, 1905		20,000.00
		66,469.72
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$26,893.95	
For maintenance of improvement	10,803.58	
		37,697.53
July 1, 1905, balance unexpended		28,772.19
July 1, 1905, outstanding liabilities		4,292.39
July 1, 1905, balance available		24,479.80
July 1, 1905, amount covered by uncompleted contracts		404.80
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		10,000.00

APPROPRIATIONS.

For previous project.

August 30, 1852	$1,500	
March 3, 1871	14,000	
March 3, 1873	5,000	
		$20,500

For present project.

June 18, 1878	$18,000	
March 3, 1879	10,000	
June 14, 1880	30,000	
March 3, 1881	86,000	
August 2, 1882	30,000	
August 5, 1886	10,000	
August 11, 1888	10,000	
September 19, 1890	10,000	
July 13, 1892	10,000	
August 18, 1894	5,000	
June 3, 1896	15,000	
March 3, 1899	10,000	
June 6, 1900 (allotment) (maintenance)	10,000	
June 13, 1902	75,000	
March 3, 1905	20,000	
		349,000
Total for both projects		369,500

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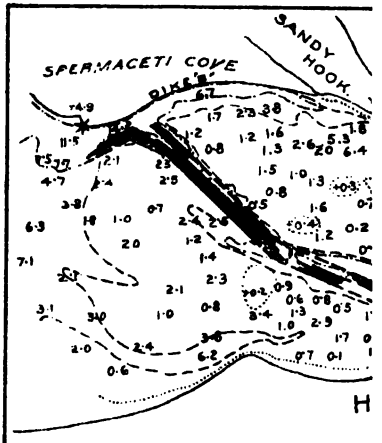


NOTE.

Mean rise and fall of tide is

Low water line is shown thu

3-ft. curve is shown thus:

6-ft. " " " "

Outlines of proposed Chann

are shown thus:

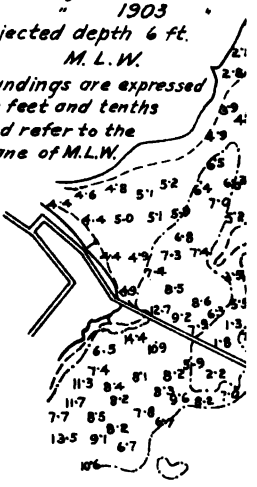
Areas dredged, 1904-5, shown

" " 1903 "

Projected depth 6 ft.

M. L. W.

Soundings are expressed in feet and tenths and refer to the plane of M.L.W.



To accompany Annual Report.

W. A. Livermore

Colonel, Corps of En

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ABSTRACTS OF CONTRACTS IN FORCE.

Name of contractor: The Newburgh Dredging Company.
Date of contract: June 28, 1904.
Date of commencement: July 19, 1904.
Date of completion: March 21, 1905; time of completion waived.
Dredging 100,000 cubic yards of material, more or less, below the Highlands bridge, at 23 cents per cubic yard, scow measurement. Contract was completed on May 18, 1905.

Name of contractor: Walter H. Gahagan.
Date of contract: July 1, 1904.
Date of approval: July 14, 1904.
Date of commencement: July 19, 1904.
Date of completion: October 18, 1904; time of completion waived.
Dredging 60,000 cubic yards of material, more or less, above the Highlands bridge, at 23 cents per cubic yard, scow measurement.

COMMERCIAL STATISTICS.

Freight received and shipped by water, 1904.

[Statement by T. G. and W. R. Patten, Long Branch, N. J., for south branch of the river, and Capt. C. E. Throckmorton, Red Bank, N. J., for north branch of the river.]

Articles.	Tons.	Estimated value.
Received:		
Coal	35,000	$175,000
Lumber	1,200	36,000
Building materials	15,500	775,000
Miscellaneous	457,545	367,913
Shipped:		
Farm produce	250,000	5,000,000
Fish and shellfish	12,000	480,000
Miscellaneous	9,045	217,913
Total	780,290	7,051,826

Vessels engaged in above commerce.

Class.	Number of trips.	Draft when loaded.	Tonnage.
		Feet.	
Steamers	1,650	4½ to 5½	300 to 875
Sail vessels	200	3½ to 5	25 to 40
Barges, etc	25	4 to 5	45 to 75
Total	1,875		

Number of passengers carried by the Patten Line during the year 1904 was 266,157.

G 7.

IMPROVEMENT OF MANASQUAN (SQUAN) RIVER, NEW JERSEY.

Detailed description of this river and of the project for its improvement are printed in the Annual Report of the Chief of Engineers for 1898, page 1070, and a condensed history is contained in current summary.

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OPERATIONS DURING THE PAST FISCAL YEAR.

At the close of the last fiscal year project approved on April 30, 1904, provided for expending the available funds in making an examination of the ruins of the south dike and vicinity and for the removal of the dike from the channel of the inlet.

A further examination of the inlet and dikes was made on August 16, and a report on same was submitted to the Chief of Engineers on August 29, which was approved on October 5, 1904. This report contained recommendation to expend $1,000 for repairing the north dike and to hold remaining available funds for work which may hereafter be necessary. This project is now in force, and a proposal has been accepted to do the required work, but operations under same have not yet been commenced.

This improvement under the present project is about half completed.

It is proposed to apply the available balance and the appropriation recommended to the continuation of the improvement.

Money statement.

July 1, 1904, balance unexpended	$5,797.57
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	26.84
July 1, 1905, balance unexpended	5,770.73
Amount (estimated) required for completion of existing project	14,375.00
Amount that can be profitably expended in fiscal year ending June 30, 1897, for work of improvement, in addition to the balance unexpended July 1, 1905	14,375.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

March 3, 1879	$12,000	March 3, 1899	$5,000
June 14, 1880	20,000		
August 2, 1882	7,000	Total	46,000
September 19, 1890	2,000		

COMMERCIAL STATISTICS.

The commerce of this river is small, owing to obstructions at the inlet. The river is largely used by pleasure craft during the summer season, and the inlet is used to some extent by small fishing boats. No estimates of tonnage or values have been received.

G 8.

MODIFICATION OF HARBOR LINES IN ARTHUR KILL AND NEWARK BAY, AT ELIZABETHPORT, NEW JERSEY.

SIR: The Central Railroad Company of New Jersey, owners of water-front land at Elizabethport, N. J., more fully described in the accompanying map,[a] respectfully request changes in the pierhead and bulkhead lines at that point. The particular changes which are requested are set forth in red lines on the accompanying map,[a] of which

[a] Not printed.

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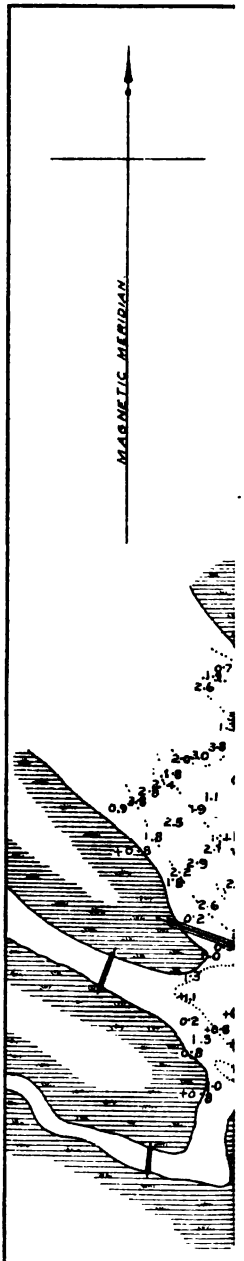

To accompany Annu

W. R. Li

Colonel, Corps

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duplicate copies are inclosed. The changes asked for do not propose any substantial alteration in the bulkhead line as indicated upon the Government maps, nor, indeed, in the pierhead line, except in that portion of the latter line northeast of Pine street, where the water is very shoal and the stream quite wide. Our attention has been called to the desirability of these changes in connection with the rebuilding of some of our docks and piers at this point, and particularly in connection with the location of new piers. Upon inquiry it appears that the monuments, as well as the surveyor's notes, based upon which the present Government maps have been prepared, have been lost, and that there is no way of precisely locating the bulkhead and pierhead lines on the ground, so that we can certainly conform our new construction to these lines. Furthermore, it has developed that the flats extend so far out from the shore northeast of Pine street extended that piers in this region should extend about 200 feet beyond what appears to be the present pier line; and that no detriment to general navigation or to other interests will result from this extension, inasmuch as this pier line would only be extended where there are broad flats and where the stream is very wide. The beginning point of the proposed pier and bulkhead lines, indicated on the blueprint in Chancellor Dock, corresponds, we understand, with the beginning point of these lines as now fixed. From our conference with members of the Harbor Line Board in New York, we understand that it is quite as desirable from their points of view as from ours to be able by appropriate monuments to definitely locate the lines on the ground at this point.

The Central Railroad Company of New Jersey is the owner of all the property which will be affected by the proposed changes.

Respectfully, yours,

THE CENTRAL RAILROAD COMPANY OF NEW JERSEY,
By ROBERT W. DE FOREST, *Vice-President.*

The honorable SECRETARY OF WAR.

[Second indorsement.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, June 17, 1904.

Respectfully referred to Col. Charles R. Suter, Corps of Engineers, president, for report by the New York Harbor Line Board.

This paper to be returned. The duplicate may be retained by the Board if desired.

A. MACKENZIE,
Brig. Gen., Chief of Engineers, U. S. Army.

[Third indorsement.]

THE NEW YORK HARBOR LINE BOARD,
ARMY BUILDING,
New York City, July 7, 1904.

Respectfully returned to the Chief of Engineers, inviting attention to the report of the Board of this date.

The duplicate of this paper has been retained.

CHAS. R. SUTER,
Colonel, Corps of Engineers,
President of the Board.

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[Fourth indorsement.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, July 16, 1904.

Respectfully returned to the Secretary of War.

The Central Railroad Company of New Jersey requests a modification of the existing bulkhead and pierhead lines in front of its property on Arthur Kill and Newark Bay, at Elizabethport, N. J., in connection with a project for rebuilding its docks and piers and locating others at this point.

The matter has been referred to the New York Harbor Line Board, which recommends for adoption certain modified lines, described in its report of the 7th instant, herewith, and delineated on the accompanying tracing.[a]

I concur in the recommendation of the Board, and further recommend that the Secretary place his approval upon the Board's report and tracing,[a] both of which have been prepared for his signature.

The lines selected by the Harbor Line Board are practically the same as those requested by the applicant.

A. MACKENZIE,
Brig. Gen., Chief of Engineers, U. S. Army.

REPORT OF THE NEW YORK HARBOR LINE BOARD.

HARBOR LINE BOARD,
New York City, July 7, 1904.

GENERAL: The New York Harbor Line Board has the honor to submit the following report on the application of the Central Railroad of New Jersey for modification of the pier and bulkhead lines in front of its property at Elizabethport, N. J., which was referred to the Board by your indorsement of June 17, 1904.

Accompanying the report is a tracing[a] showing modified lines for this locality, which are recommended for adoption. Owing to the indefinite character of the description of the present lines, due to a lack of points of reference which can now be definitely located, the Board has acertained and fixed as accurately as practicable the points for the beginning and ending for the modified lines herein recommended, and, so far as this particular locality is concerned, those points have been so described by fixed monuments that, if lost, they can readily be restored; but the absence of monuments in this general locality, and especially around Staten Island, with regard to which the Board has heretofore called the attention of the Department, is a constant source of difficulty and leads to frequent requests from navigation interests for interpretation of the existing lines. A separate communication[a] to the Department on this subject is forwarded this date.

[a] Not printed.

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The modified lines as now recommended are described as follows:

The pierhead and bulkhead lines begin at the same point, being a point in the pierhead and bulkhead line approved by the Secretary of War March 4, 1890, which is 925 feet from the center line of First street measured on a line parallel to and 33 feet northeasterly from the southwest side of Elizabeth avenue; from thence the pierhead and bulkhead lines diverge and run generally northeasterly and in straight lines, as follows:

The bulkhead line runs to a point in the prolongation of the southwest side of Fulton street 730 feet from the center line of First street; thence to a point 603.21 feet from the center line of First street measured on a line parallel to and 21 feet northeasterly from the center line of Livingston street; thence to a point 1,512 feet from the center line of First street measured on a line parallel to and 50 feet northeasterly from the center line of Pine street; thence to a point 1,512 feet from the center line of First street measured at right angles thereto at a point 234.25 feet northeasterly from the stone monument at the intersection of the center lines of First street and Isham place; thence to a point in the bulkhead line approved by the Secretary of War March 27, 1890, said point being 338 feet northerly from the center line of the Central Railroad of New Jersey measured at right angles thereto at a point 300 feet westerly from a stone monument at station No. 457 of said railroad on said center line, and being 500 feet from the pierhead line approved by the Secretary of War May 13, 1901.

The pierhead line runs to a point in the prolongation of the southwest side of Fulton street 830 feet from the center line of First street; thence to a point 783.21 feet from the center line of First street measured on a line parallel to and 21 feet northeasterly from the center line of Livingston street; thence to a point 1,912 feet from the center line of First street measured on a line parallel to and 375 feet northeasterly (at right angles) from the center line of Pine street; thence to a point 1,912 feet from the center line of First street measured at right angles thereto at a point 234.25 feet northeasterly from the stone monument at the intersection of the center lines of First street and Isham place; thence to a point in the pierhead line approved by the Secretary of War March 27, 1890, being a terminal point in the modification of that line approved by the Secretary of War May 13, 1901, said point being 354 feet southerly from the center line of the Central Railroad of New Jersey measured at right angles thereto at a point 232.6 feet westerly from a stone monument at station No. 457 of said railroad on said center line.

Respectfully submitted.

CHAS. R. SUTER,
Colonel, Corps of Engineers.
AMOS STICKNEY,
Colonel, Corps of Engineers.
W. L. MARSHALL,
Lieut. Col., Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

[First indorsement.]

WAR DEPARTMENT, *July 18, 1904.*

Approved.

ROBERT SHAW OLIVER,
Acting Secretary of War.

G 9.

MODIFICATION OF HARBOR LINES ON ARTHUR KILL FROM PINE STREET TO ELIZABETH AVENUE, ELIZABETHPORT, NEW JERSEY.

FEBRUARY 1, 1905.

SIR: The Central Railroad Company of New Jersey, owners of water-front land at Elizabethport, N. J., more fully described in the

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accompanying map,[a] respectfully request changes in the bulkhead line at that point. The particular changes which are requested are set forth by red lines on the accompanying map,[a] of which duplica. copies are inclosed. They involve adopting as the combined pierhead and bulkhead line that portion of the present pierhead line which lies substantially between Elizabeth avenue, so called, and Bond street, so called, to the Arthur Kill. Our attention has been called to the desirability of these changes in connection with the rebuilding of some of our docks and piers at this point, where we have extensive improvements in progress. We are satisfied that no detriment to general navigation or other interests will result from this combination of the bulkhead and pier lines at this point.

The Central Railroad Company of New Jersey is the owner in fee of all the property which will be in any way affected by the proposed change.

In addition to the accompanying map,[a] of which duplicate copies are inclosed, we send duplicate descriptions[a] of the proposed new bulkhead.

Respectfully yours,

THE CENTRAL RAILROAD COMPANY OF NEW JERSEY,
By ROBERT W. DE FOREST, *Vice-President.*

The SECRETARY OF WAR.

* * * * * * *

[Second indorsement.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, February 10, 1905.

Respectfully referred to Col. Charles R. Suter, Corps of Engineers, for consideration and report by the New York Harbor Line Board.

To be returned.

A. MACKENZIE,
Brig. Gen., Chief of Engineers, U. S. Army.

[Third indorsement.]

NEW YORK HARBOR LINE BOARD,
New York City, March 17, 1905.

Respectfully returned to the Chief of Engineers, inviting attention to the report of the New York Harbor Line Board of this date on the within subject.

CHAS. R. SUTER,
Colonel, Corps of Engineers,
President of the Board.

[Sixth indorsement.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, April 8, 1905.

Respectfully returned to the Secretary of War.

The Central Railroad Company of New Jersey requests a modification of the bulkhead line on Arthur Kill, between Pine street and

[a] Not printed.

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Elizabeth avenue, in the city of Elizabethport, N. J., in such manner as to make the bulkhead line for a part of the distance coincident with the pierhead line.

The matter has been referred for consideration by the New York Harbor Line Board, from whose report of the 17th ultimo, herewith, it appears that in the opinion of the Board the granting of this application will not injuriously affect the navigable waters in the locality in question, and approval of the request by the Secretary of War is recommended.

Concurring in the views of the Board, I recommend that the modified line as proposed, which is described in detail in the Board's report and delineated on the accompanying tracing,[a] be approved by the Secretary of War, and that the Secretary indicate his approval on said report and tracing, both of which have been prepared for his signature.

Among the accompanying papers is a letter [a] addressed to the Harbor Line Board by Mr. Thomas W. Butts, of New York City, protesting against the granting of this application.

From the Board's indorsement thereon it appears that Mr. Butts was represented at the public hearing held in this case, that the objections urged by him were considered before arriving at a conclusion in the matter, and that, after a careful consideration of the letter of protest referred to, the Board sees no reason for modifying the recommendation made in its formal report on the subject.

A. MACKENZIE,
Brig. Gen., Chief of Engineers, U. S. Army.

REPORT OF THE NEW YORK HARBOR LINE BOARD.

HARBOR LINE BOARD,
New York City, March 17, 1905.

GENERAL: The New York Harbor Line Board has carefully considered the application of the Central Railroad of New Jersey, made to the Secretary of War February 1, 1905, for extension of the existing bulkhead line in the Arthur Kill at Elizabethport, N. J., which was referred to the Board for consideration and report by your indorsement of February 10, 1905, and has the honor to submit the following report thereon:

A public hearing in the matter was given by the Board on the 9th instant, which had been advertised in the public press. Invitations to attend this hearing were also sent to all corporations and individuals interested so far as their addresses could be ascertained.

From the stenographer's report [a] of the hearing, herewith inclosed, it will be seen that there is practically no opposition to the extension asked for, and as the Board is satisfied that the granting of the application will not injuriously affect the navigable waters in the locality in question, its approval by the Secretary of War is recommended.

The modified line as applied for is shown on a tracing [a] which accompanies this report and is described as follows:

The bulkhead line begins at a point in the pierhead and bulkhead line approved by the Secretary of War March 4, 1890, being also the beginning of the

[a] Not printed.

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pierhead and bulkhead lines approved by the Secretary of War July 18, 1904, said point being 925 feet from the center line of First street, measured on a line parallel to and 33 feet northeasterly from the southwest side of Elizabeth avenue; thence the bulkhead line coincides with the pierhead line approved by the Secretary of War July 18, 1904, as follows: Running northeasterly to a point in the prolongation of the southwest side of Fulton street 830 feet from the center line of First street; thence to a point 783.21 feet from the center line of First street, measured on a line parallel to and 21 feet northeasterly from the center line of Livingston street; thence to a point in the pierhead line approved by the Secretary of War July 18, 1904, said point being 1,512 feet from the center line of First street, measured on a line parallel to and 317.73 feet southwesterly at right angles from the center line of Pine street; thence the bulkhead line diverges from the pierhead line and runs in a straight line to a point in the bulkhead line approved by the Secretary of War July 18, 1904, said point being 1,512 feet from the center line of First street, measured on a line parallel to and 50 feet northeasterly at right angles from the center line of Pine street.

Respectfully submitted.

CHAS. R. SUTER,
Colonel, Corps of Engineers.
AMOS STICKNEY,
Colonel, Corps of Engineers.
W. L. MARSHALL,
Lieut. Col., Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. Army.

[First indorsement.]

WAR DEPARTMENT, *April 12, 1905.*

Approved.

WM. H. TAFT,
Secretary of War.

G 10.

MODIFICATION OF HARBOR LINES IN ARTHUR KILL AT SMOKING POINT, ROSSVILLE, STATEN ISLAND, NEW YORK.

31 NASSAU STREET,
New York, April 17, 1905.

SIR: On February 21, 1905, on behalf of James G. Timolat, of Staten Island, I requested that the bulkhead or harbor pier line in front of his property at Smoky Point, in Rossville, Staten Island, fronting on the Arthur Kill, be altered and amended in accordance with a map[a] and description[a] sent in that letter. That matter was referred to the Harbor Line Board, and since that time a final survey of the neighborhood has been had. Owing to the effacement of the original station of the harbor-line survey, the map and description are not correct. The survey having been had now and the line asked for being referred to as the station Smoky Point of the United States Geodetic Survey, which is on the property, the matter becomes clarified, and I would now ask for an extension of the pierhead line in accordance with the following description. The courses refer to the true meridian:

---

[a] Not printed.

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Beginning at a point in the pierhead and bulkhead line approved by the Secretary of War March 4, 1890, said point being north 55° 43′ east, 267.3 feet from station Smoky Point, and thence easterly and in a straight line to a point north 69° east, 470 feet from station Smoky Point; thence southeasterly in a straight line to a point in the pierhead and bulkhead line approved by the Secretary of War March 4, 1890, said point being south 89° 19′ 20″ east, 815.2 feet from station Smoky Point.

Having been given to understand that the Harbor Line Board is to have a meeting within a day or so, I have drawn this letter and map [a] in duplicate and have sent them a copy. It is respectfully requested that permission be given as herein set forth.

Respectfully,

MONTAGUE LESSLER.

Hon. WILLIAM H. TAFT,
Secretary of War.

[Second indorsement.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, April 22, 1905.

Respectfully referred to Col. Charles R. Suter, Corps of Engineers, for consideration and report by the New York Harbor Line Board.

To be returned.

A. MACKENZIE,
Brig. Gen., Chief of Engineers, U. S. Army.

[Third indorsement.]

NEW YORK HARBOR LINE BOARD,
New York City, April 26, 1905.

Respectfully returned to the Chief of Engineers, inviting attention to the accompanying report of this date.

CHAS. R. SUTER,
Colonel, Corps of Engineers,
President of the Board.

[Fourth indorsement.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, May 8, 1905.

Respectfully returned to the Secretary of War.

This is an amended request for modification of existing harbor line in front of the property of Mr. James G. Timolat, on Arthur Kill, at Smoking Point, Rossville, Staten Island, New York.

The matter has been referred for consideration by the New York Harbor Line Board, from whose report of the 26th ultimo, herewith, it appears that the interests of navigation will not be injuriously affected by a modification of the line substantially as requested.

Concurring in the views of the Board, I recommend that the modified line proposed by it, which is delineated on the accompanying tracing [a] and described in detail in the Board's report, be approved by the Secretary of War.

---

[a] Not printed.

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I further recommend that the Secretary indicate his approval on the tracing[a] and description, both of which have been prepared for his signature.

A. MACKENZIE,
Brig. Gen., Chief of Engineers, U. S. Army.

REPORT OF THE NEW YORK HARBOR LINE BOARD.

HARBOR LINE BOARD,
New York City, April 26, 1905.

GENERAL: The New York Harbor Line Board has the honor to submit the following report on the application of Mr. Montague Lessler, dated April 17, 1905, for a change in the pierhead line on Arthur Kill in front of the property of his client, Mr. James G. Timolat, which was referred to the Board by your indorsement of April 22, 1905, this application being a modification of a former one made by Mr. Lessler under date of February 21, 1905.

The Board has fully considered this application and finds that the interests of navigation will not be injuriously affected by modifying the existing harbor lines in the vicinity in question, as shown by the tracing[a] which accompanies this report, and therefore recommends that such modification be approved. The change of the lines thus recommended substantially agrees with what is desired by the applicant, and the modified line is described as follows:

Beginning at a point in the pierhead and bulkhead line approved by the Secretary of War March 4, 1890, tabulated as being 95 feet from Station XI, measured at right angles to the base line joining Stations X and XI, said point being north 55° 34′ 00″ east 267.9 feet from station Smoky Point, established by the United States Coast and Geodetic Survey, 1885; thence easterly in a straight line to a point north 69° east 470 feet from station Smoky Point; thence southeasterly in a straight line to a point in the pierhead and bulkhead line approved by the Secretary of War March 4, 1890, tabulated as being 95 feet at right angles from the base line joining Stations XI and XIII, at a point 533 feet from its origin in Station XI, said point being south 89° 23′ 05″ east, 815.3 feet from station Smoky Point. All bearings refer to the true meridian.

Respectfully submitted.

CHAS. R. SUTER,
Colonel, Corps of Engineers.
AMOS STICKNEY,
Colonel, Corps of Engineers.
W. L. MARSHALL,
Lieut. Col., Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

WAR DEPARTMENT, *May 11, 1905.*

Approved.

ROBERT SHAW OLIVER,
Assistant Secretary of War.

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[a] Not printed.

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APPENDIX H.

IMPROVEMENT OF DELAWARE RIVER, NEW JERSEY AND PENNSYLVANIA, AND OF CERTAIN WORKS IN DELAWARE BAY, DELAWARE.

REPORT OF MAJ. J. C. SANFORD, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1905, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1 Delaware River, New Jersey and Pennsylvania.
2. Ice Harbor at Marcus Hook, Pennsylvania.
3. Construction of iron pier in Delaware Bay, near Lewes, Delaware.
4. Delaware breakwater, Delaware.
5. Construction of harbor of refuge, Delaware Bay, Delaware.
6. Removing sunken vessels or craft obstructing or endangering navigation.
7. Construction of seagoing hydraulic dredges.

ENGINEER OFFICE, UNITED STATES ARMY,
Philadelphia, Pa., July 19, 1905.

GENERAL: I have the honor to transmit herewith the annual reports for the works of river and harbor improvement of the Philadelphia district, also of dredge construction in my charge, for the fiscal year ending June 30, 1905.

Very respectfully, your obedient servant,

J. C. SANFORD,
Major, Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

H 1.

IMPROVEMENT OF DELAWARE RIVER, NEW JERSEY AND PENNSYLVANIA.

An account of this improvement is contained in the Annual Reports of the Chief of Engineers for 1896, page 877; 1897, page 1192; 1898, page 1075; 1899, page 1317; 1900, page 1557; 1901, page 1310; 1902, page 1025; 1903, page 957, and 1904, page 1181.

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Expenditures during the past fiscal year have been applied to the following operations:

1. Surveys of the channel at Duck Creek flats and near Reedy Island.
2. Improvement of Salem Cove and Duck Creek Flats shoals.
3. Improvement of Cherry Island Flats shoals.
4. Improvement of Schooner ledge.
5. Improvement of Deep Water Point Flats shoal.
6. Improvement of Tinicum Island Flats shoal.

These operations will be described in the above order. The localities referred to and previous operations thereat are described in the Annual Reports of the Chief of Engineers for 1896, pages 1075 to 1079, and 1899, pages 1317 to 1322.

1. SURVEYS.

Duck Creek flats.—This survey was made for the purpose of ascertaining the changes in the channel due to dredging and the amount of material dredged by the contractor below the depth of 31 feet at mean low water.

Near Reedy Island.—This survey was made for the purpose of ascertaining the changes in the channel due to dredging and the construction of the bulkhead.

2. IMPROVEMENT OF BAKER, SALEM COVE, AND DUCK CREEK FLATS SHOALS.

During the past fiscal year operations under the general project have been in progress as follows:

Under a project submitted July 1 and approved July 7, 1902, for the expenditure of $600,000 appropriated and $2,400,000 additional authorized in the river and harbor act approved June 13, 1902, and a further project submitted April 3 and approved April 13, 1903, for the expenditure of $1,400,000 appropriated in the sundry civil act approved March 3, 1903, this latter amount being part of the $2,400,000 authorized in the river and harbor act above referred to, contracts for work have been entered into as follows:

Under date of September 9, 1902, with the American Dredging Company, of Philadelphia, for all the dredging required, estimated at 10,900,000 cubic yards, scow measurement, to obtain a channel of the project dimensions through Salem Cove and Duck Creek Flats shoals, including the widening of the channel at the bends and removal of shoals from the existing channel through Baker shoal, and the construction of retaining banks composed of clay, gravel, and bowlders across the lower ends of basins A and B within the timber bulkhead on Baker shoal, for the reception of dredged material. Work under this contract was commenced on October 21, 1902, and practically completed December 31, 1904. The time for completion was waived for a reasonable period, for the removal of lumps found to exist in a portion of the dredged area through Duck Creek flats. Up to December 31, 1904, 10,296,491 cubic yards of material, scow measurement, had been removed from the channel, 2,827,106 cubic yards of the quantity having been removed during the past fiscal year; 24,829 cubic yards of heavy material were placed in the retaining banks. Of the 10,296,491 cubic yards removed, 1,336,173 cubic

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yards were deposited on Pea Patch Island and 139,307 cubic yards on the marsh land at the military reservation of Fort Du Pont, near Delaware City, Del., between the fort and the river. A portion of the total quantity stated as dredged under the contract has not been paid for, as it is known a considerable part of the material was dredged below the contract depths. The exact quantity of the overdepth dredging can not be determined at this time and will not be known until the results of a survey of the dredged areas just completed can be computed. Under the terms of the contract material dredged below the prescribed depths is not to be paid for.

By the work done under this contract a channel 43,000 feet long, 600 feet wide, and 30 feet deep at mean low water has been made through Duck Creek flats, a channel of the same depth and width and 20,500 feet long has been made through Baker shoal, and a channel 12,500 feet long and of like dimensions has been made through Salem Cove flats.

It having been found that material composed of clay, gravel, and bowlders was unsatisfactory, on account of the strong currents developed, for use in raising (above the plane of mean low water) the retaining bank across the lower end of basin A, the part of the contract with the American Dredging Company covering this work was abandoned by supplemental articles of agreement entered into with the company under date of February 14, 1903. Arrangements were made for building this bank above low water by the deposit of from 15,000 to 18,000 tons of stone.

By further supplemental articles of agreement dated April 27, 1903, the retaining bank to be constructed of heavy material across the lower end of Basin B, under the contract, was abandoned, and a timber bulkhead to be riprapped with stone was substituted therefor. This bulkhead, 1,893 feet long, was completed on May 31, 1904.

During the operations of dredging the channel through Duck Creek flats an old wreck was discovered. The American Dredging Company removed the wreck in accordance with the terms of its contract for dredging.

The amounts expended under the above contract to the close of the past fiscal year were as follows:

Dredging	$1,317,849.58
Retaining banks	10,951.04
Bulkhead	45,948.38
Total	1,374,749.00

The total amount of material removed from the channel under the general project up to June 30, 1905, was 14,146,173 cubic yards, scow measurement.

Under date of August 31, 1903, contract was entered into with Richardson & Ward, of Philadelphia, Pa., for furnishing and depositing 160,000 tons, more or less, of stone, at $1.09 per ton of 2,000 pounds, in the construction of buttresses at intervals, and riprap along the outer faces of the bulkhead already built and of the bulkhead then under construction on Baker shoal for the reception of dredged material. Work under this contract was commenced October 13, 1903, and completed November 10, 1904. The amount of stone deposited under the contract was 145,255 tons, 83,764 tons having been deposited during the past fiscal year.

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The amount expended under the contract with Richardson & Ward was $169,016.20.

The timber work of the bulkhead at Baker shoal was completed during the fiscal year of 1904, under a contract dated September 9, 1902, with the Sanford & Brooks Company, of Baltimore, Md., but the final payment under the contract was not made until May 8, 1905. The total amount expended under this contract was $223,196.51. The total amount expended in the construction of this bulkhead to the close of the past fiscal year was as follows:

Timber work	$405,762.35
Stone	465,326.89
Total	871,089.24

By this expenditure there have been constructed 30,627 linear feet of timber bulkhead, partly reinforced and strengthened on the outside by riprap buttresses, forming a dumping basin for dredged material between Stony Point and Baker shoals.

RETAINING BANKS.

Fort Du Pont.—The work of construction of retaining banks was completed at the military reservation of Fort Du Pont, near Delaware City, Del., for retaining dredged material deposited with the view to filling the marsh land between the fort and the river. The work of depositing material behind these banks was commenced on September 20, 1904, by the U. S. pump dredge *Uncle Sam*, and continued until November 23, 1904, when the dredge was removed to Pea Patch Island. The American Dredging Company deposited material at this locality during the months of November and December, 1904. The quantity of material deposited at this locality to the close of the past fiscal year was as follows:

	Cubic yards.
By U. S. pump dredge *Uncle Sam*	60,164
By American Dredging Company	139,307
Total	199,471

Fort Delaware.—The work of constructing retaining banks at Pea Patch Island, on which Fort Delaware is located, was completed during the fiscal year of 1904. These banks are for the purpose of retaining dredged material deposited with the view to raising the height of the island to about 12 feet above mean low water. The work of depositing material behind these banks was commenced by the American Dredging Company on May 19, 1904, and continued until July 27, 1904. The U. S. pump dredge *Uncle Sam* was engaged in depositing material at this locality from November 23 to December 13, 1904.

The quantity of material deposited at this locality to the close of the past fiscal year was as follows:

	Cubic yards.
By U. S. pump dredge *Uncle Sam*	37,524
By American Dredging Company	336,173
Total	373,697

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The cost of constructing the retaining banks at the military reservation of Fort Du Pont and at Pea Patch Island is to be paid for by the Quartermaster's Department.

The filling behind the banks at these localities was done by pumping over the banks material dredged from the channel of the Delaware River. The work done by the American Dredging Company was without additional expense to the United States, these contractors having been willing to deposit material at these points rather than at the bulkhead at the contract price paid them for excavating, removing, and depositing the dredged material. Part of the work of dredging material from the channel of the river and pumping it over the banks at both localities was done by plant belonging to the United States, the dredging being done in accordance with the existing project.

Under date of June 27, 1905, an emergency contract was entered into with the Sanford & Brooks Company, of Baltimore, Md., for the construction of timber revetment, weirs, sluices, trestle, and raising and repairing of the retaining banks at Fort Du Pont, Del., and the raising and repairing of retaining banks at Fort Delaware, Del., and possibly repair of waste weirs at both places. Work under this contract is to be paid for by the Quartermaster's Department upon vouchers certified by the engineer officer in charge. Funds to the amount of $33,185 have been allotted for the work, $30,485 to be applied at Fort Du Pont and $2,700 at Fort Delaware, Del.

MARSH LANDS.

A piece of marsh land at mouth of Crum Creek, Pennsylvania, containing about 60 acres, was accepted during the fiscal year of 1904 as a place of deposit for material dredged from the channel of the river in the vicinity, and preparations were made by the owners for the reception of such dredgings. During July, 1904, the U. S. pump dredge *Uncle Sam* completed the excavation of a dumping basin at this place, and on July 11, 1904, the work of pumping the material over the banks was commenced and continued until September 20, 1904, when 31,784 cubic yards of material dredged from the channel had been deposited within the 60-acre tract.

3. CHERRY ISLAND FLATS.

Under the project above referred to a contract dated February 14, 1903, was entered into with the F. K. Wills Construction Company for the construction of about 9,979 linear feet of timber bulkhead between the Edgemoor Iron Works and the mouth of Christiana River. Work under this contract was commenced on May 18, 1903. Up to June 30, 1904, about 1,500 feet had been completed and about 600 feet additional had been partly constructed.

On account of the very slow progress made by the F. K. Wills Construction Company in the work of constructing this bulkhead, and in order to hasten its completion within the contract time limit, the space behind it being urgently needed as a place for the deposit of material dredged from the channel, an emergency contract, dated August 15, 1903, was entered into with the Baltimore Construction Company, of Wilmington, Del., for the construction of about 3,000

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linear feet of the bulkhead, the work to be completed on or before December 31, 1903. Under the terms of the contract with the F. K. Wills Construction Company, the excess cost of the work provided for in the contract with the Baltimore Construction Company over the cost of the same work under the contract with the F. K. Wills Construction Company was to be deducted from any moneys due or to become due to the latter company.

At the expiration of the time limit of the contract with the Baltimore Construction Company no part of the work had been completed; the piling for only about 380 linear feet of the bulkhead had been driven, but nothing had been done on the sheet piling and bracing. Efforts were made to have the contractors consent to a reduction of the amount of work from 3,000 to 500 linear feet, to be completed at an early date. No definite information as to the willingness of the contractors with reference to the proposed reduction in quantity could be obtained until February 18, 1904, when they filed notice that they would not consent to the reduction and complete the 500 feet by April 30, 1904.

Under date of March 7, 1904, it was recommended that the contract with the Baltimore Construction Company be annulled, because of failure on the part of the contractors to prosecute the work faithfully and diligently according to the terms and requirements of the contract. This recommendation was approved under date of March 10, 1904, and accordingly the contract was annulled, notices in writing of this action being given the contractors and the surety to the contract.

The expenditures under this contract to the close of the fiscal year ending June 30, 1904, were confined to cost of inspection, and amounted to $1,013.56.

After the annulment of the contract with the Baltimore Construction Company, the F. K. Wills Construction Company undertook and continued the construction of the bulkhead as originally contracted for until October 31, 1904, at which date only 3,080 linear feet, or less than one-third of the work, had been completed. The time limit of this contract was September 30, 1904, but this time was waived until a supplemental agreement could be entered into.

Under date of October 15, 1904, a supplemental agreement was entered into with the F. K. Wills Construction Company, modifying the original contract by changing the style of the rows of piles to be driven in the remaining work required to be done, from rows of five piles, as provided in the original contract, to rows of three piles, and reducing the length of the bulkhead to be built from about 9,979 linear feet, as required by the original contract, to such length as could be completed by December 31, 1904, not to exceed in the aggregate 5,800 linear feet, the latter length to be the extreme length of the bulkhead to be constructed under the contract if completed at any time before December 31, 1904; if not completed on or before December 31, 1904, then such length as could be completed by that date to be the length of the bulkhead to be built.

This supplemental contract was entered into largely in the interest of the United States, it having been found that a more simple and less costly bulkhead, of shorter length than that provided for in the original contract, would be sufficient for public requirements.

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The contract was closed on April 3, 1905, at which date 4,535 linear feet of bulkhead had been constructed, 3,035 linear feet of the amount during the past fiscal year.

The total amount expended in the construction of this bulkhead to the close of the past fiscal year was $100,527.72.

DREDGING BY UNITED STATES DREDGES.

On May 5, 1904, the U. S. dredge *Cumberland* commenced operations in the channel across the flats and continued dredging until June 13, 1904, when it was withdrawn temporarily to work in the channel at Deep Water Point. From May 22 to May 26 (inclusive), 1904, the dredge was undergoing, at Wilmington, Del., repairs necessitated by its previous work in the Savannah, Ga., district. Up to June 30, 1904, the dredge removed and deposited behind the bulkhead, between Edgemoor and the Christiana River, 105,340 cubic yards of material, 28,084 cubic yards of which was from the channel near Deep Water Point.

The dredge *Cumberland* continued operations of dredging in the channel across the flats until September 3, 1904.

During the past fiscal year this dredge removed from the channel through the flats shoal 155,659 cubic yards of material and deposited the same behind the bulkhead between Edgemoor and the Christiana River, making a total of 260,999 cubic yards removed and deposited by it since May 4, 1904. The dredge was withdrawn from the work on Delaware River on September 6, 1904, when she went to the shipyard for repairs before returning to her station at Savannah, Ga. Upon completion of these repairs on October 5, 1904, the dredge left the Delaware River.

The total cost of the work done by the *Cumberland*, including rental paid for the dredge—one hundred and five days at $65 per day, was $23,320.40, or at the rate of 0.0893+ cent per cubic yard, including the sum of $6,825 paid for rental.

On August 30, 1904, the U. S. dredge *Burton* commenced operations of dredging in the channel across the flats and continued the work until October 15, 1904. This dredge removed and deposited behind the bulkhead at Edgemoor, Del., 85,722 cubic yards of material dredged from the channel. The *Burton* left this district on October 21, 1904.

The cost of the work done by the *Burton* was $6,597.97, or at the rate of 0.07696+ cent per cubic yard.

On September 21, 1904, the U. S. dredge *Gen. Gillespie* commenced work, continuing until December 24, and dredged a total of 135,147 cubic yards from Cherry Island Flats and along Deep Water Point Range.

The cost of the work done by the *Gen. Gillespie* was $12,766.43, or at the rate of 0.09446+ cent per cubic yard.

4. SCHOONER LEDGE.

Proposals for the removal of rock and overlying and adjacent material from the channel were opened on April 2, 1903, and all bids rejected as being too high. The work was readvertised and new proposals opened on May 22, 1903. Only one bid was received, and as it

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was about $55,000 in excess of the lowest bid received at the first letting it also was rejected.

On July 29, 1903, the Department authorized the removal of the rock at this locality by the use of plant belonging to the United States, to be transferred from the New York district. The transfer of this plant from New York to the Delaware River was completed in November, 1903. It consists of the dredge *Hell Gate*, drill scow *General Newton*, tugboat *General A. A. Humphreys*, four dump scows, one derrick scow, and a water barge. Extensive repairs had to be made to this plant in New York to make it seaworthy for the transfer, and other extensive repairs were made to it after its arrival in the Delaware River to render it serviceable for work on the rock ledge. The total cost of these repairs was $82,309.90, including $3,838.15 paid for towing from New York.

On April 4, 1904, the dredge *Hell Gate* was placed on the work and commenced operations for the removal of the material overlying the rock ledge. Up to June 30, 1904, 376 cubic yards of rock and 11,954 cubic yards of mud, sand, and gravel were removed and deposited partly behind the timber bulkhead between Edgemoor and the mouth of Christiana River and partly in the prepared basin at Crum Creek.

On June 1, 1904, the drill scow *General Newton* was placed on the work, and up to June 30, 1904, 16 holes were drilled in the rock and blasted, using 359 pounds of dynamite.

The work done at this locality during the past fiscal year was as follows:

Removal of 64,946 cubic yards overlying material, including bowlders.
Removal of 2,080 cubic yards of ledge rock.
810 holes drilled and blasted.
14,058 pounds dynamite used.
4,000 cubic yards (estimated) rock blasted, but not yet removed.

Since the commencement of operations at this locality the following work has been accomplished:

Removal of 76,900 cubic yards overlying material, including bowlders.
Removal of 2,456 cubic yards ledge rock.
826 holes drilled and blasted.
14,417 pounds dynamite used.
4,000 cubic yards (estimated) rock blasted, but not yet removed.

Part of the material dredged was deposited behind the bulkhead between Edgemoor and the mouth of Christiana River and part in the dumping basin at Crum Creek, and some was used by the lighthouse department at Salem Creek light.

The total amount expended at this locality during the past fiscal year was $111,721.99, making the total amount expended since commencement of operations, including amounts expended for repairs to the plant and for survey of the locality, $209,676.47.

5. DEEP WATER POINT FLATS.

During the past fiscal year the U. S. dredge *Cumberland* removed from the channel at this locality 638 cubic yards of material, making a total of 28,084 cubic yards removed by this dredge from the locality since she was placed upon the work. The entire work done on the

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river by this dredge, its total cost, and rate per cubic yard are stated under item 3, " Cherry Island flats."

During the past fiscal year the U. S. dredge *Gen. Gillespie* removed from the channel at this locality 108,813 cubic yards of material. The entire work done on the river by the dredge, its total cost, and rate per cubic yard are stated under item 3, " Cherry Island flats."

6. TINICUM ISLAND FLATS.

During the past fiscal year the U. S. dredge *Burton* removed from the channel at this locality 21,165 cubic yards of material. The entire work done on the river by this dredge, its total cost, and rate per cubic yard are stated under item 3, " Cherry Island flats."

MISCELLANEOUS.

Under date of December 19, 1903, authority was given by the Department for the construction of a large self-propelling hopper dredge for use in the improvement of the Delaware River, at a cost not exceeding $400,000. Plans for the construction of this dredge were prepared, and sealed proposals for its construction were invited by public advertisement. The proposals were opened May 18, 1904, and a contract was entered into with the Maryland Steel Company, of Baltimore, Md., the lowest bidders, for the sum of $358,400.

The dredge was launched on June 3, 1905. At that date the contract was 68.4 per cent completed.

During the past fiscal year the sum of $200,250.77 was expended on this dredge, making the total amount expended $202,853.82.

During the past fiscal year the sum of $1,010,214.52 was expended upon this improvement, making the total amount expended under the approved project $3,247,626.90. By this expenditure about 53 per cent of the approved project was accomplished at the close of the past fiscal year.

Under date of March 22, 1905, a project was submitted for the expenditure of $1,500,000, of which $500,000 was appropriated and $1,000,000 authorized by the river and harbor act approved March 3, 1905. This project was approved April 1, 1905, and provides for continuing the work under the present project, partly by contract and partly by hired labor, using the Government plant.

Bids for work under this project were advertised for June 16, 1905.

Under date of June 2, 1905, authority was requested for the construction of a rehandling machine for rehandling material to be dredged from the Delaware River by the U. S. dredge *Delaware*, the estimated cost of such machine being $40,000. Authority for the construction of this machine was granted June 9, 1905.

It is proposed to apply available balances and the $1,000,000 authorized to the continuation of the work under the approved project.

IMPROVEMENT OF PHILADELPHIA HARBOR.

Up to June 30, 1904, thirty-nine wharves between Allegheny avenue and Moore street, on the Delaware River water front of the city of Philadelphia, had been extended to the new pierhead line, and between

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Pearl and Mickle streets, Camden, five wharves had been similarly extended to the New Jersey pierhead line.

During the fiscal year ending June 30, 1904, licenses were granted by the board of port wardens of the city of Philadelphia for the extension of two additional piers on the Philadelphia water front, and during the past fiscal year a license was granted for the extension of one more pier.

The city of Philadelphia has constructed a new bulkhead along the bulkhead line from Vine to South street, which has permitted the widening of Delaware avenue at that locality to 150 feet. The work of widening Delaware avenue between Vine and Walnut streets has been completed, and efforts are being made to continue the work of widening the avenue between Vine and Green streets. Arrangements have been made for repaving of portions of the avenue and for the laying of railroad tracks thereon, limited to three.

IMPROVEMENT OF SCHUYLKILL RIVER, PENNSYLVANIA.

Dredging operations at this locality by the city of Philadelphia were completed during the past fiscal year. During the year 1903, 261,000 cubic yards of material were removed from the channel of the river. In the year 1904, 380,400 cubic yards were removed, which, with the work done this season, makes a total of 731,809.5 cubic yards removed, including 62.5 cubic yards rock.

Detailed information with reference to these subjects is given in a letter dated June 9, 1905, from Mr. Theodore C. Knauff, secretary of the board of harbor commissioners, which he has kindly prepared at my request. This letter and its accompanying papers are appended hereto.

Money statement.

July 1, 1904 balance unexpended		$1,334,936.90
Amount appropriated by river and harbor act approved March 3, 1905		500,000.00
Amount received from sales of condemned property		485.00
		1,835,421.90
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$1,010,214.52	
By Treasury settlements, 1898–99	1.35	
		1,010,215.87
July 1, 1905, balance unexpended		825,206.03
July 1, 1905, outstanding liabilities		269,263.05
July 1, 1905, balance available		555,942.98
July 1, 1905, amount covered by uncompleted contracts		146,136.00
Amount (estimated) required for completion of existing project		1,754,463.26
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$1,754,463.26	
For maintenance of improvement	100,000.00	
		1,854,463.26

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

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APPROPRIATIONS.

July 4, 1836	$15,000.00	March 3, 1899	$300,000.00
June 10, 1872	10,000.00	June 6, 1900	270,500.00
March 3, 1873	115,000.00	March 3, 1901	61,500.00
June 23, 1874	60,000.00	June 13, 1902	600,000.00
March 3, 1875	30,000.00	March 3, 1903	1,400,000.00
August 14, 1876	40,000.00	April 28, 1904	1,000,000.00
June 18, 1878	110,000.00	March 3, 1905	500,000.00
March 3, 1879	201,000.00		
June 14, 1880	235,000.00	Total	7,104,000.00
March 3, 1881	250,000.00	Amount received from sales of condemned property	485.00
August 2, 1882	286,000.00		
July 5, 1884	200,000.00	Grand total	7,104,485.00
August 5, 1886	210,000.00		
August 11, 1888	250,000.00		
September 19, 1890	240,000.00	Total amount appropriated on present project to June 30, 1905	4,055,536.74
July 13, 1892	50,000.00		
August 18, 1894	170,000.00		
June 3, 1896	500,000.00		

EXPENDITURES.

Under previous projects	$3,031,650.72
By Treasurer's certificate, 1898–99	1.35
	3,031,652.07
Under present project	3,247,626.90
Total to June 30, 1905	6,279,278.97

ABSTRACT OF CONTRACTS IN FORCE, WITH NAMES OF CONTRACTORS, DATE OF APPROVAL OF BEGINNING WORK, AND EXPIRATION.

1. With the American Dredging Company, of Philadelphia, Pa., dated September 9, 1902, approved October 4, 1902, for excavating and removing by dredging, from the channel of the Delaware River at Duck Creek flats and Salem Cove shoals of about 10,900,000 cubic yards of material, at 13.9 cents per cubic yard, the dredged material to be deposited within the limits of the timber bulkhead near Reedy Island, and at such other places provided by the contractors and approved by the engineer officer in charge. Work to be commenced on or before November 7, 1902, and be completed on or before December 31, 1904. The time limit of this contract has been waived for a reasonable period for the removal of some lumps found to exist in the dredged areas.

2. With the Maryland Steel Company, of Baltimore County, Md., dated June 1 and approved June 17, 1904, for the construction of one steel hull, twin-screw suction dredge, including propelling machinery, pumping machinery, electric-light plant, and steam arrangement for operating dumping gates, for use on the work of improving Delaware River, for the sum of $358,400. Work to be commenced on or before July 5, 1904, and to be completed on or before September 5, 1905.

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COMMERCIAL STATISTICS.

The following statement concerning the foreign commerce of the Delaware River for the years ending December 31, 1903 and 1904, is compiled from reports of the board of trade, commercial exchange, and maritime exchange of the city of Philadelphia.

Articles.	1903.	1904.	Articles.	1903.	1904.
IMPORTS.	Tons.	Tons.	EXPORTS.	Tons.	Tons.
Asphalt and asphalt blocks	35,240	18,123	Beef, pork, and products	48,577	46,311
Cement	3,428	1,609	Bricks	1,378	525
Chalk	29,712	21,634	Cars and locomotives	418	187
Clay	66,297	60,623	Coal	543,090	622,611
Coal	43,982	240	Corn and corn meal	35,770	148,278
Coal tar, and pitch of	920	1,211	Cotton and cotton fabrics	12,602	13,638
Cork and cork wood	1,745	2,304	Drugs and chemicals	9,636	8,068
Cotton and cotton fabrics	4,615	5,614	Feed	3,149	9,128
Drugs and chemicals	112,159	120,300	Fertilizers	91	1,062
Earthenware, china, and stone ware	254	71	Flour	282,908	128,102
Fertilizers	3,241	15,087	Fruit	451	120
Fruits	23,667	19,301	Glucose	1,566	13,358
Glass, and manufactures of	2,301	809	Glue and glue stock	65	87
Groceries and provisions	15,867	28,453	Groceries and provisions	9,875	12,161
Hair, and manufactures of	6,433	1,803	Gunpowder and explosives	209	213
Hemp, jute, flax, and their fabrics	29,101	30,830	Hay	6	87
Hides and skins	16,324	18,240	Hides, leather, and manufactures of	2,314	2,350
Iron:			Iron:		
Manufactured	123,177	11,204	Manufactured	13,164	93,567
Ore	304,654	105,837	Pig	751	4,495
Pig	112,907	2,664	Scrap	48	67
Scrap	42,574	341	Live stock	15,079	15,421
Leather, and manufactures of	227	183	Metals, other, and manufactures of	2,015	5,313
Live stock and fowls	123	33	Molasses	26,596	29,648
Mineral water	746	853	Oats and oatmeal	2,594	2,971
Molasses	71,388	54,462	Oil cake	79,105	60,817
Oil	10,165	971	Oils:		
Ores, metals, and manufactures of	8,908	12,587	Lubricating	92,377	93,240
Plants and seeds	8,691	2,232	Other	1,000	1,582
Plaster of Paris	47,760	65,172	Paraffin	28,204	24,980
Rags	7,927	7,500	Petroleum, crude and refined	1,017,912	1,091,096
Salt	16,606	15,757	Residuum	3,716	24,210
Silk, and manufactures of	116	258	Rosin and turpentine		11,491
Stone, and manufactures of	2,643	1,682	Seeds	800	606
Sugar	239,975	259,601	Soap, tallow, and grease	16,316	15,980
Sulphur:			Stone, and manufactures of	5,615	3,788
Crude	16,043	11,050	Tobacco	3,265	3,201
Ore	75,095	74,023	Wheat	48,024	784
Tin	11,366	13,413	Wines and liquors	1,458	1,068
Tobacco	1,022	873	Wood pulp, paper, and manufactures of	5,351	744
Wines and liquors	2,051	2,390	Wood, and manufactures of	45,978	54,967
Wood pulp, paper, and manufactures of	19,637	17,133	Miscellaneous	15,964	11,809
Wood, and manufactures of	9,993	17,457	Total	2,378,807	2,552,065
Wool and wool fabrics	17,111	17,678			
Miscellaneous	15,558	20,709			
Total	1,561,249	1,057,348			

Passengers arriving from and departing for foreign countries by river.

	1903.	1904.
Arrivals	34,177	35,972
Departures	8,876	11,007
Total	43,053	36,979

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Comparative statement of quantity and value of exports, imports, and revenue collected.

Year.	Exports.		Imports.		Revenue collected.
	Quantity.	Value.	Quantity.	Value.	
	Tons.		*Tons.*		
1895	1,738,913	$36,745,119	1,355,456	$47,271,435	$13,526,966
1896	1,875,081	42,431,100	1,151,723	39,807,278	12,657,803
1897	2,599,952	51,760,616	1,182,807	27,921,738	14,057,074
1898	3,019,005	59,392,047	949,097	37,516,707	19,818,783
1899	3,069,570	67,044,250	1,270,440	48,241,016	20,777,735
1900	3,513,526	81,145,966	1,316,564	49,186,877	21,775,201
1901	3,183,584	79,324,344	1,279,044	51,365,142	19,046,007
1902	2,748,339	76,022,896	1,679,408	55,064,776	22,360,362
1903	2,378,307	73,184,394	1,561,249	55,516,052	21,020,331
1904	2,552,065	66,539,909	1,057,348	53,852,194	17,997,700

Foreign entrances and clearances.

Class.	Entered from foreign ports.		Cleared for foreign ports.		Total.	
	Number.	*Tons.*	*Number.*	*Tons.*	*Number.*	*Tons.*
American steam vessels	45	49,834	43	48,641	88	98,475
American sailing vessels	90	47,067	87	64,040	177	111,107
Foreign sailing vessels	73	62,886	76	69,747	149	132,633
Foreign steam vessels	753	1,527,385	770	1,526,695	1,523	3,054,080
Total	961	1,687,172	976	1,709,123	1,937	3,396,295

The following statement concerning the domestic and coastwise commerce of the Delaware River for the years ending December 31, 1903 and 1904, has been compiled from returns made to this office by shippers, consignees, and carriers:

Articles.	1903.		1904.	
	Quantity.	Value.	Quantity.	Value.
ARRIVALS.	*Tons.*		*Tons.*	
Asphalt	34,488	$305,508	12,762	$141,913
Bricks and terra cotta	25,926	74,654	19,336	51,520
Cement and plaster	8,880	31,610		
Chemicals	148,462	3,312,754	133,120	3,509,302
Clay	6,884	12,400	6,438	11,740
Coal	399,698	1,438,000	434,259	1,574,474
Coal tar	11,589	100,025	1,680	11,887
Cotton	11,208	2,023,950	38,000	6,080,000
Fertilizers	68,245	900,513	68,433	969,150
Grain	126,648	2,865,778	94,851	1,996,780
Hay	4,193	32,510	85,950	634,750
Ice	55,733	96,500	59,246	119,708
Iron:				
Manufactured	40,301	1,196,294	62,821	1,675,349
Ore	12,336	185,788	10,060	55,330
Pig	76,053	1,303,433	35,496	535,972
Scrap	136	5,230	3,900	76,300
Lumber	948,491	18,417,757	1,055,076	10,224,542
Manure	36,400	47,200	41,581	45,739
Oysters and fish	35,573	779,416	54,436	820,215
Petroleum and products	367,225	7,360,861	388,590	6,677,321
Produce and fruit	36,443	1,820,533	46,961	1,551,628
Railroad ties	335,358	1,780,797	234,156	1,196,007
Sand	1,423,859	762,892	1,325,756	679,337
Stone:				
Building	158,820	256,005	104,613	123,999
Paving	73,036	78,779	121,594	183,188
Sugar	96,835	8,136,600	122,400	9,180,000
Wood (cord)	52,954	188,614	102,758	407,174
Miscellaneous	2,580,370	595,720,732	2,776,755	754,371,854
Total	7,171,139	649,295,128	7,441,017	802,905,267

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Articles.	1903.		1904.	
	Quantity.	Value.	Quantity.	Value.
DEPARTURES.				
	Tons.		*Tons.*	
Asphalt	34,871	$315,005	12,822	$143,443
Bricks and terra cotta	25,476	67,604	22,066	58,005
Cement and plaster	3,000	19,200		
Chemicals	108,902	2,444,793	132,846	3,275,241
Coal	7,452,125	30,303,465	7,656,356	29,908,722
Coal tar	73,264	976,190	26,885	173,700
Cotton	11,183	2,018,350		
Fertilizers	101,047	1,725,749	112,083	1,788,020
Grain	22,100	447,970	60,065	2,800,728
Hay	2,812	33,365	11,274	80,822
Ice	9,500	16,625		
Iron:				
Manufactured	71,414	3,934,717	94,816	3,491,730
Pig	45,759	786,370	35,297	582,292
Ore			520	111,226
Lumber	31,697	348,660	40,348	294,447
Manure	68,918	102,168	72,285	79,525
Oysters and fish	179,292	2,039,232	196,516	2,157,972
Petroleum and products	243,701	3,897,321	339,899	4,349,905
Produce and fruit	1,295	184,550	6,115	401,200
Sand	821,647	372,196	874,105	613,792
Stone:				
Building	170,870	258,755	298,647	926,105
Paving	21,435	38,816		
Sugar			20,100	1,680,000
Wood	2,478	21,192	6,571	21,080
Miscellaneous	2,213,445	461,727,321	2,305,040	602,765,581
Total	11,716,231	512,029,514	12,321,606	655,763,536

Passengers arriving at and departing from Philadelphia.

	1903.	1904.
Arriving	1,034,552	1,088,454
Departing	1,019,089	1,146,513
Total	2,053,641	2,234,967

Domestic and coastwise arrivals and departures in cargo.

Class.	1903.		1904.	
	Arrivals.	Departures.	Arrivals.	Departures.
Steamers	[a] 17,982	[a] 19,508	[a] 18,276	[a] 19,150
Sailing vessels	2,944	[b] 33,461	3,760	[b] 34,150
Canal boats and barges	[c] 32,889	[d] 42,879	[c] 27,070	[d] 40,981
Rafts	258	48	135	37
Total	54,073	95,891	49,241	94,318

[a] Exclusive of tugboats and ferryboats.
[b] Including 33,000 oyster boats.
[c] Including 18,000 railroad lighters.
[d] Including 18,200 railroad lighters.

SUMMARY.

Freight movement.

	1903.		1904.	
	Quantity.	Value.	Quantity.	Value.
	Tons.		*Tons.*	
Foreign:				
Arrivals	1,562,249	$55,516,052	1,057,348	$53,852,194
Departures	2,378,307	73,184,394	2,552,055	66,539,909
Domestic:				
Arrivals	7,171,139	649,235,128	7,441,017	802,905,267
Departures	11,716,231	512,029,514	12,321,606	655,763,536
Total	22,827,926	1,289,965,088	23,372,026	1,579,060,906

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Vessel movement.

	Foreign trade.		Domestic trade.	
	1903.	1904.	1903.	1904.
Arriving:				
Steam vessels	852	798	17,982	18,276
Sailing vessels	174	163	2,944	3,760
Canal boats and barges	----------	----------	32,889	27,070
Rafts	----------	----------	259	135
Departing:				
Steam vessels	848	813	19,503	19,150
Sailing vessels	149	163	32,461	34,150
Canal boats and barges	----------	----------	42,879	40,981
Rafts	----------	----------	48	37
Total	2,023	1,937	148,965	143,559

LETTER FROM MR. THEO. C. KNAUFF, SECRETARY OF THE BOARD OF HARBOR COMMISSIONERS FOR THE CITY OF PHILADELPHIA, PA., WITH REFERENCE TO THE IMPROVEMENT BY THE CITY OF THE HARBOR OF PHILADELPHIA BY MEANS OF THE WIDENING OF DELAWARE AVENUE AND THE EXTENSION OF PIERS BY PRIVATE OWNERS, DURING THE FISCAL YEAR ENDING JUNE 30, 1905, WITH TWO INCLOSURES.

BOARD OF HARBOR COMMISSIONERS FOR THE CITY OF PHILADELPHIA,
Philadelphia, Pa., June 9, 1905.

DEAR SIR: I beg to acknowledge the receipt of your communication of May 29, 1905, in which you ask to be furnished with a concise statement regarding the progress made by the city of Philadelphia since June 30, 1904, in the reconstruction of the water front along the Delaware River and in the advancement of wharves to the new pierhead line by the city and private owners.

Under the head of the "Improvement of Delaware avenue" I would state that during the past year the plans and specifications for a permanent paving on a permanent concrete base, in place of the temporary paving, which has now been allowed to rest and settle for several years, were prepared by the bureau of surveys and a contract was entered into with D. J. McNichol for the work, payment for the same being from the Girard estate fund.

The portion of the work to be done by the railway companies was given to the same contractor.

On the Schuylkill River the city appropriation was used entirely for work on that river, the appropriation from the General Government being used on the 30-foot channel in the Delaware. This work has now been completed and results in a vastly improved channel.

I inclose herewith, marked "Exhibit A," copy of a letter from Mr. George S. Webster, chief engineer and surveyor of the city, giving all details in connection with these subjects.

I also inclose herewith, marked "Exhibit B," copy of a communication from Mr. George F. Sproule, secretary of the board of port wardens, giving all information in relation to the extension of piers to the new pierhead line during the year.

Very truly, THEO. C. KNAUFF, *Secretary.*

Maj. J. C. SANFORD, *Corps of Engineers.*

EXHIBIT A.

DEPARTMENT OF PUBLIC WORKS, BUREAU OF SURVEYS,
Philadelphia, Pa., June 6, 1905.

DEAR SIR: Answering your letter of recent date requesting information as to the work accomplished by the city of Philadelphia in connection with harbor improvement and the improvement of the landing facilities of the port, I reply as follows:

Improvement of Delaware avenue.—The portion of Delaware avenue between Vine and South streets, which had been widened prior to 1901 by the construction of a bulkhead about 100 feet easterly of the old line of the avenue and

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filling in behind it, with the construction of the necessary sewers and alteration of underground structures, also the paving of the avenue, was allowed to rest for several years until the filled-in material had become settled to such an extent as to permit of placing a permanent foundation under the paving.

During this interval the high-pressure fire-service system was installed; also electrical conduits were placed underground for the lighting of the avenue.

After several conferences between the city officials and the railroad officials, by agreement of May 20, 1902, between the city of Philadelphia, trustee under the will of Stephen Girard, Pennsylvania Railroad Company, Philadelphia and Reading Railway Company, Philadelphia Belt Line Railroad Company, it was arranged that the number of tracks would be limited to three, and the obligations of the railway companies for paving and repaving portions of the street surface and the maintenance of the same were set forth.

By agreement it was arranged that the Pennsylvania Railroad Company, acting for itself and the other companies, should do the work and apportion the expense.

A plan was prepared and received the approval of the railway and city authorities July 31, 1903, fixing the number and location of tracks in the avenue.

The style of rail adopted as a standard, suitable for use in city streets for heavy traffic, was approved May 13, 1903. The rail is somewhat similar in design to that in use by passenger railway companies, and has a deep groove and broad head and permits heavy traffic along and across it with very little obstruction.

During the past year plans and specifications were prepared by the bureau of surveys for paving Delaware avenue between Vine and South streets upon a permanent concrete base.

The trustees of the Girard estate entered into a contract with D. J. McNichol to do the work, paying for the same from the Girard estate fund. The railway companies arranged with the same contractor to do the portion of the work for which they were responsible.

In regard to the improvement of city wharf property, it may be mentioned that the property acquired by the city from the Uhler estate, north of Race street, containing 138 feet 0.75 inch in frontage, has been leased under authority of an ordinance of councils to the Baltimore and Ohio Railroad Company, which has secured the privilege to construct a pier 60 feet in width to the pierhead line, and also a temporary building between this pier and the one to the northward, which construction is completed. This will make a property heretofore unproductive yield an income to the city.

Improvement of the Schuylkill River.—The Government appropriations having been made to continue the work of securing a 30-foot channel in the Delaware River, the appropriation made by the city of Philadelphia was utilized entirely for the improvement of the Schuylkill River.

The sum of $400,000 having been obtained from a loan in June, 1902, and applied to this purpose, a contract was entered into in 1903 with the American Dredging Company, which comprised, first, the dredging of the new east channel through Grays Ferry bridge to a depth of 20 feet below mean low water; the removal of some old wharves and constructing a piling fender rack in front of the east rest pier of the Pennsylvania Railway Company's new bridge at Grays Ferry; the widening and deepening of the river approaches to these bridges and the continuance of the channel improvement from a point about 500 feet above Penrose Ferry bridge, the terminus of a former contract, to a point about 1,000 feet above the Philadelphia Refinery wharf, all of which was to be 26 feet in depth and generally of a width of 250 feet except at the curves where the channel was widened to about 300 feet.

The project above the point designated near the Philadelphia refinery wharf is to obtain a depth of 20 feet and a general width of 150 feet.

All material dredged was placed over the banks, within the limits of League Island Park, east and west of Broad street.

During the year 1903 261,000 cubic yards of material were removed from the channel of the river, during 1904 380,400 cubic yards, which, with the work done this season, makes a total of 731,747 cubic yards other than rock and 62.5 cubic yards of rock.

The dredging out of the old wharves at Grays Ferry and the construction of the fender rack were completed in 1903.

The result accomplished under this contract just completed has been the formation of a channel 250 feet in width and 26 feet in depth below the plane of mean low water, a distance of 2.12 miles northward from the terminus of

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contract No. 9, the formation of a clear waterway through the east draw spans of the bridges at Grays Ferry, and a channel 200 feet in width and 20 feet in depth below the plane of mean low water from these bridges, a distance of about 0.4 mile upstream. There has been expended under this contract the sum of $371,998.50.

Removing the wreck of the steamship Bermuda.—Owing to the abandonment of the steamship *Bermuda*, an iron vessel 233 feet in length, after she had sunk at her pier, No. 19 North Wharves, and after several attempts had been made to raise her, the city of Philadelphia appropriated a sum of money for the purpose of removing the wreck from the river.

A contract was entered into with Louis H. Darling in June, 1904, the city agreeing to make no claim for the vessel or its cargo.

Attempts were made by the alleged owners of the steamer to make a claim against the city of Philadelphia in case the contract should be carried out.

After all legal forms had been complied with, work was begun July last. It was prosecuted with vigor in the fall in the face of unusual difficulties.

A large portion of the wreck has been removed, so that there is considerable water over it, but the intervention of extreme winter weather prevented the use of dredges and tows and caused the work to be shut down for a time.

Early this spring the work was abandoned by the contractor, Louis H. Darling, and is being carried on by his surety, the American Surety Company, of New York, who expect to complete the contract in a short time.

Yours, truly,

G. S. WEBSTER, *Chief Engineer.*

Mr. THEO. C. KNAUFF,
Secretary Board of Harbor Commissioners.

EXHIBIT B.

BOARD OF PORT WARDENS FOR THE PORT OF PHILADELPHIA, PA.,
Philadelphia, Pa., June 8, 1905.

DEAR SIR: In reply to your favor of the 31st ultimo I would state that since June 30, 1904, license was granted to the William J. McCahan Sugar Refining Company to extend pier No. 68, South wharves, to the pierhead line.

Very truly, yours,

GEO. F. SPROULE, *Secretary.*

Mr. THEO. C. KNAUFF,
Secretary Board of Harbor Commissioners.

H 2.

IMPROVEMENT OF ICE HARBOR AT MARCUSHOOK, PENNSYLVANIA.

An account of this improvement is contained in the Annual Reports of the Chief of Engineers for 1896, page 920; 1900, page 1574; 1904, page 1196.

The protection works for this harbor consist of the old landing piers and seven detached piers having foundations of wooden cribs filled with stone, the superstructures being filled with cut stone.

Under date of April 7, 1903, the revocable license granted by the Secretary of War November 13, 1901, referred to in the Annual Report for 1902, was modified so as to permit the extension of the pier into the Delaware River, a distance of 175 feet farther than originally authorized.

The two landing piers in the harbor were repaired in 1903, at a cost of $1,637.94.

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The amount expended during the past fiscal year was 73 cents for incidental expenses.

Rules for the use of the landing piers at this locality were approved by the Acting Secretary of War under date of April 29, 1904. These rules are contained in the Annual Report of the Chief of Engineers for 1904, page 1196.

Money statement.

July 1, 1904, balance unexpended	$38.27
June 30, 1905, amount expended during fiscal year	.73
July 1, 1905, balance available	37.54

APPROPRIATIONS.

June 23, 1866	$5,000	August 5, 1886	$15,000
March 2, 1867	94,000	August 11, 1888	15,000
January 14, 1880	35,000	September 19, 1890	5,000
March 3, 1881	30,000		
August 2, 1882	15,000	Total	214,000

EXPENDITURES.

Total to June 30, 1905	$213,962.46

H 3.

CONSTRUCTION OF IRON PIER IN DELAWARE BAY, NEAR LEWES, DELAWARE.

An account of this work is contained in the Annual Reports of the Chief of Engineers for 1896, page 920, and for 1900, page 1574.

During the past fiscal year no work has been done or liabilities incurred.

It is proposed to hold the sum of $820.60, which remains available, for maintenance and repairs as needed.

The funds now available are considered sufficient for present needs.

Money statement.

July 1, 1904, balance unexpended	$820.60
July 1, 1905, balance unexpended	820.60

APPROPRIATIONS.

July 15, 1870	$225,000	June 14, 1880	$10,000
June 23, 1874	10,000	March 3, 1881	10,000
March 3, 1875	25,000	August 2, 1882	13,000
March 3, 1875	15,000	April 4, 1890	10,000
August 14, 1876	30,000	June 3, 1896	7,660
June 18, 1878	20,000		
March 3, 1879	10,500	Total	386,160

EXPENDITURES.

Total to June 30, 1905	$385,339.40

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H 4.

IMPROVEMENT OF DELAWARE BREAKWATER, DELAWARE.

An account of this improvement is contained in the Annual Reports of the Chief of Engineers for 1896, page 922; for 1897, page 1214; for 1898, page 1094, and for 1901, page 1323.

During the past fiscal year no work has been done nor expenses incurred.

The funds now available are considered sufficient for present needs, and it is proposed to hold the sum of $874.38, the available balance, for maintenance and repairs as needed.

The commercial statistics of the harbor at and in the vicinity of this breakwater are given in connection with the report on the harbor of refuge, Delaware Bay, Delaware.

On October 3, 1903, the Secretary of War authorized the sale and removal of the old building belonging to the United States and located on the breakwater.

Under date of October 16, 1903, sealed proposals were invited for the sale and removal of the building. Only one bid, by Horace Brown, of Lewes, Del., for the sum of $1, was received, and this bid was accepted, the building, including its foundations, to be removed. The $1 collected from Mr. Brown for the building was deposited to the credit of the appropriation for improving harbor at Delaware breakwater, Delaware, for which work the building was originally erected. The work of removal of the building and its foundations was completed during the past winter.

Money statement.

July 1, 1904, balance unexpended	$875.64
July 1, 1905, balance unexpended	875.64

APPROPRIATIONS.

May 7, 1822	$22,700.00	August 2, 1882	$125,000.00
May 23, 1828	250,000.00	July 5, 1884	75,000.00
April 23, 1830	162,000.00	August 5, 1886	56,250.00
March 2, 1831	208,000.00	August 11, 1888	100,000.00
July 3, 1832	270,000.00	September 19, 1890	80,000.00
March 3, 1833	270,000.00	July 13, 1892	50,000.00
June 28, 1834	270,000.00	August 18, 1894	50,000.00
March 3, 1835	100,000.00	June 3, 1896	80,000.00
July 2, 1836	100,000.00		
July 4, 1836 (survey)	1,000.00	Total	2,808,353.70
March 3, 1837	141,000.00	Received from sale of old building	1.00
July 7, 1838	150,000.00		
August 30, 1852	30,000.00	Grand total	2,808,354.70
June 23, 1866	107,910.00		
March 2, 1867	109,493.70		

EXPENDITURES.

Total to June 30, 1905	$2,807,479.06
Total under present project to June 30, 1905	615,375.36

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COMMERCIAL STATISTICS.

Arrivals at Delaware breakwater during 1904.

	Steamers.	Ships.	Barks.	Brigs.	Schooners.	Barges.	Total.
For orders	72	10	12	3	14	2	113
For harbor	17	3	28	1	751	249	1,049
In distress	5				1	3	9
Total	94	13	40	4	766	254	1,171

H 5.

CONSTRUCTION OF HARBOR OF REFUGE, DELAWARE BAY, DELAWARE.

An account of this improvement is contained in the Annual Reports of the Chief of Engineers for 1897, page 1216; for 1901, page 1325; for 1902, page 1036; for 1903, page 970, and for 1904, page 1199.

The breakwater provided for under the project was completed December 11, 1901, and the ice piers, 15 in number, June 19, 1903.

Under date of November 19, 1902, a report was submitted in accordance with the provisions of the river and harbor act of June 13, 1902, regarding the necessity of further protection, if any, from northwest winds. A further report on this subject containing a detailed project and estimate of cost of the proposed extension of the breakwater at this harbor was submitted under date of November 14, 1903. Both reports and the recommendations of the Board of Engineers for Rivers and Harbors are published in House Executive Document No. 548, Fifty-eighth Congress, second session.

The funds now on hand will be held for examinations and maintenance and repair of the breakwater.

Money statement.

July 1, 1904, balance unexpended		$1,132.91
Treasury settlement, June 9, 1898	$0.46	
June 30, 1905, amount expended during fiscal year	3.79	
		4.25
July 1, 1905, balance unexpended		1,128.66

APPROPRIATIONS.

June 3, 1896	$5,000	June 6, 1900	$450,000
June 4, 1897	394,334	March 3, 1901	213,000
July 1, 1898	800,000		
March 3, 1899	377,000	Total	2,239,334

EXPENDITURES.

Total to June 30, 1905 ..... $2,238,205.34

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H 6.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

(1) A canal boat was sunk during a freshet in the Schuylkill River near the Mill Creek sewer, just above Grays Ferry Highway Bridge. The wreck being considered a dangerous obstruction to navigation, its removal was recommended. Under date of January 20, 1904, a contract was entered into with Charles T. Johnston, of Lewes, Del., for the removal of all parts of the wreck and contents from the waterway for the sum of $498.

Under authority of the Department, dated March 2, 1904, the contract time limit was waived for a reasonable period. For about sixty days the contractor was prevented doing any work on account of the severe winter weather. On March 4, 1904, when operations became practicable and the contractor had made preparations for commencing the work it was found that the wreck had disappeared from the position it formerly occupied. Upon examination a wreck was found lodged against one of the piers of the Grays Ferry Highway Bridge in much deeper water.

The use of explosives in the removal of the wreck at Grays Ferry Bridge would not be permitted on account of probable resulting damage to the bridge, and Mr. Johnston was unwilling to bear the extra expense which he claimed would be incurred in its removal without the use of explosives. In view of these facts, and the uncertainty that the wreck at Grays Ferry Bridge was the identical wreck Mr. Johnston had contracted to remove, it was recommended that the contract be abandoned, and the balance, $527.76, from the allotment of $600 originally made, be applied to the removal of the wreck at the Grays Ferry Highway Bridge. This recommendation was approved under date of June 8, 1904, and the contractor so informed.

On October 7, 1904, bids for the removal of the wreck were opened, but rejected because they were considered too high. Bids were again opened on October 24, 1904. The lowest bid, that of Louis H. Darling, was $549. This being slightly in excess of the available balance on hand, but considered as low as could be obtained by readvertisement, an additional allotment of $250 was asked for with a view to its acceptance. This allotment was made November 21, 1904, and an emergency contract was entered into with Louis H. Darling, of Philadelphia, Pa., on January 24, 1905. This contract was annulled by authority of the Department, dated May 4, 1905, because of the failure on the part of the contractor to prosecute faithfully and diligently the work contracted for. The work was readvertised and bids opened May 22, 1905. The lowest bid, that of Charles T. Johnston, of Lewes, Del., was $747. This amount being in excess of available balance on hand, an additional allotment of $200 was requested with a view to the acceptance of Mr. Johnston's bid. The allotment was made on June 8, 1905, and on June 19, 1905, an emergency contract was entered into with Charles T. Johnston, of Lewes, Del., for the removal of the wreck. Work under this contract has not been commenced.

(2) On April 22, 1904, the barge *Alice* was sunk by collision in the Delaware River near Tinicum Island. The wreck being consid-

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ered an obstruction to navigation, its removal was recommended. Sealed proposals were opened July 8, 1904. All the bids were rejected, the prices offered being considered too high. Nothing further has been done in regard to the removal of this wreck. It is proposed to remove this wreck by the use of United States plant.

(3) On December 3, 1904, the barge *Santiago* was sunk in collision with the pilot boat *Philadelphia*, in the national harbor of refuge, Delaware Bay. The wreck being considered a dangerous obstruction to navigation, its removal was recommended. A contract was entered into under date of March 20, 1905, with the National Wrecking Company, of Fall River, Mass. The contractor agreed to pay the United States for the wreck and contents and do the work of removal for $3,160. This amount was paid over at the execution of the contract and deposited to the credit of the Treasurer of the United States, on account of the indefinite appropriation for removing sunken vessels or craft obstructing or endangering navigation. The work of removal is still in progress.

(4) On February 5, 1905, the Philadelphia ice boat *No. 3* was sunk in collision with the wreck of the barge *Santiago* in the national harbor of refuge, Delaware Bay. The wreck being considered a menace to navigation, its removal was recommended. Under date of March 20, 1905, a contract was entered into with Charles W. Johnston, of Lewes, Del., for the removal of all parts of the wreck and contents for the sum of $4,700. The work of removal is still in progress.

(5) In September, 1895, the three-masted schooner *Lottie K. Friend*, with a cargo of coal, was sunk in Delaware Bay in collision with another vessel, about 1¼ miles west from Ship John light. The wreck being considered a dangerous obstruction to navigation, its removal was recommended. Under date of February 8, 1897, a contract was entered into with Thomas Poynter and Elijah D. Register, of Lewes, Del., for the removal of the wreck for the sum of $1,100, the work to be completed on or before April 25, 1897. At the close of the fiscal year ending June 30, 1897, the removal of the wreck had been commenced, but had not been completed. During the fiscal year ending June 30, 1898, no additional work had been done toward the removal of the wreck under the above contract, and on June 16, 1898, it was recommended that the contract be annulled and the remaining wreckage be removed by dredging at some time when dredging operations were in progress in the neighborhood. This recommendation was approved on June 18, 1898. Since that time nothing has been done toward the removal of the wreck.

H 7.

CONSTRUCTION OF SEAGOING HYDRAULIC DREDGES.

DREDGE FOR IMPROVING HARBOR AT CHARLESTON, S. C.

k previously performed under contract for a wooden-hull
w suction dredge, see pages 1166 and 1167, Annual Report
f of Engineers for 1902, pages 972 and 973, Annual Report

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of the Chief of Engineers for 1903, and pages 1202 and 1203, Annual Report of the Chief of Engineers for 1904.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1905.

At the beginning of the year the dredge *Gen. Abbot* was at the Norfolk Navy-Yard having her bottom coppered and other necessary repairs made. These were completed and she left for Charleston, S. C., July 22, arriving there July 24, and on July 30 the dredge and property were transferred to Capt. G. P. Howell, Corps of Engineers.

Total amount expended to June 30, 1905, including cost of inspection, outfit, voyage from Newport News, Va., to Charleston, S. C., coppering, alterations, etc., at Norfolk Navy-Yard, and the greater portion of operating expenses for five months, $186,425.69 (includes also value of supplies on hand at first arrival at Charleston).

Money statement.

June 30, 1905, amount drawn		$186,425.69
Amount expended to June 30, 1904	$153,399.92	
June 30, 1905, amount expended during fiscal year	20,688.51	
Treasury settlement October 21, 1904	12,337.26	
		186,425.69

2. DREDGE FOR IMPROVING PASSES OF THE MISSISSIPPI RIVER.

For work (95 per cent) previously performed under contract for steel twin-screw hydraulic dredge, see pages 1173 and 1174, Annual Report of the Chief of Engineers for 1902, pages 973 and 974, Annual Report of the Chief of Engineers for 1903, and pages 1203 and 1204, Annual Report of the Chief of Engineers for 1904.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1905.

At the beginning of the year the dredge *Benyaurd* was at the United States navy-yard, Norfolk, Va., being completed. At the end of July the contract was 98 per cent completed. On August 25 the dredge had her official trial, which proved to be satisfactory. She left for her station on October 1, arrived at Charleston, S. C., on the 3d, left there on the 5th, arrived and left Key West on the 8th, arrived at Port Eads on the 12th, and at New Orleans, La., on the same date. Dredging was started at Port Eads by the dredge on October 24.

The dredge and property were transferred to Lieut. Col. Clinton B. Sears, Corps of Engineers, New Orleans, La., as per invoices dated December 17, 1904, and receipts dated January 13, 1905.

Total amount expended to June 30, 1905, including cost of inspection, outfit, voyage from Norfolk, Va., to New Orleans, La., and cost of completion by the Navy Department, $402,602.42 (includes also value of supplies on board on arrival at New Orleans, La., $880.90).

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Money statement.

June 30, 1905, amount drawn		$403,644.78
Amount expended to June 30, 1904	$163,039.45	
June 30, 1905, amount expended during fiscal year	11,598.04	
Treasury settlement, July 21, 1904	163,754.74	
Treasury settlement, September 13, 1904	36,550.35	
Treasury settlement, October 21, 1904	12,385.94	
Treasury settlement, November 30, 1904	7,048.81	
Treasury settlement, November 30, 1904	1,097.90	
Treasury settlement, January 27, 1905	7,127.19	
		402,602.42
July 1, 1905, balance unexpended		1,042.36
July 1, 1905, outstanding liabilities		1,536.77

3. DREDGE FOR IMPROVING THE SOUTHWEST PASS OF THE MISSISSIPPI RIVER.

For work previously performed under contract for the construction of one steel-hull twin-screw suction dredge, see page 980, Annual Report of the Chief of Engineers for 1903, and pages 1204 and 1205, Annual Report of the Chief of Engineers for 1904.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1905.

At the beginning of the year the dredge had been delivered to the Government in a completed condition and had been taken to the shipyard of Quigley, Davis & Dorp, of Camden, N. J., where she was being prepared for her trip to New Orleans, La. She left for this place on August 6, but put into Newport News to have a new and larger rudder fitted. On August 23 she left Newport News, arriving at Charleston, S. C., on August 25, and at New Orleans, La., on September 3. After some necessary work to put the dredge in condition to dredge she started for Port Eads October 19 and commenced dredging on October 25. Owing to a breakdown of the distributing valve in the discharge pipe and pump, work was delayed until April 20, 1905, when dredging was started at Southwest Pass. Since that date dredging has continued and the thirty days' trial of pumping machinery successfully completed.

PONTON PIPE LINE.

For work previously performed under contract for the construction of 36 pontons and 900 feet of 36-inch wrought-iron pipe, see Report of Chief of Engineers for 1904, page 1204.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1905.

At the beginning of the year the pontons and pipe line were about 25 per cent completed. In February, 1905, these were completed and sent to New Orleans, La., for test by the dredge, which test has since been satisfactorily made.

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ELEVATED DISCHARGE PIPE SCOW.

The work of constructing an elevated discharge pipe scow was advertised October 7, 1904. Proposals were opened November 7, 1904. Five bids were received, as follows:

Dubuque Boat and Boiler Works, Dubuque, Iowa	$14,694
The Pusey & Jones Company, Wilmington, Del	14,721
Merrill Stevens Company, Jacksonville, Fla., delivered at Jacksonville, Fla., instead of New Orleans, La	12,500
Johnson Iron Works, New Orleans, La	12,400
Ellicott Machine Company, Baltimore, Md	11,964

The contract was entered into with Ellicott Machine Company November 21, 1904, and approved by the Chief of Engineers December 31, 1904; time of completion, three months.

At the end of January, 1905, the contract was 31.4 per cent completed, and at the end of the year the scow was completed and tested satisfactorily on June 26, 1905.

Total amount expended to June 30, 1905, including cost of inspection, voyage from Camden, N. J., to New Orleans, La., and outfit of dredge, $278,552.08 (includes also value of supplies on board on arrival at New Orleans, La.).

Money statement.

June 30, 1905, amount drawn		$300,026.25
Amount expended to June 30, 1904	$209,300.86	
Treasury settlement February 18, 1904	8.59	
Treasury settlement February 23, 1904	7.81	
June 30, 1905, amount expended during fiscal year	68,570.58	
Treasury settlement December 19, 1904	664.24	
		278,552.08
July 1, 1905, balance unexpended		71,447.92
July 1, 1905, outstanding liabilities		22,494.67

4. DREDGE FOR IMPROVING MOUTH OF COLUMBIA RIVER, OREGON AND WASHINGTON.

For work previously performed in converting the U. S. army transport *Grant* into a seagoing suction dredge, see pages 975 and 976, Annual Report of the Chief of Engineers for 1903, and page 1205, Annual Report of the Chief of Engineers for 1904.

The unexpended balance in hand July 1, 1904, amounting to $2,403.81, was deposited August 31, 1904.

5. DREDGE FOR IMPROVING ST. JOHNS RIVER, FLORIDA.

For work (85.99 per cent) previously performed under contract for a wooden hull single-screw suction dredge, see page 976, Annual Report of the Chief of Engineers for 1903, and page 1206, Annual Report of the Chief of Engineers for 1904.

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OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1905.

At the end of July the contract was 86.33 per cent completed.
At the end of August the contract was 88.69 per cent completed.
At the end of September the contract was 90.22 per cent completed.
At the end of October the contract was 92 per cent completed.
At the end of November the contract was 94 per cent completed.

On December 30, 1904, the vessel was given a preliminary dock trial, and on January 17, 18, 19, and 20 her official trial, which was satisfactory. The vessel was accepted March 7, and after getting stores, etc., on board left for Jacksonville, Fla., March 26. After stopping at Charleston, S. C., for coal she arrived at Jacksonville, Fla., March 31.

Dredging was started April 7 and continued five days. After being aground several times it was found that the gates were so badly damaged that she was sent to the League Island Navy-Yard, Philadelphia, Pa., to have her bottom coppered and repairs made. Leaving Jacksonville, Fla., April 27, she arrived at League Island Navy-Yard May 1. The repairs and coppering having been finished, she left for Jacksonville, Fla., arriving there May 31.

Dredging was started June 3 and has proceeded continuously since.

Total amount expended to June 30, 1905, including cost of inspection, outfit, and voyage from New York, N. Y., to Jacksonville, Fla., $165,487.43 (includes also value of supplies on board on first arrival at Jacksonville, Fla., $844.20).

Money statement.

June 30, 1905, amount drawn		$174,000.00
Amount expended to June 30, 1904	$117,304.74	
June 30, 1905, amount expended during fiscal year	48,182.69	
		165,487.43
July 1, 1905, balance unexpended		8,512.57
July 1, 1905, outstanding liabilities		2,665.99
July 1, 1905, amount covered by uncompleted contracts		4,500.00

ABSTRACT OF CONTRACT IN FORCE.

With the James Reilly Repair and Supply Company, New York, N. Y., dated January 15, 1903, approved February 21, 1903, for constructing one wooden hull seagoing suction dredge, complete, at $150,000. Date of beginning, March 12, 1903; date of completion, February 26, 1904; time limit for completion waived February 26, 1904.

6. DREDGE FOR IMPROVING HARBOR OF PENSACOLA, FLA.

For work (72.81 per cent) previously performed under contract for a wooden hull single-screw suction dredge, see page 977, Annual Report of the Chief of Engineers for 1903, and page 1207, Annual Report of the Chief of Engineers for 1904.

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OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1905.

At the end of August the contract was 73 per cent completed.
At the end of September the contract was 80 per cent completed.
At the end of October the contract was 85 per cent completed.
At the end of November the contract was 87 per cent completed.
At the end of December the contract was 87.60 per cent completed.
At the end of January the contract was 88.86 per cent completed.
At the end of February the contract was 88.86 per cent completed.
At the end of March the contract was 91.10 per cent completed.
At the end of April the contract was 93.70 per cent completed.

The work continued, and on June 5 the vessel left Greenport, Long Island, on her official trial. On the evening of this day the vessel ran aground and was pulled off the following day. After going into dry dock and having the necessary repairs made, she was again ready for trial June 29.

Total amount expended to June 30, 1905, including cost of inspection and outfit, $140,691.17.

Money statement.

June 30, 1905, amount drawn		$150,000.00
Amount expended to June 30, 1904	$90,503.24	
Treasury settlement May 5, 1903	5.65	
June 30, 1905, amount expended during fiscal year	50,182.28	
		140,691.17
July 1, 1905, balance unexpended		35,308.83
July 1, 1905, outstanding liabilities		15,104.16
July 1, 1905, amount covered by uncompleted contracts		15,000.00

ABSTRACT OF CONTRACT IN FORCE.

With the James Reilly Repair and Supply Company, New York, N. Y., dated January 17, 1903, approved March 30, 1903, for constructing one wooden hull, seagoing suction dredge, complete, at $150,000. Date of beginning, April 15, 1903; date of completion, June 1, 1904; time limit for completion waived May 23, 1904.

7. DREDGES FOR IMPROVING NEW YORK HARBOR, NEW YORK.

For work previously performed (*Manhattan*, 65 per cent; *Atlantic*, 51.76 per cent) under contract for two steel-hull, twin-screw suction dredges, see page 979, Annual Report of the Chief of Engineers for 1903, and pages 1208 and 1209, Annual Report of the Chief of Engineers for 1904.

MANHATTAN.

At the beginning of the year the contract was 65 per cent completed.
At the end of July the contract was 75 per cent completed.
At the end of August the contract was 85.9 per cent completed.
At the end of September the contract was 93.5 per cent completed.

The vessel was successfully launched July 9, and work on her continued rapidly until August 17, when she was given a dock trial. On August 29 and 30 the vessel was given her official trial. With

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the exception of showing that the overflows as originally provided were too small, this trial was satisfactory. Later, other overflows were installed and the vessel completed and accepted. She left Sparrows Point, Md., October 29 and arrived at New York, N. Y., October 31. On November 15 the dredge started working in Ambrose channel, and has continued working in the same place since. The dredge *Manhattan* and property were transferred to Lieut. Col. W. L. Marshall, Corps of Engineers, as per invoices dated January 30, 1905, and receipts dated February 8, 1905.

ATLANTIC.

At the beginning of the year the contract was 51.76 per cent completed.

At the end of July the contract was 60.39 per cent completed.

At the end of August the contract was 72.15 per cent completed.

At the end of September the contract was 83.29 per cent completed.

At the end of October the contract was 90 per cent completed.

At the end of November the contract was 96 per cent completed.

The vessel was successfully launched August 20. The extra overflows, having been shown to be necessary in the trials of the dredge *Manhattan*, were put in and the vessel given her official trial October 17 to 20, inclusive. The vessel was completed and accepted by the United States December 5, 1904.

It having been determined from the experience with the *Manhattan* that the suction pipe was longer than was advisable, the after suction-pipe davits were moved about 20 feet forward and other work necessitated by this change done. This was completed and the vessel left for New York March 30, arriving there April 1. Dredging operations were started in Ambrose channel April 28 and continued until the end of the year, with few delays.

Invoices for the transfer of the dredge *Atlantic* and her property were sent to Lieut. Col. W. L. Marshall, Corps of Engineers, in June, but receipts had not been received by the close of the year.

Total amount expended to June 30, 1905, including cost of inspection, outfits, voyages from Sparrows Point, Md., to New York, and repairs and alterations at the latter point, $682,464.92 (includes value of supplies on board on arrival at New York, $3,029.81).

Money statement.

June 30, 1905, amount drawn		$688,490.00
Amount expended to June 30, 1904	$282,057.88	
June 30, 1905, amount expended during fiscal year	400,407.04	
		682,464.92
July 1, 1905, balance unexpended		6,025.08
July 1, 1905, outstanding liabilities		999.50

8. DREDGE FOR IMPROVING HARBORS ON LAKE ERIE.

For work (90 per cent) previously performed under contract, see page 979, Annual Report of the Chief of Engineers for 1903, and pages 1209 and 1210, Annual Report of the Chief of Engineers for 1904.

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OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1905.

At the beginning of the year the dredge had been given her speed and pumping trials. A second speed trial was given on July 1. The dredge was completed and accepted and left Sparrows Point, Md., August 10, arriving at Newport News August 11. She left there on the 19th and arrived at Philadelphia, Pa., August 20, where preparations were made to put her at work. She worked at this location until October 15, when she was taken to the shipyard of Quigley, Davis & Dorp, Camden, N. J., and prepared for her trip to Cleveland, Ohio. She left Philadelphia, Pa., October 21, arriving at Cleveland, Ohio, November 18, having stopped for coal at Pictou, Nova Scotia, and Ogdensburg, N. Y. The vessel dredged from November 25 to December 1. Early in December she was laid up for the winter in Sandusky, Ohio.

The vessel and property were transferred to Lieut. Col. Dan C. Kingman, Corps of Engineers, on November 29, 1904.

Total amount expended to June 30, 1905, including cost of inspection, outfit, and voyage from Sparrows Point, Md., to Philadelphia, Pa., and from Philadelphia, Pa., to Cleveland, Ohio, $184,139.32. (Includes also value of supplies on board at arrival at Cleveland, Ohio, $182.24.)

Money statement.

June 30, 1905, amount drawn		$184,300.00
Amount expended to June 30, 1904	$121,797.04	
June 30, 1905, amount expended during fiscal year	62,342.28	
		184,139.32
July 1, 1905, balance unexpended		160.68
July 1, 1905, outstanding liabilities		326.51

9. DREDGE FOR IMPROVING HARBORS ON LAKE MICHIGAN.

For work (73.18 per cent) previously performed, see page 979, Annual Report of the Chief of Engineers for 1903, and pages 1211 and 1212, Annual Report of the Chief of Engineers for 1904.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1905.

At the beginning of the year the contract was 73.18 per cent completed.

At the end of July the contract was 86 per cent completed.

At the end of August the contract was 97 per cent completed.

The vessel was given her official trial on July 26 and 28. All work having been completed and the vessel accepted, she left Sparrows Point, Md., September 7 for Philadelphia, Pa., arriving at that point on the 9th. She was fitted for work, and began dredging in the Delaware River September 21. On January 10, 1905, she left for Boston Harbor, arriving there January 14. Dredging was started at the latter place on the 21st and continued until the latter part of April. On April 29 she was placed in dry dock at Boston Navy-Yard for cleaning and to have a new propeller fitted. The repairs being

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completed, she left Boston May 12 for Lake Michigan. Stopping for coal at Ogdensburg, N. Y., the dredge arrived at Ludington, Mich., June 8, 1905. Dredging was started at this place June 15, 1905, and has continued since at that point and at Grand Haven, Mich.

Invoices for transfer of the dredge and her property were sent to Col. M. B. Adams, Corps of Engineers, in June, but receipts had not been received by the close of the year.

Total amount expended to June 30, 1905, including cost of inspection, outfit, voyage from Sparrows Point, Md., to Philadelphia, Pa., thence to Boston, Mass., and Ludington, Mich., $183,240.59. (Includes also value of supplies on board on arrival at Ludington, Mich., $225.43.)

Money statement.

June 30, 1905, amount drawn		$183,409.36
Amount expended to June 30, 1904	$91,951.54	
June 30, 1905, amount expended during fiscal year	91,279.69	
Treasury settlement, December 19, 1904	9.36	
		183,240.59
July 1, 1905, balance unexpended		168.77
July 1, 1905, outstanding liabilities		342.92

10. DREDGE FOR IMPROVING SAVANNAH HARBOR, GEORGIA.

For work (45.71 per cent) previously performed under contract for a steel-hull twin-screw suction dredge, see page 980, Annual Report of the Chief of Engineers for 1903, and pages 1212 and 1213, Annual Report of the Chief of Engineers for 1904.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1905.

At the beginning of the year the contract was 45.71 per cent completed.

At the end of July the contract was 50 per cent completed.

At the end of August the contract was 60 per cent completed.

At the end of September the contract was 70.1 per cent completed.

At the end of October the contract was 81 per cent completed.

At the end of November the contract was 90.45 per cent completed.

The vessel was successfully launched October 1, and work continued rapidly. She was given her official trials on November 10, 15, and 29. The vessel was completed and accepted by the United States January 18, 1905. The continued cold weather and ice rendered it impracticable for the vessel to leave Sparrows Point, Md., until March 9. She arrived at Savannah, Ga., March 14 and commenced dredging March 21 and has continued at work with few interruptions since that date. The dredge *Savannah* and her property were transferred to Lieut. Col. J. B. Quinn, Corps of Engineers, Savannah, Ga., as per invoices and receipts dated June 2, 1905.

Total amount expended to June 30, 1905, including cost of inspec-

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tion, outfit, and voyage from Sparrows Point, Md., to Savannah, Ga., $195,085.08 (includes also value of supplies on hand on arrival at Savannah, Ga., $314.63).

Money statement.

June 30, 1905, amount drawn		$196,000.00
Amount expended to June 30, 1904	$66,458.66	
June 30, 1905, amount expended during fiscal year	128,626.42	
		195,085.08
July 1, 1905, balance unexpended		4,914.92

11. DREDGE FOR IMPROVING HARBOR AT KEY WEST, FLA.

For work (69.87 per cent) previously performed under contract for a wooden-hull single-screw dredge, see page 980, Annual Report of the Chief of Engineers for 1903, and pages 1213 and 1214, Annual Report of the Chief of Engineers for 1904.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1905.

At the beginning of the year the contract was 69.87 per cent completed.

At the end of July the contract was 76.72 per cent completed.

At the end of August the contract was 83.5 per cent completed.

At the end of September the contract was 87 per cent completed.

The vessel was launched July 25 and work proceeded until October 31, when she was given her trial trip. This having been satisfactory, the vessel was completed and left Portland, Me., for Philadelphia, Pa., on November 22, arriving on the 26th. She again left Camden, N. J., December 6 and arrived at Jacksonville, Fla., on the 14th, and began dredging for the trial period at the mouth of St. John River December 19, 1904. On January 24, 1905, the dredge left for Key West, Fla., arriving on the 28th, where she began dredging during the month of February.

The dredge *Key West* and her property were transferred to Maj. Francis R. Shunk, Corps of Engineers, as per invoices dated January 23, 1905, and receipts dated June 10, 1905.

Total amount expended to June 30, 1905, including cost of inspection, outfit, and voyage from Portland, Me., to Philadelphia, Pa., and then to Key West, Fla., $102,918.91 (includes also value of supplies on hand at arrival at Key West, $374.38).

Money statement.

June 30, 1905, amount drawn		$103,500.00
Amount expended to June 30, 1904	$44,145.79	
June 30, 1905, amount expended during fiscal year	58,773.12	
		102,918.91
July 1, 1905, balance unexpended		581.09
July 1, 1905, outstanding liabilities		93.40

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12. DREDGE FOR IMPROVING DELAWARE RIVER, PENNSYLVANIA AND NEW JERSEY.

For work (3.12 per cent) previously performed under contract for a twin-screw, steel-hull suction dredge, see Annual Report of the Chief of Engineers for 1904, pages 1214 and 1215.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1905.

At the beginning of the year the contract was 3.12 per cent completed.

At the end of July the contract was 9.25 per cent completed.
At the end of August the contract was 15 per cent completed.
At the end of September the contract was 19 per cent completed.
At the end of October the contract was 24.76 per cent completed.
At the end of November the contract was 30.58 per cent completed.
At the end of December the contract was 40 per cent completed.
At the end of January the contract was 43.72 per cent completed.
At the end of February the contract was 47.88 per cent completed.
At the end of March the contract was 52.02 per cent completed.
At the end of April the contract was 57.53 per cent completed.
At the end of May the contract was 65.27 per cent completed.
At the end of June the contract was 68.40 per cent completed.

The vessel was successfully launched June 3, 1905, and work has proceeded rapidly since.

From experience gained in the operation of other dredges (New York) it was thought necessary to shorten the suction pipes, and on May 10, 1905, a supplemental contract was entered into with the Maryland Steel Company, Sparrows Point, Md., approved by the Acting Secretary of War May 29, 1905, to do this and some other necessary work, the amount of the contract being $1,388.

Total amount expended to June 30, 1905, including cost of inspection and part of outfit, $202,853.82.

Money statement.

June 30, 1905, amount drawn		$235,756.00
Amount expended to June 30, 1904	$2,603.05	
June 30, 1905, amount expended during fiscal year	200,250.77	
		202,853.82
July 1, 1905, balance unexpended		197,146.18
July 1, 1905, outstanding liabilities		25,925.28
July 1, 1905, amount covered by uncompleted contracts		144,748.00

ABSTRACT OF CONTRACT IN FORCE.

With the Maryland Steel Company, Sparrows Point, Md., dated June 1, 1904, approved June 17, 1904, for constructing one steel-hull seagoing suction dredge. Price for hull, machinery, and electric-light plant, $353,000; price for a steam arrangement for operating the dumping gates, $5,400; total, $358,400. Date of beginning, July 6, 1904; date of completion, August 21, 1905.

With the same company, supplemental contract dated May 10, 1905, approved May 29, 1905, for—

Changing location of 8-inch after suction pipes	$350
Construction of two additional bridges	720
Furnishing 25 additional electric lights	318
Total	1,388

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APPENDIX I.

IMPROVEMENT OF RIVERS AND HARBORS IN SOUTHERN NEW JERSEY, OF CERTAIN RIVERS AND HARBORS IN DELAWARE, AND OF INLAND WATERWAY FROM CHINCOTEAGUE BAY TO DELAWARE BAY, VIRGINIA, MARYLAND, AND DELAWARE.

REPORT OF CAPT. C. A. F. FLAGLER, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1905, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Rancocas River, New Jersey.
2. Cooper Creek, New Jersey.
3. Mantua Creek, New Jersey.
4. Alloway Creek, New Jersey.
5. Goshen Creek, New Jersey.
6. Tuckerton Creek, New Jersey.
7. Raccoon Creek, New Jersey.
8. Wilmington Harbor, Delaware.
9. Appoquinimink, Murderkill, and Mispillion rivers, Delaware.
10. St. Jones River, Delaware.
11. Smyrna River, Delaware.
12. Inland waterway from Chincoteague Bay, Virginia, to Delaware Bay, at or near Lewes, Delaware.
13. Removing sunken vessels or craft obstructing or endangering navigation.

ENGINEER OFFICE, UNITED STATES ARMY,
Wilmington, Del., July 15, 1905.

GENERAL: I have the honor to inclose herewith annual report for the works of river and harbor improvement in this district for the fiscal year ending June 30, 1905.

Very respectfully, your obedient servant,

C. A. F. FLAGLER,
Captain, Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

I 1.

IMPROVEMENT OF RANCOCAS RIVER, NEW JERSEY.

For the history of this improvement see the Annual Report of the Chief of Engineers for 1905, Part 1, page 164.

No work was done on this improvement during the past fiscal year. The expenditure was for contingent expenses.

It was impracticable to obtain commercial statistics.

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Money statement.

July 1, 1904, balance unexpended	[a] $433.21
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	12.75
July 1, 1905, balance unexpended	[a] 420.46
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	3,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

Below the forks.

March 3, 1881	$10,000	
August 2, 1882	10,000	
September 19, 1890	10,000	
		$30,000

Mount Holly Branch.

July 13, 1902	$5,000	
August 18, 1894	3,000	
		8,000

Lumberton Branch.

June 3, 1896	$2,000	
March 3, 1899	2,000	
June 13, 1902	3,000	
		7,000
Total		45,000

NOTE.

Total expended to June 30, 1905	$44,479.45
Carried to surplus fund in July, 1890	100.09
Redeposited to credit of appropriation	399.70
On hand June 30, 1905	20.76

I 2.

IMPROVEMENT OF COOPER CREEK, NEW JERSEY.

For the history of this improvement see the Annual Report of the Chief of Engineers for 1905, Part 1, page 165.

No work has been done on this improvement during the past fiscal year. The disbursement was for contingent expenses.

Money statement.

July 1, 1904, balance unexpended	$8,618.81
June 30, 1905, amount expended during fiscal year	1.36
July 1, 1905, balance unexpended	8,617.45

APPROPRIATION.

June 3, 1896	$37,000

[a] $399.70 pertains to Mount Holly Branch, and will be returned to the surplus fund of the Treasury.

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I 3.

IMPROVEMENT OF MANTUA CREEK, NEW JERSEY.

For the history of this improvement see the Annual Report of the Chief of Engineers for 1905, Part 1, page 166.

At the close of the fiscal year 1904 work was in progress under a contract made with the River and Harbor Improvement Company, of Philadelphia, Pa., dated March 20 and approved April 8, 1903, at 17 cents per cubic yard, place measurement. The work was begun on November 7, 1903, and after many interruptions was completed January 18, 1905. During this period a channel 12 feet deep at mean low water was dredged from the phosphate works to the Delaware River, the width made being 110 feet across the flats and 100 feet at the upper and lower ends. The quantity of material removed is 101,381 cubic yards, measured in place. It consisted of sand and mud, with some clay. The material dredged between the 12-foot contour in the Delaware River and its low-water line was deposited in the two upper bends cut off just below Paulsboro and a few scow loads in the bend nearest the mouth. Most of that from the cut through the marsh was placed upon the banks along the sides of the cut, and the remainder, to the phosphate works, was dumped into the old mouth of the creek, which had been cut off.

Plans, etc., for the jetties necessary for the protection of the channel at the mouth, as far as available funds will permit, are now in preparation.

It was impracticable to obtain commercial statistics.

No contract in force.

It is proposed to expend the appropriation recommended below, if obtained, and the available balance, if any, in dredging shoals between Paulsboro and the mouth and in the partial construction of jetties projected at the mouth.

Money statement.

July 1, 1904, balance unexpended	$32,521.86
June 30, 1905, amount expended during fiscal year, for works of improvement	16,952.17
July 1, 1905, balance unexpended	15,569.69
Amount (estimated) required for completion of existing project	85,030.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	40,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

August 2, 1882	$3,000
March 3, 1899	25,000
June 13, 1902	35,000
Total	63,000

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I 4.

IMPROVEMENT OF ALLOWAY CREEK, NEW JERSEY.

For the history of this improvement see Annual Report of the Chief of Engineers for 1905, Part 1, page 167.

No work has been done on this improvement during the past fiscal year. The expenditures were for outstanding liabilities and examinations.

The river and harbor act of March 3, 1905, appropriated $3,000 for continuing the improvement and for maintenance. A project for the expenditure of this appropriation in removing shoals between the "Square" and a point about 1,000 feet above upper Hancock Bridge and for dredging thence toward Quinton was duly approved and proposals invited for the work, to be opened June 21, 1905, but none were received. The advisability of doing the work either by readvertising for proposals or by day labor was under consideration at the close of the fiscal year.

Local interests in the navigation of this stream are desirous of having a cut-off made at a bend known as "Fosters Bottle." The proposed cut-off is to be about 1,200 feet long, 75 feet wide, and 6 feet deep at mean low water. Its lower end is about 7,000 feet above the mouth of the creek and the bend 7,000 feet long. It will shorten the distance to the mouth by over a mile and will remove two difficult turns and be an improvement to the stream. The estimate for the entire work will not be increased if the proposed cut-off be made, and it is understood that the necessary land—a strip 250 feet wide—will be deeded to the United States free of expense.

No contracts in force.

It is proposed to expend the appropriation recommended below, if obtained, and the available balance, if any, in dredging throughout the navigable portions of the creek and in making a cut-off at "Fosters Bottle," if such cut-off be approved.

Money statement.

July 1, 1904, balance unexpended		$297.30
Amount appropriated by river and harbor act approved March 3, 1905		3,000.00
		3,297.30
June 30, 1905, amount expended during fiscal year, for maintenance of improvement		292.74
July 1, 1905, balance unexpended		3,004.56
Amount (estimated) required for completion of existing project		5,200.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$5,200.00	
For maintenance of improvement	3,000.00	
		8,200.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

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APPROPRIATIONS.

September 19, 1890	$6,000	June 13, 1902	$3,000
July 13, 1892	3,000	March 3, 1905	3,000
August 18, 1894	3,000		
June 3, 1896	3,000	Total	24,000
March 3, 1899	3,000		

COMMERCIAL STATISTICS FOR CALENDAR YEAR ENDING DECEMBER 31, 1904.

Receipts and shipments.

Class.	Quantity.	Value.	Class.	Quantity.	Value.
Receipts:	*Tons.*		Shipments:	*Tons.*	
Coal	10,000	$30,000	Canned goods	8,750	$375,000
Sand for glass	12,000	18,000	Glassware	2,800	140,000
Oyster shells	2,500	6,250	Sawed lumber	100	3,500
Soda ash	500	10,000	Fruits, grain, wheat, poultry, etc	3,200	50,000
Tin plate	2,000	150,000	Miscellaneous	2,000	20,000
Sawed lumber	3,200	40,950			
Fertilizers, flour, etc	10,000	200,000	Total	16,850	588,500
Miscellaneous	3,300	49,500			
Total	43,500	504,700	Total receipts and shipments	60,350	1,093,200

Arrivals and departures of vessels trading in Alloway Creek, New Jersey.

Kind of vessel.	Arrivals.		Departures.	
	Number.	Tonnage.	Number.	Tonnage.
Steamers	70	10,500	70	10,500
Sailing vessels	15	2,000	15	2,000
Barges	65	1,200	65	1,200
Total	150	13,700	150	13,700

The foregoing statistics were furnished by William Plummer, jr., of the Quinton Glass Company, Quinton, N. J.

I 5.

IMPROVEMENT OF GOSHEN CREEK, NEW JERSEY.

For the history of this improvement see Annual Report of the Chief of Engineers for 1905, Part 1, page 169.

No work done on this improvement during the past fiscal year, and no further work is contemplated. The unexpended balance has been recommended to be covered into the surplus fund of the Treasury. Final report.

Money statement.

July 1, 1904, balance unexpended	$771.23
July 1, 1905, balance unexpended	771.23

APPROPRIATIONS.

July 13, 1892	$3,000
August 18, 1894	3,000
June 3, 1896	3,000
March 3, 1899	8,000
Total	17,000

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I 6.

IMPROVEMENT OF TUCKERTON CREEK, NEW JERSEY.

For the history of this improvement see the Annual Report of the Chief of Engineers for 1905, Part 1, page 170.

No dredging was done during the past fiscal year. The expenditure was for examination and contingent expenses.

The river and harbor act of March 3, 1905, provides as follows:

Improving Tuckerton Creek, New Jersey: Continuing improvement and for maintenance, twelve thousand dollars; and the Secretary of War may, in his discretion, direct that the plan heretofore adopted for this improvement may be modified: *Provided*, That the cost of completion shall not exceed the estimate heretofore made for the completion of such improvement.

In accordance with this act, and to meet the wishes of those directly interested in the improvement, the Secretary of War, under date of April 11, 1905, approved the modification of the project by extending the channel from the mouth of the creek in a south-southeast direction to deep water, at the head of Marchelder channel, in lieu of dredging to Gaunts Point. The change will give a straighter and shorter course to the inlet, and will not be more expensive than under the original project. For the expenditure of the available funds a project was approved which provided for dredging from the point where work was last suspended, abreast of Flax Island, down river to the mouth and thence by the new route toward Marchelder channel to the 6-foot depth in Little Egg Harbor, the width and depth to be made approximately 50 feet and 6 feet at mean low water, respectively.

Proposals for this dredging were opened June 19, 1905, and contract awarded to Anson J. Rider, of Tuckerton, N. J., the lowest bidder, at 15⅞ cents per cubic yard, place measurement, the work to be completed in six months. It is expected that operations under this contract will be begun shortly.

It is proposed to expend the appropriation recommended below, if provided, in addition to the available balance, if any, in dredging out the creek where shoals may have formed, and in completing the cut across the bay from the mouth of the creek to the deep water in Marchelder Channel.

Money statement.

July 1, 1904, balance unexpended	$129.42
Amount appropriated by river and harbor act approved March 3, 1905	12,000.00
	12,129.42
June 30, 1905, amount expended during fiscal year, for works of improvement	307.78
July 1, 1905, balance unexpended	11,821.64
July 1, 1905, outstanding liabilities	50.00
July 1, 1905, balance available	11,771.64
Amount (estimated) required for completion of existing project	37,380.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:	
For works of improvement $20,000.00	
For maintenance of improvement 1,000.00	
	21,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

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APPROPRIATIONS.

June 13, 1902	$12,000
March 3, 1905	12,000
Total	24,000

COMMERCIAL STATISTICS FOR CALENDAR YEAR ENDING DECEMBER 31, 1904.

Receipts and shipments.

Class.	Quantity.	Value.
Receipts:	*Tons.*	
Coal, oysters, clams, and fish	15,782	$501,400
Hay, fertilizers, building material, etc	988	13,105
Total	16,720	514,505
Shipments: Cord wood, lumber, and general merchandise	610	50,375
Total receipts and shipments	17,330	564,880

Vessels sailing and trading in Tuckerton Creek, New Jersey.

Class.	Number.	Aggregate tonnage.	Draft.	Trips.
			Feet.	
Schooners	6	240	4	At various times.
Sloops	8	160	8	Do.
Catboats	105	420	2½	Do.
Garveys	400	800	1½	Do.
Gunning and clam boats	160			Pleasure.
Launches	10	80	2½	Do.
Total	689	1,700		

One power and sail boat makes daily trips four months in the year to Beach Haven, a summer resort, carrying a general cargo of merchandise, produce, poultry, and some passengers. All boats together are worth $116,000.

One gas launch, 10 tons registered, 2 feet draft, built, and vessels of an aggregate of 350 tons repaired, during the year.

The above statistics were furnished by Benjamin H. Crosby, Tuckerton, N. J.

I 7.

IMPROVEMENT OF RACCOON CREEK, NEW JERSEY.

For the history of this improvement, see the Annual Report of the Chief of Engineers for 1905, Part 1, page 172.

No work has been done on this improvement during the past fiscal year.

The river and harbor act of March 3, 1905, appropriated $15,000 for continuing this improvement, and under date of April 11, 1905, a project for the expenditure of this appropriation was approved by the Chief of Engineers, for dredging the channel to a depth of 7 feet between the mouth and Springer's wharf, the width to be 75 feet to Bridgeport, and 60 feet thence to Springer's wharf, and above

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that point to a depth of 5 feet and a width of 40 feet. Proposals for this work were opened June 20, 1905, the Edward F. Fonder Company, of Philadelphia, Pa., being the lowest bidder, at 9½ cents per cubic yard, place measurement. At the close of the fiscal year award of contract was under consideration.

A cut-off at Molonox shoal, about 5½ miles above Bridgeport, is much desired by the local interests, and will be a valuable improvement to the stream. It will shorten the run from Swedesboro 2,950 feet, and will eliminate eight bad bends. It can be executed for about $1,000 more than would be required to dredge the channel in the bends cut off. If authorized, the present estimated cost of the improvement will not be increased thereby, and the necessary land with right of way 200 feet wide will, it is stated, be deeded, without expense, to the United States.

No contract in force.

It is proposed to expend the appropriation recommended below, if obtained, with the available balance, if any, in dredging out shoals that may have formed between Springer's bar and the mouth, in continuing work under the project from Springer's bar upstream, and in the executing of a cut-off at Molonox shoal, if such cut-off be approved.

Money statement.

July 1, 1904, balance unexpended		$3,659.69
Amount appropriated by river and harbor act approved March 3, 1905		15,000.00
		18,659.69
June 30, 1905, amount expended during fiscal year, for works of improvement		1,361.62
July 1, 1905, balance unexpended		17,298.07
Amount (estimated) required for completion of existing project		72,135.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$25,000.00	
For maintenance of improvement	2,000.00	
		27,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

APPROPRIATIONS.

August 2, 1882	$3,000
June 13, 1902	15,000
March 3, 1905	15,000
Total	33,000

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COMMERCIAL STATISTICS FOR CALENDAR YEAR ENDING DECEMBER 31, 1904.

Receipts and shipments.

Class.	Quantity.	Value.
Receipts:	*Tons.*	
Raw bone, coal, dimension stone, sand, glass, etc	22,400	$45,700
Bricks, fertilizers, lumber, etc	16,354	916,400
Agricultural products, manure, oyster shells, etc	164,245	683,650
General merchandise	2,000	200,000
Total	204,999	1,845,750
Shipments:		
Building and molding sand, barrels, baskets, etc	9,250	321,200
Fruits, vegetables, poultry, etc	35,828	1,041,850
Shad and carp and general merchandise	2,312	92,000
Total	47,390	1,455,050
Total receipts and shipments	252,389	3,300,800

Vessels sailing and trading in Raccoon Creek, New Jersey.

Class.	Number.	Aggregate tonnage.	Draft.
			Feet.
Steamers	2	600	8
Do	2	200	6
Do	10	250	4½
Do	18	144	2
Sailing vessels	5	750	7
Canal boats	12	2,400	6
Tow barges	12	2,400	6
Tugs	12	600	6
Total	73	7,344	

Two steamers make daily trips; the other vessels make trips at irregular intervals.

The foregoing statistics were furnished by Capt. John F. Truitt, Bridgeport, N. J.

I 8.

IMPROVEMENT OF WILMINGTON HARBOR, DELAWARE.

For the history of this improvement see Annual Reports of the Chief of Engineers for 1901, pages 246 to 249, and for 1905, Part 1, page 173.

At the close of the fiscal year 1904 a contract was in force with John L. Grim, of Philadelphia, Pa., for dredging, for the expenditure of $25,000 of the appropriation made by the river and harbor act of June 13, 1902. The work was begun on July 16, 1904, and after many interruptions, for which the contractor was responsible, due largely to the breaking down of his plant, it was completed May 5, 1905. A shoal extending a length of 3,400 feet between the Third Street Bridge and the Market Street Bridge was dredged to a depth of 18 feet at mean low water for a width of between 100 and

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150 feet, resulting in a channel 18 feet deep at mean low water and a width of 200 feet from the Third Street Bridge to the lower end of the Pusey & Jones yards; thence 100 feet wide to the foot of French street, and thence an average width of 200 feet to Market Street Bridge; a shoal between the mouth of the Brandywine and the Pennsylvania Railroad cut-off bridge No. 3 was dredged to a width of 200 feet to the bridge and of 100 feet through the south draw, the depth made being 20 feet at mean low water; and a shoal extending a length of about 2,500 feet between the Baltimore and Ohio Railroad bridge and the pulp works was dredged to a width of 100 feet and depth of 16 feet at mean low water. The quantity of material removed is 141,941 cubic yards, measured in place, and consisted of mud and sand. This was pumped ashore behind banks above the high-water line.

Under date of December 8, 1904, a Board of officers was convened by authority of the Secretary of War to consider the establishment of harbor lines at the harbor of Wilmington, Del. The Board met, held a public hearing regarding the matter, and concluded to have a detailed survey made, in so far as may be necessary, to express accurately on a map the positions of the harbor lines to be recommended by the Board in its report. This survey is now in progress and will be completed shortly.

The river and harbor act of March 3, 1905, provides as follows:

Improving harbor at Wilmington, Delaware: Continuing improvement and for maintenance, up to Third Street Bridge, twenty-five thousand dollars, in addition to the amounts heretofore appropriated, which are hereby made available and the restrictions upon the expenditure of which are hereby removed.

Under date of April 27, 1905, the Chief of Engineers approved a project for the expenditure of about $40,000 of the $50,000 made available by the act above quoted, the remaining $10,000 to be held for dredging on such places as may need immediate relief in 1906, and to defray the expenses of the survey for the harbor lines, estimated at about $1,800. This project provides for dredging a channel 18 feet deep, 200 feet wide, from the Third Street Bridge to the mouth of the Brandywine, and thence 250 feet wide to the Delaware River, and for repairing the north jetty at the mouth of the Christiana River, and that at the mouth of the Brandywine. After due advertisement an emergency contract, dated June 8, 1905, was made with the Franklin K. Wills Company, of Wilmington, Del., the lowest bidder, at the prices given below under the head of "Contracts in force," for the repair of the jetties. The work was begun on June 13, 1905, and by the terms of the contract is to be completed within two months from date of contract. For the dredging, proposals were opened on June 26, 1905, and at the close of the fiscal year were under consideration. It is expected that it will be completed by June 30, 1906.

It is proposed to expend the appropriation recommended below, if obtained, and the available balance to restoring the channel to the project widths and depths by dredging from the 21-foot curve in the Delaware River to Newport, Del.

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Money statement.

July 1, 1904, balance unexpended	$57,477.94
Amount appropriated by river and harbor act approved March 3, 1905	25,000.00
	82,477.94
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	24,550.95
July 1, 1905, balance unexpended	57,926.99
July 1, 1905, outstanding liabilities	8,480.00
July 1, 1905, balance available	49,446.99
July 1, 1905, amount covered by uncompleted contracts	835.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	105,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

APPROPRIATIONS.

July 14, 1836	$15,000	July 5, 1884	$25,000
March 3, 1837	8,000	August 5, 1886	18,750
July 7, 1838	9,356	August 11, 1888	30,000
July 11, 1870	15,000	September 19, 1890	30,000
June 10, 1872	10,000	July 13, 1892	40,000
March 3, 1873	6,000	August 18, 1894	25,000
June 23, 1874	6,000	June 3, 1896	20,000
March 3, 1875	10,000	July 1, 1898	205,846
August 14, 1876	16,000	March 3, 1899	45,000
June 18, 1878	7,000	June 6, 1900	200,000
March 3, 1879	3,500	June 13, 1902	50,000
June 14, 1880	10,000	March 3, 1905	25,000
March 3, 1881	50,000		
August 2, 1882	50,000	Total	930,452

NOTE.

Amount appropriated	$930,452.00	
Received from sale of river and harbor property	210.00	
		$930,662.00
Expended	870,323.79	
Turned back into Treasury, surplus funds	2,411.22	
Balance on hand July 1, 1905	57,926.99	
		930,662.00

CONTRACTS IN FORCE.

Contract of the Franklin K. Wills Company, of Wilmington, Del., dated June 8, 1905, for repairing jetties at mouths of the Brandywine and the Christiana rivers, Delaware, at the following prices for material in place, viz:

Christiana jetty.—Face logs, 12 by 12 inches, at $39 per M feet B. M.; tie logs, 9 inches diameter, 14 feet long, at 13 cents per linear foot; tie-rods, 1¼-inch iron, 14 feet long, at 6 cents per pound; wharf bolts, ⅞-inch square, 20 inches long, at 5½ cents per pound; wrought-iron spikes, ¾ by 12 inches long, at 5 cents per pound; stone filling, at $1.65 per cubic yard; white oak piles, 60 feet long, at 39 cents per linear foot; iron bands, ½ by 2 inches, at 6 cents per pound.

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Brandywine jetty.—Yellow pine wales, 6 by 12 inches, at $58 per M feet B. M.; drift bolts, ⅞ by 15 inches, at 5½ cents per pound; tie-rods, 1¼ inches by 7 feet, at 6 cents per pound; stone filling, at $1.65 per cubic yard.

Estimated cost of the repairs to these jetties, $1,315.20.

COMMERCIAL STATISTICS OF THE CITY OF WILMINGTON, DEL., FOR THE CALENDAR YEAR 1904.

The tonnage and value of the leading articles shipped to and from the port of Wilmington, by water, during the year ending December 31, 1904, are as follows:

Domestic commerce.

[Furnished by the Wilmington Board of Trade.]

Articles.	Quantity.	Value.
	Tons.	
Coal	58,000	$160,950
Cord wood	9,360	20,050
Quarry stone	8,576	250,760
Building and molding sand and cement	78,700	110,600
Ship timber	937	250,650
Fertilizers	9,500	90,900
Iron and steel supplies	80,400	1,020,650
Machinery	38,875	350,680
General merchandise	160,350	20,500,460
Miscellaneous	240,750	8,500,250
Total	679,448	31,255,354

Foreign commerce.

[Furnished by the United States collector of customs, Wilmington, Del.]

Articles.	Quantity.	Value.
Imports:	*Tons.*	
Laths	470	$8,462
Lumber	37	
Exports: Cars, railroad (knockdown)	308	78,783
Total	815	87,245
Grand total	680,263	31,343,099

[Furnished by the Wilmington Board of Trade.]

Class.	Number.	Aggregate tonnage.	Draft.
Vessels trading in Wilmington Harbor:			*Feet.*
Steamships	8	76,516	12–18
Schooners	7	5,580	10–20
Barks	4	3,041	12–16
Total	19	85,137	
Local trading in Wilmington Harbor:			
Steamers	6	2,450	8–15
Tugs	12	750	5–10
Schooners	8	850	Not known.
Barges	22	10,675	Not known.
Total	48	14,725	
Grand total	67	99,862	

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The above vessels trading in Wilmington Harbor are engaged in daily river and harbor work.

In addition, there are numerous vessels of various classes engaged in general coastwise trade, of which no record is kept. It is estimated that there passed in and out of this port in 1904, 1,200 steamers, barges, tugs, schooners, vessels, and floats with merchandise or material for repairs, not included in our regular lines.

There is invested in freight and passenger lines between Wilmington, Del., and Philadelphia, Pa., and Pennsgrove, N. J., and other points, over $1,250,000. These vessels carry annually 550,000 passengers, and freight valued at $17,250,000.

There is invested in manufacturing and mercantile interests on the Christiana River, all dependent upon the facilities of this river navigation, fully $19,000,000.

The number of foreign vessels entered during the year is 19, of a total tonnage of 19,298, and the number cleared is 17, of a total tonnage of 18,823.

Vessels built.

Class.	Number.	Aggregate tonnage.	Draft when leaving shipyard.
			Ft. in.
Steel screw steamers	2	786.00	9 2½
Wooden hull steamer	1	245.00	8 6
Do	1	500.00	10 0
Do	1	450.00	8 7
Steel tug	1	79.02	7 5½
Wooden fishing steamer	1	250.00	.....
Wooden freight barges	2	1,500.00	.....
Wooden deck lighters	3	3,600.00	.....
Wooden dumping scows	2	3,200.00	.....
Steel double-screw ferry	1	1,200.00	11 7½
Do	1	1,434.00	11 ½
Do	1	800.00	9 4½
Total	17	14,044.02	

Vessels repaired.

Class.	Number.	Aggregate tonnage.
Steamers and sailing vessels	625	53,929
Steamers	16	2,365
Sailing vessels	15	3,370
Do	6	2,300
Total	662	61,964

Vessels under construction.

One steamer, 120 feet long, 26 feet beam, 13 feet 10 inches depth, and 9 feet 6 inches draft.

One steamer, 80 feet long, 30 feet beam, 7 feet depth, and 8 feet 9 inches draft.

One steel-hull boat, 113 feet long, 24 feet beam, and 11 feet depth of hold.

Machinery for United States revenue cutter, 210 feet long, 29 feet 4 inches beam, 21 feet 9 inches depth, 1,270 tons.

Four car floats.

Three dumping scows.

One tank barge.

One dredge and snag boat, 150 feet by 28 feet by 7 feet 6 inches.

One fire tug, 93 feet by 23 feet 2 inches by 13 feet.

One boarding tug, 103 feet by 22 feet 6 inches by 12 feet 6 inches.

One passenger and freight steamer, 296 feet by 44 feet by 17 feet 9 inches.

One dry-dock caisson, 105 feet by 37 feet 9 inches by 22 feet beam.

One double-screw ferry, 192 feet by 43 feet 6 inches by 17 feet 9 inches.

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I 9.

IMPROVEMENT OF APPOQUINIMINK, MURDERKILL, AND MISPILLION RIVERS, DELAWARE.

(A) APPOQUINIMINK RIVER.

For previous history see Annual Report of the Chief of Engineers for 1905, Part 1, page 175.

At the close of the fiscal year 1904 the $4,000 allotted June 23, 1904, for this river from the appropriation made by the river and harbor act of June 13, 1902, for emergencies in river and harbor works, was available. Under date of July 9, 1904, a project for the expenditure of this allotment was approved, and, after due advertisement, an emergency contract, dated July 22, 1904, was entered into with the Houston-Rickards Dredging Company, of Philadelphia, Pa., the lowest bidders, for dredging at 15.4 cents per cubic yard, place measurement. Work under this contract was begun on August 8 and continued to September 24, 1904. During this period twenty shoals, aggregating 8,509 feet in length and of an average width of 23 feet, were dredged to a least depth of 6 feet at mean low water, and resulted in a navigable 6-foot channel from Odessa to the Delaware River. Twenty-one thousand two hundred and twenty cubic yards of material, place measurement, consisting of sand and mud, was removed and deposited upon the adjacent banks above the high-water line.

The river and harbor act of March 3, 1905, appropriated $20,000 for the Appoquinimink, Murderkill, and Mispillion rivers for continuing improvement and for maintenance. Of this amount $5,500 was allotted by the Secretary of War on April 19, 1905, for the Appoquinimink River, and on June 12, 1905, the Chief of Engineers approved a project for its expenditure in making a cut-off at New, or Fennimore's, bridge, and in dredging the channel where required, to a width of 50 feet and a depth of 7 feet at mean low water, as far as the available funds will permit. The cut-off is No. 4 in the project. As the cut-off is to cross a public highway, a conveyance of the land required has been obtained by deed of Julius C. Cleaver and wife, dated July 21, 1898, an act has been passed by the legislature of the State of Delaware, approved March 7, 1901, giving the consent of the State to the proposed cutting through or across the public road, and a resolution was passed June 6, 1905, by the levy court of Newcastle County, Del., in which it agrees to build a bridge over the cut-off, all without expense to the United States. Specifications for the proposed dredging were approved June 30, 1905, and proposals will be advertised for, and it is expected that contract will be made shortly.

No contract in force.

It is proposed to apply the funds recommended, if provided, with the balance available, to the restoration of the dredged channel, so far as practicable, to executing the projected cut-off near Fennimore's bridge and to dredging the stream in accordance with the existing project.

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Money statement.

July 1, 1904, balance unexpended		$4,214.88
Amount allotted from appropriation by river and harbor act approved March 3, 1905		5,500.00
		9,714.88
June 30, 1905, amount expended during fiscal year:		
For maintenance of improvement	$4,323.22	
June 30, 1905, returned to Treasury	3.09	
		4,326.31
July 1, 1905, balance unexpended		5,388.57
Amount (estimated) required for completion of existing project		10,463.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$10,400.00	
For maintenance of improvement	1,000.00	
		11,400.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

APPROPRIATIONS.

September 19, 1890	$5,000	June 13, 1902 (allotments)	$7,000
July 13, 1892	5,000	March 3, 1905 (allotment)	5,500
August 18, 1894	5,000		
June 3, 1896	5,000	Total	37,500
March 3, 1899	5,000		

COMMERCIAL STATISTICS FOR CALENDAR YEAR ENDING DECEMBER 31, 1904.

Receipts and shipments.

Class.	Quantity.	Value.
Receipts:	*Tons.*	
Coal	2,150	$12,900
Fertilizers	5,425	75,950
Potatoes	240	10,800
General merchandise	6,725	605,250
Total	14,540	704,900
Shipments:		
Canned goods	2,350	235,000
Agricultural products—butter, eggs, fruit, etc	10,850	812,050
Fish	265	42,400
Live stock	1,825	182,500
General merchandise	875	78,750
Total	16,165	1,350,700
Total receipts and shipments	30,705	2,055,600

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Vessels trading in Appoquinimink River, Delaware.

Class.	Number.	Aggregate tonnage.	Draft.	Remarks.
			Feet.	
Steamer	1	136	7	Triweekly 8 months and semiweekly 7 months.
Do	1	210	7	Transient.
Tugs	2			Do.
Barges	2	400	5½	Do.
Schooners	2	150	6	Do.
Total	8	896		

The above statistics were furnished by F. B. Watkins, Odessa, Del.

(B) MURDERKILL RIVER.

The previous history of this improvement is contained in the Annual Report of the Chief of Engineers for 1905, Part 1, page 177.

Under date of June 16, 1904, the Secretary of War allotted the sum of $5,500 from the appropriation of $3,000,000, contained in the emergency river and harbor act of April 28, 1904, for the restoration and maintenance of the channel at the mouth of the river, and, after due advertisement, contract, dated July 9, 1904, was made with the Wilmington Dredging Company, of Wilmington, Del., for dredging, at 15 cents per cubic yard, place measurement, and during the month of August, 1904, the channel was dredged to a width of 50 feet and a depth of 7 feet at mean low water for a length of 4,480 feet, from Sand Point into Delaware Bay. The quantity of material removed was 30,483 cubic yards, measured in place, and was thrown over on the south side, distant about 70 feet from the center of the dredged cut. The unexpended balance of the allotment, $68.33, was returned to the Treasury.

Under date of April 18, 1905, the Secretary of War allotted $5,500 from the appropriation of $20,000, made by the river and harbor act of March 3, 1905, for improving Appoquinimink, Murderkill, and Mispillion rivers, Delaware. For the expenditure of this allotment contract, dated June 27, 1905, has been made, after due advertisement, with the Houston-Rickards Dredging Company, of Philadelphia, Pa., the lowest bidder, at 9¾ cents per cubic yard, place measurement, the work to be completed in six weeks.

It is proposed to expend the appropriation recommended below, if obtained, in dredging with a view to restoring the existing dredged channel to projected width and depth, and in continuing work under the project on the navigable portion of the stream.

Money statement.

July 1, 1904, balance unexpended		$5,612.89
Amount allotted from appropriation by river and harbor act approved March 3, 1905		5,500.00
		11,112.89
June 30, 1905, amount expended during fiscal year:		
For maintenance of improvement	$5,580.64	
June 30, 1905, returned to Treasury	68.33	
		5,648.97
July 1, 1905, balance unexpended		5,463.92

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July 1, 1905, amount covered by uncompleted contracts	$4,950.00
Amount (estimated) required for completion of existing project	23,264.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:	
For works of improvement	$10,000.00
For maintenance of improvement	1,000.00
	11,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

July 13, 1892	$7,000	April 28, 1904 (allotment)	$5,500
August 18, 1894	[a]6,500	March 3, 1905 (allotment)	5,500
June 3, 1896	6,500		
March 3, 1899	5,000	Total	[a]38,000
June 13, 1902 (allotment)	2,000		

CONTRACT IN FORCE.

With the Houston-Rickards Dredging Company, of Philadelphia, Pa., for dredging, at 9¾ cents per cubic yard, place measurement; work to be commenced June 27, 1905, and to be completed about August 14, 1905.

COMMERCIAL STATISTICS FOR CALENDAR YEAR ENDING DECEMBER 31, 1904.

Receipts and shipments.

Class.	Quantity.	Value.
Receipts:	*Tons.*	
Coal	2,000	$10,000
Fertilizers and furniture	4,150	109,000
Horses, cattle, tin, etc	855	73,080
General merchandise	1,200	240,000
Total	8,205	432,080
Shipments:		
Canned goods, baskets, etc	3,750	126,250
Agricultural products—fruit, eggs, poultry, etc	9,825	287,500
General merchandise	700	140,000
Total	14,275	553,750
Total receipts and shipments	22,480	985,780

Vessels sailing and trading in Murderkill River, Delaware.

There is 1 steamer trading in the Murderkill River, Delaware, with a tonnage of 293 and draft of 6 feet. It makes two or three trips a week with general merchandise. There are also 10 to 15 sailing vessels carrying grain, etc.

One steamer and 6 sailing vessels, aggregate tonnage 493, repaired during the year.

The foregoing statistics were furnished by J. W. Townsend, secretary Frederica and Philadelphia Steamboat Company, Frederica, Del.

[a] Of this amount $1,500 was expended in removing shoal at mouth of St. Jones River.

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(c) MISPILLION RIVER.

For the history of this improvement see Annual Report of the Chief of Engineers for 1905, Part 1, page 178.

Under date of June 23, 1904, the Secretary of War allotted from the appropriation of $200,000 made by act of June 13, 1902, for emergencies in river and harbor works, the sum of $5,300 for maintenance and restoration of the channel at the mouth. For the expenditure of this allotment contracts were made, after due advertisement, with the Christiana Construction Company and the Wilmington Dredging Company, both of Wilmington, Del., and dated July 19, 1904, the former for filling in with stone a gap between the pile jetty at Sand Point and the inner end of the new jetty on the north side of the channel, at $3 per cubic yard in place, and the latter for dredging at 15.4 cents per cubic yard, place measurement. Under date of August 29, 1904, an additional allotment of $1,800 was made for necessary dredging at the mouth, and a supplemental contract, dated September 3, 1904, was made therefor at the same price.

Work under these contracts was begun on August 15 and completed October 11, 1904. Three hundred and thirteen cubic yards of stone was deposited and placed in position in the gap between the jetties, as required by the contract. A cut 40 feet wide and 6,415 feet long was dredged to a depth of 6 feet at mean low water from the 6-foot depth in the Mispillion River to the 6-foot curve in Delaware Bay, removing 31,207 cubic yards of material, place measurement, consisting of sand, gravel, and mud. The material dredged inside the river was thrown over onto Sand Point, and the remainder of the material, dredged across the flats in the bay, was thrown over along the south side of the cut about 70 feet from the center of the dredged channel. The unexpended balance of this allotment, $132.25, was returned to the Treasury.

The river and harbor act of March 3, 1905, appropriated $20,000 for improving Appoquinimink, Murderkill, and Mispillion rivers, Delaware, and of this appropriation $9,000 has been allotted for maintenance of this improvement, and proposals for the work to be done therewith have been advertised for, to be opened July 6, 1905.

It is proposed to apply the amount asked for below, if provided, in dredging throughout the navigable portions of the river where the channel has shoaled, in dredging the cut at the mouth to the projected depth, and in extending, so far as funds will permit, the dikes now constructed for maintenance of this cut.

If the modified project covered by House Document No. 102, Fifty-sixth Congress, second session, is approved by Congressional action, $50,000 could be profitably expended thereunder during the fiscal year ending June 30, 1907, in jetty construction and dredging at the mouth of the river.

No contracts in force.

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Money statement.

July 1, 1904, balance unexpended		$9,545.33
Amount allotted from appropriation by river and harbor act approved March 3, 1905		9,000.00
Amount allotted from appropriation for maintenance of river and harbor improvements, act of April 28, 1904		1,800.00
		20,345.33
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	$11,233.44	
June 30, 1905, returned to Treasury	132.25	
		11,365.69
July 1, 1905, balance unexpended		8,979.64
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$20,000.00	
For maintenance of improvement	2,500.00	
		22,500.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

APPROPRIATIONS.

Previous projects.

March 3, 1879	$3,000	
June 14, 1880	4,000	
March 3, 1881	3,500	
August 2, 1882	3,000	
August 11, 1888	3,500	
		$17,000

Project of 1891.

July 13, 1892	$12,000	
August 18, 1894	10,000	
March 3, 1899	2,500	
June 6, 1900 (allotment)	1,050	
June 13, 1902 (allotments)	15,300	
April 28, 1904 (allotment)	1,800	
March 3, 1905 (allotment)	9,000	
		51,650
Total		68,650

NOTE.

Expended to June 30, 1905	$59,510.43
June 30, 1902, redeposited to credit of appropriation for emergencies in river and harbor work, act June 6, 1900	27.68
June 30, 1905, redeposited to credit of appropriation for emergencies in river and harbor work, act June 3, 1902	132.25
July 1, 1905, balance on hand	8,979.64
Total	68,650.00

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COMMERCIAL STATISTICS FOR CALENDAR YEAR ENDING DECEMBER 31, 1904.

Receipts and shipments.

Class.	Quantity.	Value.
Receipts:	*Tons.*	
Coal, stone, railroad ties, piling, etc	37,500	$218,300
Bricks, fertilizers, flour, etc	69,200	1,787,000
Agricultural products, eggs, fruit, etc	26,300	627,000
General merchandise	10,000	1,000,000
Total	143,000	3,632,300
Shipments:		
Logs, railroad ties, ship timber	14,500	155,000
Canned goods	7,500	200,000
Agricultural products, grain, poultry, cattle, etc	22,065	550,000
Total	44,065	905,000
Total receipts and shipments	187,065	4,537,300

Vessels sailing and trading in Mispillion River, Delaware.

Class.	Number.	Aggregate tonnage.	Draft.	Remarks.
			Feet.	
Steamers	2	320	5½	Semiweekly.
Schooners	9	815	5-5½	Weekly.
Sloop	1	30	5	Do.
Total	12	1,165		

Also sundry other barges and vessels of which no record has been kept.

Six vessels of a total tonnage of 1,728 built and 3 vessels of a tonnage of 205 repaired during the year.

The foregoing statistics were furnished by J. Stanley Short, of Milford, Del.

I 10.

IMPROVEMENT OF SAINT JONES RIVER, DELAWARE.

For history of this improvement, see the Annual Report of the Chief of Engineers for 1905, Part 1, page 181.

Under date of June 23, 1904, the Secretary of War allotted the sum of $4,500 from the appropriation made by the act of June 13, 1902, for emergencies in river and harbor works to the restoration and maintenance of the channel. After due advertisement a contract, dated July 20, 1904, was made with the Wilmington Dredging Company, of Wilmington, Del., for dredging at 14 cents per cubic yard, place measurement. Work thereunder was begun on September 12 and completed November 10, 1904. Shoals at and just below Lebanon, below Horseshoe Cut-off, and at White Stone reach and Barkers Landing, an aggregate length of 5,135 feet, were removed, and at the mouth the channel was dredged from inside the river across the flats to the 6-foot contour in Delaware Bay, a length of 3,650 feet, the width and depth made in these operations being 40 and 6 feet at mean

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low water, respectively. The quantity of material dredged was 26,615 cubic yards, measured in place, and consisted of mud, compact sand, and gravel.

It is proposed to expend the appropriation recommended below, if obtained, in dredging with a view to restoring, so far as possible, the projected channel depth throughout the navigable portions of the river.

Money statement.

July 1, 1904, balance unexpended		$4,500.00
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	$4,495.01	
June 30, 1905, returned to Treasury	4.99	
		4,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement		5,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

APPROPRIATIONS.

March 3, 1881	$5,000	June 6, 1900 (allotment)	[a]$3,500
July 5, 1884	10,000	June 13, 1902 (allotment)	[a]4,500
August 5, 1886	10,000		
August 11, 1888	15,000	Total	[a]49,500
August 18, 1894	1,500		

COMMERCIAL STATISTICS FOR CALENDAR YEAR ENDING DECEMBER 31, 1904.

Receipts and shipments.

Class.	Quantity.	Value.
Receipts:	*Tons.*	
Raw bone, coal, phosphate rock, pig tin, etc	9,692	$178,975
Chemicals, fertilizers, flour, lumber, etc	9,056	519,208
Fruits, cattle, hogs, sheep, etc	1,959	171,280
General merchandise	8,000	1,520,000
Total	28,707	2,389,463
Shipments:		
Railroad ties, ship timber, fish (sturgeon) caviar, etc	2,506	98,081
Barrels, baskets, canned goods, etc	11,821	596,325
Grain, hay, poultry, sheep, horses, etc	36,076	1,199,625
General merchandise	2,500	375,000
Total	52,903	2,268,981
Total receipts and shipments	81,610	4,658,444

[a] Of the above sums, $558.26 was returned to the Treasury.

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Vessels trading in St. Jones River, Delaware.

Class.	Number.	Aggregate tonnage.	Draft.	Remarks.
			Feet.	
Steamer	1	200	6½	Triweekly.
Do	1	150	6	Occasionally.
Do	1	100	5½	Do.
Do	1	75	5	Triweekly.
Do	1	100	6	Occasionally.
Schooners	33	1,956	4–6	At various intervals, carrying grain, coal, oysters, fish, and general freight.
Sloops	15	452	4–6	
Tugs and naphtha launches.	.....	260	5½–6	
		3,293		

The above statistics were furnished by the Lebanon Navigation Company, of Lebanon, Del.

I 11.

IMPROVEMENT OF SMYRNA RIVER, DELAWARE.

For previous history, see Annual Report of the Chief of Engineers for 1905, Part 1, page 182.

For the expenditure of the allotment of $6,000 made by the Secretary of War under date of June 25, 1904, for the restoration of the channel across the bar at the mouth from the appropriation for emergencies and contingencies in the river and harbor act of June 13, 1902, contract dated July 15, 1904, was made, after due advertisement, with Edward F. Fonder, of Philadelphia, Pa., for dredging, at 14½ cents per cubic yard, place measurement, and work under the contract was begun on August 3 and completed November 11, 1904. During this period the channel was dredged to a width of 50 feet and a depth of 6 feet at mean low water from the 6-foot curve just inside the mouth of Smyrna River across the flats to the 6-foot curve in Delaware Bay. No work was done in the river above the mouth, as the allotment had not provided for it. The unexpended balance, $3,571.58, was therefore returned to the Treasury.

The river and harbor act of March 3, 1905, appropriated $5,365 for completing improvement and maintenance, and empowered the Secretary of War to modify the plans for the cut-offs provided for in the appropriation of $15,000 made by the river and harbor act of June 13, 1902. The modification referred to was the substitution for the proposed lower cut-off of a cut from the mouth of Mill Creek to the bend above Brick Store Landing. This modification was authorized by the Secretary of War under date of April 11, 1905, and the title to the necessary land for this cut and the upper one, from the turn just below Limekiln wharf to the turn just above Mill Creek, having been secured without expense to the United States, a project for the expenditure of the available funds was approved by the Department under date of April 14, 1905.

After due advertisement, a contract dated June 15, 1905, was entered into with the River and Harbor Improvement Company, of Philadelphia, Pa., the lowest bidder, for dredging, at 10 cents per cubic yard, place measurement, the work to be completed within six

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months. Work on this contract was begun on June 20 on the lower and upper ends of the proposed cut-off above Brick Store Landing, and to the end of the month two cuts 60 feet wide were dredged, one 7 feet deep for a length of 65 feet, and the other 4 feet deep for a length of 745 feet; and an additional cut 30 feet wide was made 4 feet deep for a length of 100 feet, removing 11,978 cubic yards of material, measured in place. This consisted of mud at the approaches to the cut and vegetable matter through it. It was deposited upon the adjacent marsh at least 12 feet from the edge of the cut, as required by the specifications.

It is proposed to expend the appropriation recommended below, if obtained, in dredging with a view to restoring, so far as possible, the projected channel depth in the navigable portion of the river.

Money statement.

July 1, 1904, balance unexpended		$21,016.07
Amount appropriated by river and harbor act approved March 3, 1905		5,365.00
		26,381.07
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	$2,565.85	
June 30, 1905, returned to Treasury	3,571.58	
		6,137.43
July 1, 1905, balance unexpended		20,243.64
July 1, 1905, outstanding liabilities		1,200.00
July 1, 1905, balance available		19,043.64
July 1, 1905, amount covered by uncompleted contracts		17,100.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905		3,500.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

APPROPRIATIONS.

Project of 1878.

June 14, 1880	$5,000	
March 3, 1881	3,000	
August 2, 1882	2,000	
		$10,000

Project of 1887.

August 11, 1888	$10,000	
September 19, 1890	5,000	
July 13, 1892	3,000	
August 18, 1894	5,000	
June 3, 1896	5,000	
March 3, 1899	5,000	
June 13, 1902	15,000	
June 13, 1902 (allotment)	6,000	
March 3, 1905	5,365	
		59,365
Total		69,365

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CONTRACT IN FORCE.

Contract dated June 15, 1905, with the River and Harbor Improvement Company, of Philadelphia, Pa., for dredging, at 10 cents per cubic yard, place measurement, the work to be commenced by June 25, 1905, and to be completed by December 25, 1905.

COMMERCIAL STATISTICS FOR CALENDAR YEAR ENDING DECEMBER 31, 1904.

Receipts and shipments.

Class.	Quantity.	Value.
Receipts:	*Tons.*	
Raw bone, iron ore, phosphate rock, etc	7,410	$91,450
Canned goods, flour, millwork, etc	509,540	2,247,000
Agricultural products—fruit, grain, etc	52,249	495,000
General merchandise	10,000	400,000
Total	579,199	3,234,450
Shipments:		
Railroad ties, timber, etc	76,520	209,000
Canned goods, flour, millwork, etc	133,270	816,000
Fruit, grain, cattle, poultry, etc	27,100	1,422,750
Wool and fur	2	1,250
General merchandise	12,000	480,000
Total	248,892	2,929,000
Total receipts and shipments	828,091	6,163,450

Vessels trading in Smyrna River, Delaware.

Class.	Number.	Aggregate tonnage.	Draft.	Trips.
			Feet.	
Steamer	1	234	6	Daily three months and triweekly nine months.
Do	1	100	6	Daily three months and irregularly nine months.
Gasoline	1	50	6	Irregularly.
Do	1	200	6	Do.
Total	4	584		

Also numerous other vessels, tugs, barges, floats, schooners, etc., carrying coal; bricks, timber, railroad ties, and other freight.

The above statistics were furnished by A. E. Jardine, secretary Philadelphia and Smyrna Transportation Company.

I 12.

IMPROVEMENT OF INLAND WATERWAY FROM CHINCOTEAGUE BAY, VIRGINIA, TO DELAWARE BAY, AT OR NEAR LEWES, DELAWARE.

For the history of this improvement and of work done see Annual Reports of the Chief of Engineers for 1885, pages 891 to 914; 1892, pages 956 to 965, and 1905, Part 1, page 184.

No work was done on the improvement during the last fiscal year. The expenditures during the fiscal year were for examinations and contingent expenses.

The amount expended on the improvement to June 30, 1905, is $193,742.30, of which $25,330.42 was for maintenance.

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No statistics as to commerce have been obtained. A small steamer plies between the railroad crossing at Rehoboth and Bethany Beach.

By section 7 of the river and harbor act of March 3, 1905, the provisions of river and harbor acts heretofore passed providing for the prosecution of work on this project are repealed and the amount remaining unexpended is required to be paid into the Treasury of the United States. Accordingly, the unexpended balance, $7.70, has been returned to the Treasury. By section 9 of the same act an examination is directed to be made of the artificial channels constructed in connection with this project with a view to ascertaining whether any bridge or bridges should be constructed over such artificial channels. At the close of the fiscal year the examination was in progress.

Money statement.

June 1, 1904, balance unexpended	$156.40
June 30, 1905, amount expended during the fiscal year, for maintenance of improvement	148.70
June 30, 1905, balance covered into the Treasury in accordance with section 7 of river and harbor act of March 3, 1905	7.70

APPROPRIATIONS.

August 5, 1886	$18,750	August 18, 1894	$25,000
August 11, 1888	50,000	June 3, 1896	25,000
September 19, 1890	50,000		
July 13, 1892	25,000	Total	193,750

I 13.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

Wreck of scow lying sunk in the channel of the Mispillion River, Delaware, near its mouth.—At the close of the fiscal year 1904 proposals had been invited for the removal of this wreck, for which an allotment of $300 had been made. They were opened July 2, 1904, and contract dated July 5, 1904, was made with John S. Short, of Milford, Del., the lowest bidder. The wreck was 40 feet long, 20 feet beam, and about 5 feet deep. It was raised by the contractor on July 8, 1904, and placed ashore above high water, and then broken up for use as firewood. The cost, including inspection, etc., was $180.58. The unexpended balance, $119.42, was returned to the Treasury.

Sloop Constitution, lying sunk in Maurice River, New Jersey.—Measures for the removal of this wreck were in progress at the close of the fiscal year 1904. An allotment of $350 had been made for the work. This was subsequently increased to $450, and after due advertisement contract, dated July 11, 1904, was made with Van Sant & Boehm, of Atlantic City, N. J., the lowest bidders, for the removal of the wreck. Work thereunder was begun on July 20 and completed July 27, 1904. The wreck was blown up with dynamite. The small

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pieces were gathered up by boats waiting to get them for firewood, and the keel, crossbeams, and other heavy pieces were placed upon a scow and landed upon the steamboat wharf at Bivalve, N. J., thence to be hauled away. The obstruction was entirely removed at a total cost, including inspection, etc., of $419.51. The unexpended balance, $30.49, was returned to the Treasury.

Steamer Mary U. Githens, lying sunk in St. Jones River, Delaware.—At the close of the fiscal year 1904 about two-thirds of the wreck had been removed under a contract made with G. M. Van Sant, of Atlantic City, N. J. The work was continued, and completed on July 8, 1904. The wreck was broken up and the parts placed ashore above the high-water line. The entire cost, including inspection, etc., was $478.99. The unexpended balance, $521.01, was returned to the Treasury.

Coal barge Carrie, lying sunk at entrance to Little Egg Harbor Bay, New Jersey.—This vessel, loaded with coal, was wrecked in April, 1904. The names of the owners of the vessel and cargo could not be ascertained, but it was learned that the vessel had been surrendered to the British Lloyds Insurance Company. At the close of the fiscal year 1904 measures were in progress looking to the removal of the wreck and cargo, and by advertisement, dated July 16, 1904, proposals were invited for their removal by the Government, if not previously removed by the owners. The proposals were opened August 20, and as the wreck and its contents had not been removed, contract, dated August 30, 1904, was entered into with Van Sant & Boehm, of Atlantic City, N. J., the lowest bidders, for their removal by this Department. Work under the contract was begun on September 2. The wreck was broken up with dynamite, and on September 16, 1904, it had been entirely removed. An examination of the site, which had previously been marked by buoys, was then made by careful sounding and sweeping, extending the examination for some distance in all directions, and it was found to be free from any obstruction. The soundings showed a depth of 18 feet at mean low water, which was about the normal depth in that locality. The cost, including inspection, etc., was $1,630.69. The unexpended balance, $1,369.31, was returned to the Treasury.

Wreck of schooner Rebecca M. Smith, lying on the outer shoal of Little Egg Harbor Inlet, New Jersey.—An examination of the wreck was made on August 10, 1904. It was found to be a three-masted schooner, 116 feet long, loaded with granite blocks. It had grounded on the night of August 5, 1904, and was lying on the south side of the channel in 8 feet of water. An allotment of $3,000 was made for its removal and, after due advertisement, contract, dated September 9, 1904, was made with Van Sant & Boehm, of Atlantic City, N. J., the lowest bidders, for the work. Operations were carried on from September 16 to September 28. The wreck was broken to pieces with dynamite. The bowsprit was towed to Atlantic City, and the remainder of the wreckage, which was well broken up, drifted ashore and was taken away for firewood. The usual examination by sounding and sweeping was made and no obstruction found. The soundings showed a depth of 14 feet where the wreck had been, and for a distance of 100 yards beyond, in all directions, the least depth found was 13 feet at mean low water. The entire cost of the work, including inspection, etc., was $1,161.22. As but $1,200

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was drawn from the Treasury for this work, the unexpended balance was $38.78, and this was returned to the Treasury.

Wrecks of steamer Ranald and schooners Rival and A. L. Lee, reported to be lying sunk off Absecon Inlet, New Jersey.—By a petition to the Secretary of War, dated January 31, 1905, received at the War Department February 21, 1905, it was represented that the wrecks of the steamship *Ranald*, the schooner *Rival*, and the schooner *A. L. Lee* were obstructing navigation to the channel of Absecon Inlet, N. J. An allotment of $50 was made for an examination. This examination was made on March 29, 1905, and disclosed the following:

The steamship *Ranald* foundered in this vicinity in 1901 and, pending arrangements for its removal, it settled into the sand to such an extent that operations for its removal were abandoned, the least depth over it at that time being 16 feet, and not in the course generally taken by coastwise vessels. No trace of it was found upon this examination.

The schooner *Rival* went ashore and sank on the lower, or south, end of Brigantine Beach on April 8, 1904. Its length was 82 feet and 2 inches; tonnage, 122; and cargo, 50 barrels of mackerel. No trace of the wreck could be found upon this examination. It had entirely disappeared.

The schooner *A. L. Lee* was sunk in the south channel of the entrance to Absecon Inlet on December 10, 1902. Its length was 83 feet, tonnage 87, and its cargo brick. The wreck was found lying in the inner side of the channel between the Heinz Pier and the Steel Pier, about 800 feet from the shore, in 8 feet of water, and a dangerous obstruction to navigation. An allotment of $1,500 was made for the removal of this wreck, and, after due advertisement, contract, dated May 11, 1905, was made with Charles T. Johnston, of Lewes, Del., the lowest bidder, for the work. Operations under this contract were begun on June 3, but owing to unfavorable winds and high seas breaking over the wreck it could not be reached until June 22, when it was blown up with dynamite. On the following day a small portion of it was found remaining, and that likewise was broken up with dynamite and removed. The usual examination disclosed no obstruction on the site or in its vicinity, the clear depth found being from 10 to 13 feet. The entire cost of removal, including the examination and inspection, etc., was $616.45. The unexpended balance, $933.55, will be returned to the Treasury.

Wreck of schooner Ann Virginia, sunk in Cohansey River, New Jersey.—An examination of this wreck was made on April 23, 1905. It was found to be a small, old wooden schooner, sunk in November, 1904, and lying in 30 feet of water on the easterly side of the channel, about 3 miles above the mouth of the river. Its length was 46 feet and gross tonnage 29.34. The masts were broken off above the deck and floating, but still attached to the hull by the rigging. There was about 18 feet of water over the wreck where it lay. As in that position it might form a bar and was also liable to move into shallow water and then prove a serious obstruction, an allotment was made for its removal. After due advertisement contract, dated June 1, 1905, was made with G. M. Van Sant, of Atlantic City, N. J., the lowest bidder. The wreck was broken up with dynamite into small fragments, which floated away with the tide. The masts were

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removed and placed ashore. Upon the completion of the operations, June 13, 1905, an examination was made by sounding and sweeping without meeting any trace of the obstruction, and the depth was found to be from 28 to 30 feet at mean low water. The entire cost, including examination, inspection, etc., was $343.07. The unexpended balance, $56.93, will be returned to the Treasury.

Wreck of schooner Mary, sunk in St. Jones River, Delaware.—An examination of this wreck was made on June 9, 1905. It is a wooden vessel, 42 feet long, built in 1884, and was sunk in May, 1905. It lies on the east side of the river, on the edge of the channel, about one-half mile above Trunk ditch, where it is quite narrow and obstructs navigation. An allotment of $400 has been made for its removal, and proposals are advertised to be opened July 17, 1905, for the work.

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APPENDIX J.

IMPROVEMENT OF PATAPSCO RIVER AND BALTIMORE HARBOR, MARYLAND, AND OF RIVERS AND HARBORS IN MARYLAND ON THE EASTERN SHORE OF CHESAPEAKE BAY, OF NANTICOKE RIVER, MARYLAND AND DELAWARE, AND OF BROAD CREEK RIVER, DELAWARE.

REPORT OF LIEUT. COL. R. L. HOXIE, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1905, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Patapsco River and channel to Baltimore, Maryland.
2. Channel to Curtis Bay, in Patapsco River, Baltimore Harbor, Maryland.
3. Harbor of Southwest Baltimore (Spring Garden), Maryland.
4. Elk River, Maryland.
5. Susquehanna River above and below Havre de Grace, Maryland.
6. Harbors at Rockhall, Queenstown, Claiborne, and Cambridge, and Chester, Choptank, Warwick, Pocomoke, La Trappe, and Manokin rivers, and Tyaskin Creek, Maryland.
7. Nanticoke River, Delaware and Maryland.
8. Broad Creek River, Delaware.
9. Wicomico River, Maryland.
10. Removing sunken vessels or craft obstructing or endangering navigation.

UNITED STATES ENGINEER OFFICE,
Baltimore, Md., July 17, 1905.

GENERAL: I have the honor to forward herewith the annual reports for the year ended June 30, 1905, for the works of improvement of rivers and harbors in my charge.

Very respectfully, your obedient servant,

R. L. HOXIE,
Lieut. Col., Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

J 1.

IMPROVEMENT OF PATAPSCO RIVER AND CHANNEL TO BALTIMORE, MARYLAND.

During the fiscal year operations have been confined to examinations for maintenance of the 30-foot channel. Soundings were taken

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from time to time, which indicated that very little if any shoaling had taken place, and no dredging was required or done. Examinations were also made with a view to determining upon a location for deposit of material to be dredged under the 35-foot project authorized in the river and harbor act of March 3, 1905. At the close of the fiscal year proposals had been received for doing all the work authorized under the law, and were in process of investigation with a view to entering into continuing contracts.

It is proposed to apply available balances and the additional appropriation recommended to deepening the existing channel to 35 feet for such width, not exceeding 600 feet at bottom, as the funds permit, and to dredging a channel through the shoals in Chesapeake Bay off York Spit to equal dimensions.

Money statement.

July 1, 1904, balance unexpended		$25,732.48
Amount appropriated by river and harbor act approved March 3, 1905		250,000.00
		275,732.48
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$732.48	
For maintenance of improvement	5,239.48	
		5,971.96
July 1, 1905, balance unexpended		269,760.52
July 1, 1905, outstanding liabilities		2,975.77
July 1, 1905, balance available		266,784.75
Amount (estimated) required for completion of existing project		3,215,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905		500,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.		

The following are the amounts and dates of appropriations for improving harbor at Baltimore, Md., including Patapsco River and Chesapeake Bay:

August 30, 1852	$20,000	August 2, 1882	$450,000
August 15, 1856	100,000	July 5, 1884	250,000
June 28, 1864	20,000	August 5, 1886	150,000
June 23, 1866	5,200	August 11, 1888	300,000
March 3, 1867	75,000	September 19, 1890	340,000
July 25, 1868	17,000	March 3, 1891	151,200
April 10, 1869	26,730	August 5, 1892	208,000
July 11, 1870	42,900	August 18, 1894	50,000
March 3, 1871	50,000	June 3, 1896	400,000
June 10, 1872	100,000	June 3, 1896	50,000
March 3, 1873	200,000	March 3, 1899	200,000
June 23, 1874	75,000	June 6, 1900	324,648
March 3, 1875	75,000	March 3, 1901	475,352
August 14, 1876	75,000	June 13, 1902	25,000
June 18, 1878	75,000	March 3, 1905	250,000
March 3, 1879	160,000		
June 14, 1880	100,000	Total	4,991,030
March 3, 1881	150,000		

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CONTRACT IN FORCE.

Emergency contract with the General Electric Company for an electric plant for the U. S. S. *Sentinel*, dated October 31, 1904; date of commencement, November 21, 1904, and completed May 31, 1905.

COMMERCIAL STATISTICS FOR FISCAL YEAR ENDED JUNE 30, 1905.

Imports.

Year.	Free.	Dutiable.	Total.
1904	$11,041,065	$9,287,734	$20,328,799
1905	12,488,992	8,692,247	21,181,239
Increase (+) or decrease (−)	+1,447,927	−595,487	+852,440

Imports in American vessels, 1905:	
Sailing	$1,395,125
Steam	368,957
Imports in foreign vessels, 1905:	
Sailing	764,240
Steam	18,583,215
Imports in cars overland	69,702
Total	21,181,239

Domestic exports.

In American vessels, 1905:	
Sailing	$97,973
Steam	75,601
In foreign vessels, 1905:	
Sailing	106,125
Steam	90,893,189
Total	91,172,888

Principal articles exported.

Articles.	Quantity.	Articles.	Quantity.
	Tons.		*Tons.*
Cattle	41,961	Beef products	3,924
Grain	249,376	Pork products	17,647
Flour	66,883	Lard	56,497
Coal	266,109	Oleomargarine	12,863
Copper	77,980	Starch	910
Cotton, unmanufactured	39,532	Rosin	11,895
Glucose	4,461	Tobacco	49,044
Iron and steel	272,421	Oils	120,009
Oil cake	85,611	Wood, and manufactures of	88,166

Amount of duties collected in 1905	$3,108,022.86
Miscellaneous customs receipts in 1905	206,256.88
Total receipts in 1905	3,314,279.74
Duties on merchandise in bond in 1905	84,402.48

Summary of duties collected in 1905.

Imports and miscellaneous customs receipts	$3,314,279.74
Merchandise in bond	84,402.48
Merchandise transported with appraisement	3,246.21
Total	3,401,928.43

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Statistical recapitulation.

Dutiable imports have decreased	$595,487.00
Free imports have increased	$1,447,927.00
Domestic exports have increased	$8,352,012.00
Tonnage, foreign, has decreased—tons	55,027
Duties collected have decreased	$31,136.45
Duties on merchandise in bond have decreased	$12,238.94
Duties on merchandise in bond with and without appraisement have decreased	$29,272.25

Tonnage movement, year ended June 30, 1905.

	1903–4.		1904–5.		Increase (+) or decrease (−).
	Number.	Tons.	Number.	Tons.	
Foreign trade:					*Per cent.*
Entered	672	1,246,718	718	1,224,007	−2
Cleared	674	1,280,274	689	1,247,958	−2
Coastwise trade:					
Entered	1,509	2,155,481	1,555	2,312,891	+7
Cleared	2,140	2,651,778	2,075	2,726,362	+3

Passengers.

Alien passengers:	
1903–4	56,372
1904–5	63,002

Vessels built, 1904–5.

Class.	Number.	Tons.	Value.
Steam	16	4,949	$742,300
Sail	4	2,065	47,000
Barges	6	2,217	123,500
Total	26	9,231	912,800

Steamship lines.

Line.	Number of ships.	Tonnage.	Destination.
Hamburg American	13	54,494	Hamburg.
Atlantic Transport	9	51,021	London.
Lord	10	25,145	Belfast, Cardiff, Dublin.
Earn	5	8,357	West Indies, South America, Central America, Mexico, and Europe.
North German Lloyd	12	92,638	Bremen.
Atlantic Fruit Co	15	8,992	Cuba and Jamaica.
Johnston	6	28,184	Liverpool.
Donaldson	11	32,990	Glasgow.
Puritan	8	7,355	Antwerp.
Neptune	9	20,475	Rotterdam.
Deutsch-American Petroleum Gesellschaft.	10	19,158	German ports.
American Petroleum Co	7	13,512	Various.
Scandinavian-American	2	8,945	Copenhagen and Christiania.
Creole	12	31,338	Mediterranean ports.
Spanish-American Iron Co	7	32,150	Daiquiri, Cuba.
Munson	7	13,089	Mexico and Cuba.
Huelva	9	15,621	Huelva, Spain.
United Fruit Co	10	5,782	Jamaica.

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Lines reducing the number of vessels:	
Lord Line	3
Puritan Line	3
Total	6
Lines discontinued:	
Blue Cross	3
Mexican Lloyd Trading and Transport Company	2
Total	5
Total loss	11
Lines adding to the number of vessels:	
Atlantic Fruit Company	8
Hamburg American	1
Atlantic Transport	5
North German Lloyd	2
United Fruit Company	4
Donaldson	6
Neptune	2
Total gain	28
Net total gain	17

J 2.

IMPROVEMENT OF CHANNEL TO CURTIS BAY, IN PATAPSCO RIVER, BALTIMORE HARBOR, MARYLAND.

No dredging was done during the fiscal year. Examinations were made with a view to maintenance, which developed the fact that the channel had not deteriorated. It is proposed to expend the available funds in maintenance when such work is required.

Money statement.

July 1, 1904, balance unexpended	$6,215.98
June 30, 1905, amount expended during fiscal year, for works of improvement	2,666.30
July 1, 1905, balance unexpended	3,549.68

The following are the amounts and dates of appropriations for improving channel to Curtis Bay, in Patapsco River, Baltimore Harbor, Maryland:

July 13, 1892	$28,000
August 18, 1894	12,000
June 13, 1902	50,000
March 3, 1903	146,000
Total	236,000

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COMMERCIAL STATISTICS.

The statistics of the port of Baltimore include this harbor.

J 3.

IMPROVEMENT OF HARBOR OF SOUTHWEST BALTIMORE (SPRING GARDEN), MARYLAND.

Dredging was continued during the fiscal year until April 4, 1905, when the project was completed. During the fiscal year 608,621 cubic yards of material were removed, at a unit of cost of 12½ cents. The total quantity removed under the contract was 2,321,418 cubic yards.

Money statement.

July 1, 1904, balance unexpended	$110,389.40
June 30, 1905, amount expended during fiscal year, for works of improvement	110,389.40

The following are the amounts and dates of appropriations for improving harbor of Southwest Baltimore (Spring Garden), Md.:

June 23, 1896	$5,000
June 13, 1902	88,000
March 3, 1903	221,000
Total	314,000

CONTRACT IN FORCE.

Continuous contract with the Maryland Dredging and Contracting Company for dredging an estimated quantity of 2,288,000 cubic yards of material, at 12½ cents per cubic yard, approved November 3, 1902; date of commencement December 6, 1902, and of expiration December 6, 1905.

COMMERCIAL STATISTICS.

The statistics of the port of Baltimore include this harbor.

J 4.

IMPROVEMENT OF ELK RIVER, MARYLAND.

No field work was done in the fiscal year.

It is proposed to apply the available balance and additional appropriation recommended to maintenance of the channel dredged under the approved project.

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Money statement.

July 1, 1904, balance unexpended	$1,567.87
Amount appropriated by river and harbor act approved March 3, 1905	2,000.00
	3,567.87
June 30, 1905, amount expended during fiscal year, for works of improvement	1,567.87
July 1, 1905, balance unexpended	2,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	2,500.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

APPROPRIATIONS.

June 23, 1874	$5,000	July 13, 1892	$5,000
March 3, 1875	5,000	June 13, 1902	16,665
June 14, 1880	10,000	March 3, 1905	2,000
March 3, 1881	5,000		
August 2, 1882	6,500	Total	65,165
September 19, 1890	10,000		

COMMERCIAL STATISTICS FOR FISCAL YEAR ENDED JUNE 30, 1905.

Only partial commercial statistics could be obtained, and these showed a tonnage of 2,686, valued at $35,769.64.

J 5.

IMPROVEMENT OF SUSQUEHANNA RIVER ABOVE AND BELOW HAVRE DE GRACE, MARYLAND.

During the fiscal year dredging was continued under contract, and 64,716 cubic yards of material were removed under it to August 10, 1904, when the contract was completed. The whole amount removed under the contract was 84,667 cubic yards, at a unit cost of 14.4 cents. Most of the shoal opposite Watson Island was removed, and a shoal in the channel, commencing about 4,000 feet below Havre de Grace, was partially removed.

Proposals for dredging to expend the balance available at the close of the fiscal year are being canvassed with a view to making a contract for removing the balance of the shoal opposite Watson Island and the remainder of a shoal in the channel about 4,000 feet below Havre de Grace.

It is proposed to apply the additional appropriation recommended to dredging shoals in the channel below Havre de Grace, where there is but 11 feet depth at mean low water.

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Money statement.

July 1, 1904, balance unexpended	$17,241.49
Amount appropriated by river and harbor act approved March 3, 1905	10,000.00
	27,241.49
June 30, 1905, amount expended during fiscal year, for works of improvement	17,241.49
July 1, 1905, balance unexpended	10,000.00
Amount (estimated) required for completion of existing project	74,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	20,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

APPROPRIATIONS.

August 30, 1852	$10,000	
June 23, 1866	26,400	
July 25, 1868 (allotment)	5,000	
April 10, 1869 (allotment)	990	
July 11, 1870	12,000	
June 14, 1880	28,000	
March 3, 1881	15,000	
		$97,390
August 2, 1882	25,000	
July 5, 1884	20,000	
August 5, 1886	6,000	
August 11, 1888	10,000	
September 19, 1890	4,000	
July 13, 1892	4,000	
1879, allotment from general appropriation for examinations and surveys	500	
August 18, 1894	4,000	
June 13, 1902	10,000	
March 3, 1905	10,000	
		93,500
Aggregate		190,890

CONTRACT IN FORCE.

Contract with the Maryland Dredging and Contracting Company for dredging an estimated quantity of 83,203 cubic yards of material, at 14.4 cents per cubic yard, approved May 11, 1904; date of commencement June 1, 1904, and of expiration October 1, 1904.

COMMERCIAL STATISTICS.

It is reported that 509 steamers, 131 sailing vessels, and 304 barges carried 143,212 tons of freight in the calendar year ending December 31, 1903. Much business was also done by vessels trading transiently on the river, the statistics of which can not be obtained. No statistics could be had later.

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J 6.

IMPROVEMENT OF HARBORS AT ROCKHALL, QUEENSTOWN, CLAIBORNE, AND CAMBRIDGE; AND CHESTER, CHOPTANK, WARWICK, POCOMOKE, LA TRAPPE, AND MANOKIN RIVERS AND TYASKIN (WETIPQUIN) CREEK, MARYLAND.

(A) ROCKHALL HARBOR AND INNER HARBOR AT ROCKHALL.

No dredging was done in the fiscal year.

Proposals for dredging to expend the funds available are invited by advertisement at the close of the fiscal year. With the money it is proposed to dredge to the project depth and width from Swan Creek Inlet to the wharf at Rockhall and to expend any balance that may remain in dredging a portion of the project channel across Swan Point Bar.

It is proposed to apply the additional appropriation recommended in dredging under the existing project to complete the channel in the inner harbor, if anything remains to be done there, and to completing the channel of the project across Swan Point Bar.

Money statement.

July 1, 1904, balance unexpended	$928.45
Amount appropriated by river and harbor act approved March 3, 1905	12,829.35
	13,757.80
June 30, 1905, amount expended during fiscal year, for works of improvement	925.57
July 1, 1905, balance unexpended	12,832.23
Amount (estimated) required for completion of existing project	18,235.65
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	18,235.65

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

APPROPRIATIONS.

June 3, 1896	$16,600.00
June 13, 1902 (allotment)	12,000.00
March 3, 1905 (allotment)	12,829.35
Total	41,429.35

COMMERCIAL STATISTICS.

These were asked for, but not obtained.

(B) QUEENSTOWN HARBOR.

No dredging was done in the fiscal year.

Proposals for dredging to expend the funds available are invited by advertisement at the close of the fiscal year. Under the con-

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templated contract it is proposed to apply the money toward completing the channel of the existing project. With the additional appropriation asked for it is expected to complete the project.

Money statement.

July 1, 1904, balance unexpended	$1,383.46
Amount appropriated by river and harbor act approved March 3, 1905	4,606.50
	5,989.96
June 30, 1905, amount expended during fiscal year, for works of improvement	1,383.46
July 1, 1905, balance unexpended	4,606.50
Amount (estimated) required for completion of existing project	6,493.50
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	6,493.50
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

March 3, 1871	$5,000.00	June 13, 1902 (allotment)	$12,000.00
June 10, 1872	6,000.00	March 3, 1905 (allotment)	4,606.50
March 3, 1879	3,000.00		
June 3, 1896	5,000.00	Total	35,606.50

COMMERCIAL STATISTICS FOR CALENDAR YEAR ENDED DECEMBER 31, 1904.

Receipts and shipments.

	Tons.
Wheat, corn, and general merchandise	19,144

Vessels sailing and trading in Queenstown Harbor, Maryland.

Class.	Number.	Aggregate tonnage.	Light draft.	Loaded draft.
			Feet.	Feet.
Steamers	6	2,280	6	8½
Sailing vessels and barges	175	5,200	4	12

(C) CLAIBORNE HARBOR.

No dredging was done during the fiscal year.

Proposals for dredging to expend the funds available are invited by advertisement at the close of the fiscal year. Under the contemplated contract it is proposed to apply the money toward removing shoals in the channel already dredged, and, if any balance remains, to widen the channel south of the railroad pier.

With the additional appropriation recommended it is expected to complete the project.

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Money statement.

July 1, 1904, balance unexpended	$1,846.53
Amount appropriated by river and harbor act approved March 3, 1905	1,863.35
	3,709.88
June 30, 1905, amount expended during fiscal year, for works of improvement	1,846.53
July 1, 1905, balance unexpended	1,863.35
Amount (estimated) required for completion of existing project	626.65
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	626.65

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

APPROPRIATIONS.

June 13, 1902 (allotment)	$15,000.00
March 3, 1905 (allotment)	1,863.35
Total	16,863.35

COMMERCIAL STATISTICS FOR CALENDAR YEAR ENDING DECEMBER 31, 1904.

Total receipts and shipments.

General merchandise	tons	79,538
Coal	do	10,605
Lumber and ties	feet	238,613
United States mails	tons	64
Passengers	number	87,649

Vessels sailing and trading in Claiborne Harbor, Maryland.

Class.	Number.	Aggregate tonnage.	Light draft.	Loaded draft.
			Feet.	Feet.
Steamers	3	1,740	7	7
Sailing vessels and barges	70	3,950	4	10

(D) CAMBRIDGE HARBOR.

No dredging was done during the fiscal year.

Proposals for dredging to expend the funds available are invited by advertisement at the close of the fiscal year. Under the contemplated contract it is proposed to apply the money toward completing the project and also toward removing shoals that have appeared in the channel already dredged.

With the additional appropriation recommended it is expected to complete the project.

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Money statement.

July 1, 1904, balance unexpended	$278.02
Amount appropriated by river and harbor act approved March 3, 1905	3,120.80
	3,398.82
June 30, 1905, amount expended during fiscal year, for works of improvement	278.02
July 1, 1905, balance unexpended	3,120.80
Amount (estimated) required for completion of existing project	1,999.20
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	1,999.20
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

March 3, 1871	$10,000.00	September 19, 1890	$5,000.00
June 10, 1872	10,000.00	July 13, 1892	7,737.00
March 3, 1873	5,000.00	June 13, 1902 (allotment)	3,000.00
June 18, 1878	5,000.00	March 3, 1905 (allotment)	3,120.80
March 3, 1879	2,500.00		
August 11, 1888	5,000.00	Total	56,357.80

COMMERCIAL STATISTICS FOR CALENDAR YEAR ENDING DECEMBER 31, 1904.

Receipts and shipments.

Class.	Quantity.	Value.
Receipts:	*Tons.*	
Coal, dimension stone, ice, etc	209	$2,472
Fertilizers, flour, millwork, etc	75,929	864,025
Cattle, hogs, horses, etc	1,300	92,821
General merchandise	10,100	404,000
Total	87,538	1,363,318
Shipments:		
Canned goods, crates, lumber, etc	3,654	211,577
Fruit, grain, eggs, poultry, etc	8,369	239,661
General merchandise	3,007	171,796
Total	15,030	623,034
Total receipts and shipments	102,568	1,986,352

Vessels sailing and trading in Cambridge Harbor, Maryland.

Class.	Number.	Aggregate tonnage.	Light draft.	Loaded draft.
			Feet.	*Feet.*
Steamers	6	2,461	5	9
Sailing vessels and barges	130	3,550	4	12

(E) CHESTER RIVER.

No dredging was done during the fiscal year, but at its close proposals for dredging had been invited by advertisement to expend the

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funds available in completing the project at the upper end and removing some shoals in the channel below.

The additional appropriation recommended is to complete the project.

Money statement.

July 1, 1904, balance unexpended	$465.70
Amount appropriated by river and harbor act approved March 3, 1905	1,245.00
	1,710.70
June 30, 1905, amount expended during fiscal year, for works of improvement	465.70
July 1, 1905, balance unexpended	1,245.00
Amount (estimated) required for completion of existing project	1,255.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	1,255.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

APPROPRIATIONS.

Prior to 1882	$2,958.54	March 3, 1899	$3,200.00
September 19, 1890	5,000.00	June 13, 1902 (allotment)	5,402.00
July 13, 1892	3,000.00	March 3, 1905 (allotment)	1,245.00
August 18, 1894	1,500.00		
June 3, 1896	1,500.00	Total	20,847.00

COMMERCIAL STATISTICS FOR CALENDAR YEAR ENDING DECEMBER 31, 1904.

Receipts and shipments.

Class.	Quantity.	Value.
Receipts:	*Tons.*	
Wool, oysters, fish, and crabs	2,998	$187,027
Canned goods	1,110	68,393
Cattle, horses, mules, sheep, etc	5,100	520,965
Fruits, berries, etc	15,970	454,580
General merchandise	7,049	211,477
Total	32,223	1,437,442
Shipments:		
Fertilizers, flour, sawed lumber, etc	4,416	117,516
Hay	245	785
General merchandise	11,580	340,792
Total	16,241	459,043
Total receipt and shipments	48,463	1,896,485

Vessels sailing and trading in Chester River, Maryland.

Class.	Number.	Aggregate tonnage.	Light draft.	Loaded draft.
			Feet.	*Feet.*
Steamers	6	2,260	6	8½
Sailing vessels and barges	175	5,200	4	12

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(F) CHOPTANK RIVER.

No dredging was done during the fiscal year, but at its close proposals for dredging had been invited by advertisement to expend the funds available toward completing the project channel at its upper end and removing shoals that had formed below.

It is proposed to apply the additional appropriation recommended to completing the channel near its upper end and restoring it where it has shoaled below.

Money statement.

July 1, 1904, balance unexpended	$629.66
Amount appropriated by river and harbor act approved March 3, 1905	7,885.00
	8,514.66
June 30, 1905, amount expended during fiscal year, for works of improvement	629.66
July 1, 1905, balance unexpended	7,885.00
Amount (estimated) required for completion of existing project	8,115.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	8,115.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

June 14, 1880	$5,000	August 18, 1894	$2,000
March 3, 1881	5,000	June 3, 1896	2,000
August 2, 1882	5,000	March 3, 1899	8,000
July 5, 1884	5,000	June 13, 1902 (allotment)	3,000
August 5, 1886	10,000	March 3, 1905 (allotment)	7,885
August 11, 1888	7,500		
September 19, 1890	7,500	Total	70,885
July 13, 1892	3,000		

COMMERCIAL STATISTICS FOR CALENDAR YEAR ENDING DECEMBER 31, 1904.

Receipts and shipments.

Class.	Quantity.	Value.
Receipts:	*Tons.*	
Iron, coal, phosphate rock, oysters, fish, etc	10,679	$55,748
Canned goods, fertilizers, etc	119,229	1,706,904
Horses, sheep, etc	2,794	188,126
General merchandise	11,064	663,873
Total	143,766	2,614,651
Shipments:		
Quarry stone, timber, railroad ties, etc	2,170	11,416
Canned goods, lumber, flour, etc	16,056	728,458
Fruit, grain, cattle, etc	40,432	1,117,145
General merchandise	8,023	271,746
Total	66,681	2,128,765
Total receipts and shipments	210,447	4,743,416

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Vessels sailing and trading in Choptank River, Maryland.

Class.	Number.	Aggregate tonnage.	Light draft.	Loaded draft.
			Feet.	*Feet.*
Steamers	6	2,461	5	9
Sailing vessels and barges	246	6,800	4	12

(G) WARWICK RIVER.

No dredging was done during the fiscal year, but at its close proposals for dredging had been invited by advertisement to expend the funds available toward the restoration of the project channel and turning basin.

It is proposed to apply the additional appropriation recommended to the restoration of the channel and turning basin.

Money statement.

July 1, 1904, balance unexpended		$686.25
Amount appropriated by river and harbor act approved March 3, 1905		1,909.00
		2,595.25
June 30, 1905, amount expended during fiscal year, for works of improvement		686.25
July 1, 1905, balance unexpended		1,909.00
Amount (estimated) required for completion of existing project		691.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905		691.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.		

APPROPRIATIONS.

Previous project.

June 14, 1880	$3,000	
March 3, 1881	3,000	
		$6,000

Present project.

July 13, 1892	$6,000	
August 18, 1894	2,000	
June 3, 1896	2,000	
March 3, 1899	2,000	
June 13, 1902 (allotment)	4,000	
March 3, 1905 (allotment)	1,909	
		17,909
Total, both projects		23,909

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COMMERCIAL STATISTICS FOR CALENDAR YEAR ENDING DECEMBER 31, 1904.

Receipts and shipments.

Class.	Quantity.	Value.
Receipts:	*Tons.*	
Fish, oysters, coal, etc	1,064	$4,686
Flour, fertilizers, furniture, etc	5,912	198,839
Cattle, horses, etc	1,566	74,134
General merchandise	3,956	247,549
Total	12,468	525,208
Shipments:		
Canned goods, lumber, etc	1,108	53,839
Fruit, wheat, poultry, sheep, etc	50,892	885,646
General merchandise	1,390	68,061
Total	53,390	1,007,546
Total receipts and shipments	65,858	1,532,754

Vessels sailing and trading in Warwick River, Maryland.

Class.	Number.	Aggregate tonnage.	Light draft.	Loaded draft.
			Feet.	*Feet.*
Steamers	6	2,461	5	9
Sailing vessels and barges	78	1,720	4	8

(H) POCOMOKE RIVER, BELOW SNOW HILL.

No dredging was done during the fiscal year, but at its close proposals for dredging had been invited by advertisement, to expend the funds available in dredging some shoals formed in the channel.

Money statement.

July 1, 1904, balance unexpended	$885.08
Amount appropriated by river and harbor act approved March 3, 1905	1,743.00
	2,628.08
June 30, 1905, amount expended during fiscal year, for works of improvement	885.08
July 1, 1905, balance unexpended	1,743.00

APPROPRIATIONS.

June 18, 1878	$10,000	June 13, 1902 (allotment)	$4,800
March 3, 1879	2,500	March 3, 1905 (allotment)	1,743
August 5, 1886	8,000		
June 3, 1896	5,000	Total	35,043
March 3, 1899	3,000		

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COMMERCIAL STATISTICS FOR CALENDAR YEAR ENDING DECEMBER 31, 1904.

Receipts and shipments.

Class.	Quantity.	Value.
Receipts:	*Tons.*	
Coal, dimension stone, ice, etc	335	$2,132
Fertilizers, flour, millwork, etc	8,962	600,605
Cattle, hogs, horses, etc	967	27,757
General merchandise	200,200	1,201,200
Total	210,464	1,831,694
Shipments:		
Cordwood, logs, ship timber, etc	3,578	42,288
Canned goods, crates, lumber, etc	23,430	255,188
Fruit, grain, eggs, poultry, etc	8,751	185,251
Total	35,759	482,717
Total receipts and shipments	246,223	2,314,411

Vessels sailing and trading in Pocomoke River, Maryland.

Class.	Number.	Aggregate tonnage.	Light draft.	Loaded draft.
			Feet.	*Feet.*
Steamers	2	1,527	4	6½
Sailing vessels and barges	86	4,680	4	7

(I) LA TRAPPE RIVER.

No dredging was done during the fiscal year, but at its close proposals for dredging had been invited by advertisement to expend the funds available toward completing the channel across the bar and the partial restoration of the channel where it has shoaled.

It is proposed to apply the additional appropriation recommended to completing the project.

Money statement.

July 1, 1904, balance unexpended		$36.13
Amount appropriated by river and harbor act approved March 3, 1905		1,867.50
		1,903.63
June 30, 1905, amount expended during fiscal year, for works of improvement		36.13
July 1, 1905, balance unexpended		1,867.50
Amount (estimated) required for completion of existing project		632.50
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905		632.50
Submitted in compliance with requirements of sundry civil act of June 4, 1897.		

APPROPRIATIONS.

July 13, 1892	$2,500.00
August 18, 1894	4,750.00
March 3, 1905 (allotment)	1,867.50
Total	9,117.50

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COMMERCIAL STATISTICS FOR CALENDAR YEAR ENDING DECEMBER 31, 1904.

Receipts and shipments.

Class.	Quantity.	Value.
Receipts:	*Tons.*	
Coal, phosphate rock, etc.	2,691	7,681
Canned goods, flour, shingles, etc.	3,980	26,630
Fruit, fertilizers, etc.	291	11,332
General merchandise.	2,346	141,663
Total	9,308	187,236
Shipments:		
Logs, ship timber, ties, etc.	86	284
Fertilizers, lumber, canned goods, etc.	672	27,356
Fruit, grain, poultry, sheep, etc.	3,467	87,417
General merchandise.	68	1,133
Total	4,293	116,190
Total receipts and shipments	13,601	303,426

Vessels sailing and trading in La Trappe River, Maryland.

Class.	Number.	Aggregate tonnage.	Light draft.	Loaded draft.
			Feet.	*Feet.*
Steamers	3	923	5	9
Sailing vessels and barges	81	2,800	4	9

(J) MANOKIN RIVER.

No dredging was done during the fiscal year, but at its close proposals for dredging had been invited by advertisement to expend the funds available in completing part of the project channel and restoring it where shoaled.

It is proposed to apply the additional appropriation recommended to completing the project.

Money statement.

July 1, 1904, balance unexpended		$65.03
Amount appropriated by river and harbor act approved March 3, 1905		4,772.50
		4,837.53
June 30, 1905, amount expended during fiscal year, for works of improvement		65.03
July 1, 1905, balance unexpended		4,772.50
Amount (estimated) required for completion of existing project		2,727.50
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905		2,727.50
Submitted in compliance with requirements of sundry civil act of June 4, 1897.		

APPROPRIATIONS.

September 19, 1890	$7,500.00	March 3, 1899	$1,500.00
July 13, 1892	7,500.00	March 3, 1905	4,772.50
August 18, 1894	4,000.00		
June 3, 1896	[a] 4,000.00	Total	29,272.50

[a] Of this amount $2,000 is for work in the upper river not covered by project.

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COMMERCIAL STATISTICS.

No complete statistics could be obtained.

(K) TYASKIN CREEK.

No dredging was done during the fiscal year, but at its close proposals for dredging had been invited by advertisement to expend the funds available in widening the channel of the project.

It is proposed to apply the additional appropriation recommended to completing the project.

Money statement.

July 1, 1904, balance unexpended	$1,089.09
Amount appropriated by river and harbor act approved March 3, 1905	2,158.00
	3,247.09
June 30, 1905, amount expended during fiscal year, for works of improvement	1,089.09
July 1, 1905, balance unexpended	2,158.00
Amount (estimated) required for completion of existing project	3,042.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	3,042.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

June 13, 1902 (allotment)	$8,000
March 3, 1905 (allotment)	2,158
Total	10,158

COMMERCIAL STATISTICS FOR CALENDAR YEAR ENDING DECEMBER 31, 1904.

Receipts and shipments.

Class.	Quantity.	Value.
Receipts:	*Tons.*	
Phosphate rock	23	$246
Fertilizers, canned goods, flour, etc	254	6,919
Corn, wheat, and horses	19	262
General merchandise	178	7,110
Total	474	14,537
Shipments:		
Lumber, crates, etc	4	138
Fruit, grain, etc	291	18,092
General merchandise	27	1,051
Total	322	19,276
Total receipts and shipments	796	33,813

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Vessels sailing and trading in Tyaskin Creek, Maryland.

Class.	Number.	Aggregate tonnage.	Light draft.	Loaded draft.
			Feet.	*Feet.*
Steamers	3	1,727	4	6½
Sailing vessels and barges	35	2,100	4	6

J 7.

IMPROVEMENT OF NANTICOKE RIVER, DELAWARE AND MARYLAND.

No dredging was done during the fiscal year, but at the close proposals for dredging had been invited by advertisement to expend the funds available in widening the channel of the project and removing some shoals which have formed in the channel.

Money statement.

July 1, 1904, balance unexpended	$736.50
Amount appropriated by river and harbor act approved March 3, 1905	2,000.00
	2,736.50
June 30, 1905, amount expended during fiscal year, for works of improvement	98.86
July 1, 1905, balance unexpended	2,637.64

APPROPRIATIONS.

August 18, 1894	[a] $5,000
June 3, 1896	3,000
March 3, 1899	3,000
March 3, 1905	2,000
Total	13,000

COMMERCIAL STATISTICS FOR CALENDAR YEAR ENDING DECEMBER 31, 1904.

Receipts and shipments.

Class.	Quantity.	Value.
	Tons.	
Receipts:		
Raw bone, phosphate, ship timber, etc	463	$9,517
Fertilizers, flour, lumber, etc	90,362	548,923
Cattle, horses, hay, etc	763	36,512
General merchandise	8,459	507,525
Total	100,047	1,102,477
Shipments:		
Canned goods, basket and barrel material, etc	8,192	363,480
Berries, peaches, grain, poultry, etc	10,550	456,308
General merchandise	1,440	86,391
Total	20,182	926,179
Total receipts and shipments	120,229	2,028,656

[a] See note to appropriations for Broad Creek River, Delaware.

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Vessels sailing and trading in Nanticoke River, Delaware and Maryland.

Class.	Number.	Aggregate tonnage.	Light draft.	Loaded draft.
			Feet.	*Feet.*
Steamers	3	1,727	4	6½
Sailing vessels and barges	120	12,800	4	12

J 8.

IMPROVEMENT OF BROAD CREEK RIVER, DELAWARE.

No dredging has been done in the fiscal year and no funds are available for the coming one.

Money statement.

July 1, 1904, balance unexpended	$324.80
June 30, 1905, amount expended during fiscal year, for works of improvement	324.80

APPROPRIATIONS.

June 14, 1880	$5,000	
March 3, 1881	10,000	
August 2, 1882	5,000	
August 5, 1886	10,000	
August 11, 1888	5,000	
Total		$35,000
July 13, 1892	5,000	
August 18, 1894	[a] 5,000	
June 3, 1896	5,000	
March 3, 1899	5,000	
Total, present project		20,000
Aggregate		55,000

COMMERCIAL STATISTICS.

No commercial statistics could be obtained.

J 9.

IMPROVEMENT OF WICOMICO RIVER, MARYLAND.

No dredging was done during the fiscal year, but at its close proposals for dredging had been invited by advertisement to expend the funds available in widening the channel at some bends and in removing shoals that have formed in the channel.

[a] This appropriation was applied to removing bar on Nanticoke River, under the terms of the appropriation.

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Money statement.

July 1, 1904, balance unexpended		$1,105.54
Amount appropriated by river and harbor act approved March 3, 1905		5,000.00
		6,105.54
June 30, 1905, amount expended during fiscal year, for works of improvement		1,105.54
July 1, 1905, balance unexpended		5,000.00

APPROPRIATIONS.

June 10, 1872	$5,000	
March 3, 1873	5,000	
June 28, 1874	5,000	
March 3, 1875	5,000	
August 14, 1876	5,000	
June 18, 1878	5,000	
March 3, 1879	3,000	
June 14, 1880	5,000	
March 3, 1881	2,000	
July 5, 1884	10,000	
		$50,000
September 19, 1890	10,000	
July 13, 1892	6,500	
August 18, 1894	3,000	
June 3, 1896	3,700	
June 13, 1902 (allotment)	6,798	
March 3, 1905	5,000	
		34,998
Aggregate		84,998

COMMERCIAL STATISTICS FOR CALENDAR YEAR ENDING DECEMBER 31, 1904.

Receipts and shipments.

Class.	Quantity.	Value.
Receipts:	*Tons.*	
Bone, phosphate rock, oysters, etc	4,094	$76,688
Fertilizers, flour, dressed lumber, etc	102,998	1,603,334
Horses, hay, etc	483	38,360
General merchandise	15,606	797,129
Total	123,175	2,515,511
Shipments:		
Coal, wood, etc	10,986	23,258
Canned goods, fertilizers, bricks, etc	18,305	287,398
Corn, wheat, fruit, etc	10,239	431,282
General merchandise	36,574	1,503,648
Total	76,104	2,245,584
Total receipts and shipments	199,279	4,761,095

Vessels sailing and trading in Wicomico River, Maryland.

Class.	Number.	Aggregate tonnage.	Light draft.	Loaded draft.
			Feet.	*Feet.*
Steamers	2	1,548	5	6½
Sailing vessels and barges	80	5,600	5	9

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J 10.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

During the fiscal year the barge *Charles Gring* was removed under contract from Roads Harbor, mouth of Elk River, Maryland, at a cost of $610, work being commenced March 27, 1905, and completed April 7, 1905. This was a wooden barge of 105 gross tonnage, 9½ feet depth of hold, 18 feet beam, about 100 feet in length, and valued at about $1,200. She sunk with 300 tons of oyster shells, valued at $500, in about 30 feet of water.

The schooner *Mary L. Colbourne* was removed under ten-day public notice from Tangier Sound, Virginia, at a cost of $391.28, work being commenced April 14, 1905, and completed April 20, 1905. This was a wooden schooner of 13 net tonnage, 5½ feet depth of hold, 17½ feet beam, 49.2 feet in length, built in 1851. She was sunk in about 12 feet of water, and lay about 200 feet east of Tangier Sound lighthouse.

Operations were completed under contract dated June 2, 1904, on removal of sunken piles and logs from Elk River and Back Creek, Maryland, and 598 piles and logs were removed during the fiscal year, $2,078.40 being expended. One thousand five hundred and twenty-four piles and logs were removed under the contract, at a total cost of $2,095.14.

During the fiscal year payments amounting to $18,635.13 were made to the contractors for removing the steamers *Amy Dora* and *Uriarte No. 4*, and $79.01 outstanding liabilities from the preceding year were expended on examination of wrecks on the Atlantic coast.

CONTRACTS IN FORCE.

Emergency contract with William D. Johnston for removing an estimated quantity of 2,666 piles and logs from Elk River and Back Creek, Maryland, at $1.20 each, dated April 30, 1904; date of commencement May 5, 1904, and of completion September 30, 1904.

Emergency contract with Charles W. Johnston for removing wreck of barge *Charles Gring* from Roads Harbor, Maryland, for $549, dated January 23, 1905; date of commencement March 27, 1905, and of completion April 7, 1905.

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APPENDIX K.

IMPROVEMENT OF POTOMAC RIVER AND ITS TRIBUTARIES; OF JAMES RIVER AND OF HARBOR AT MILFORD HAVEN, VIRGINIA, AND OF CERTAIN RIVERS IN MARYLAND AND VIRGINIA ON THE WESTERN AND EASTERN SHORES OF CHESAPEAKE BAY; PROTECTON OF JAMESTOWN ISLAND, VIRGINIA.

REPORT OF LIEUT. COL. SMITH S. LEACH, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1905, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Potomac River, at Washington, District of Columbia.
2. Potomac River, below Washington, District of Columbia.
3. Anacostia River, District of Columbia.
4. Breton Bay and Patuxent River, Maryland.
5. York, Mattaponi, and Pamunkey rivers; Occoquan, Nandua, Aquia, and Carters creeks, Virginia.
6. Nomini Creek, Virginia.
7. Rappahannock River, Virginia.
8. Urbana Creek, Virginia.
9. Harbor at Milford Haven, Virginia.
10. James River, Virginia.
11. Protection of Jamestown Island, Virginia.
12. Removing sunken vessels or craft obstructing or endangering navigation.

HARBOR LINES.

13. Carters Creek at Weems, Virginia.

UNITED STATES ENGINEER OFFICE,
Washington, D. C., July 31, 1905.

GENERAL: I have the honor to forward herewith my annual report for the fiscal year ended June 30, 1905, for river and harbor works in charge of Col. A. M. Miller, Corps of Engineers, until September 13, 1904, of Capt. W. P. Wooten, Corps of Engineers, from September 14, 1904, until November 14, 1904, and in my charge since the latter date.

Very respectfully, your obedient servant,

SMITH S. LEACH,
Lieut. Col., Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

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K 1.

IMPROVEMENT OF POTOMAC RIVER AT WASHINGTON, DISTRICT OF COLUMBIA.

WORK OF THE FISCAL YEAR ENDED JUNE 30, 1905.

Proposals for dredging under allotment of June 7, 1904, from the appropriation of April 28, 1904, were opened July 11, 1904, and the contract was awarded to the lowest bidder, the Atlantic, Gulf and Pacific Company, of New York City, at 13.9 cents per cubic yard. The formation of embankments to retain the dredged material was begun July 12 and dredging was commenced July 23, from which date it was prosecuted continuously, day and night, with but few slight interruptions for repairs, until October 1, 1904, when the limit of work which was practicable with the funds available was reached. The total number of cubic yards excavated under this contract was 319,375.1, all of which was deposited upon Section I of Potomac Park, below the Easbys Point high-level sewer. In August 159,570 cubic yards of material were dredged, which was the largest month's work done under this contract. As a result of the dredging done under this contract a channel at least 21 feet deep and 360 feet wide was restored through the Virginia channel above Long Bridge, and for a considerable portion of its length this channel is 400 feet wide.

The relaying of a portion of the sea wall along the Washington channel side of Section III of Potomac Park was begun April 4, 1904, and was in progress at the close of the fiscal year, at which time 770 linear feet had been relaid. This wall was originally built as a dry wall in 1892, and has settled slightly and the upper courses of stone have been thrown out of place by malicious persons and the action of steamboat swells. A portion of this wall extending from the lower end of Section III, about half way to Long Bridge, was relaid in 1896 and 1897, the portion above mean tide being laid in cement mortar, and is now in excellent condition. The wall now being rebuilt adjoins this work and is being made of the same character. During the year 806.6 cubic yards of stone and 700 barrels of cement were purchased and delivered for this work.

The winter of 1904–5 was one of unusual severity. The river was frozen over about the middle of December and remained frozen the greater part of the time until about the middle of March. It was reported as frozen to its mouth. The ice attained its maximum thickness of 13 inches at Easbys Point and 15 inches above the Aqueduct Bridge in February. The Norfolk steamers and navy-yard tugs succeeded in making their scheduled trips, but otherwise navigation was entirely suspended for some weeks.

The total expenditure during the fiscal year was $77,484.43, of which $72,605.25 was expended upon work in connection with the dredging operations and $4,879.18 upon the reconstruction of the sea wall and other minor works of maintenance.

The entire project is now nearly two-thirds completed.

CHANNEL DEPTH.

The project for this improvement does not specify the projected depth in feet, but provides that the channels shall be of sufficient

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depth to accommodate the deepest draft vessels that can be brought up to them. At the time of the adoption of the project the ruling depth in the Potomac River below Washington was 20 feet, and all estimates for the improvement at Washington are based upon this depth. The ruling depth in the lower Potomac has now been increased by dredging to 24 feet at low tide, which accordingly makes this the present projected depth for the improvement at Washington. For this increase the present estimates, however, do not make provision, and no work with this depth in view will be undertaken until it is authorized by Congress.

The desirability of extending the advantages of increased depth in the lower Potomac River at an early date, so that deep-draft vessels may reach the navy-yard and wharves at Washington, is obvious and need not be dwelt upon here. Incidental to the deposit of the additional material thus excavated from the channel there would result the great advantage of raising the surface of Potomac Park above all possibility of injury by the highest known freshets. The estimated additional cost of this important modification of the project, which it is hoped will soon be authorized by Congress, is $592,000.

POTOMAC PARK.

Congress, by act of March 3, 1897, declared the reclaimed flats a public park. This extensive tract, amounting to 621 acres of land and 118 acres of inclosed water area, is capable of being transformed into one of the finest parks in the country. For further information reference is invited to the Annual Report of the Chief of Engineers for 1899, page 1416; for 1900, page 1702, and for 1901, page 1401.

While it is necessary that the greater part of this area be for the present reserved for the deposit of material dredged from the river channels, if sufficient funds were appropriated certain portions of the same could be soon filled to their final height and covered with a rich alluvial soil by dredging and thereafter devoted exclusively to park purposes.

During the past fiscal year about 16,000 cubic yards of good earth, free from objectionable matter, were dumped upon Potomac Park at localities remote from the river, where deposit by dredging is most expensive, and graded by private parties, under permit, free of cost to the United States.

APPROPRIATIONS.

Because of the continual shoaling of the dredged channels by deposits from freshets and the considerable expenditure required for the maintenance of this improvement it has been impossible, with the small appropriations recently made for this work, to undertake any extensive operations toward the completion of the general project. Attention is invited to the fact that of the $2,534,000 which has been appropriated for this work $2,035,000 was appropriated in the first ten years, from August, 1882, to July, 1892, and but $499,000 has been appropriated in the thirteen years since the latter date.

It is thought that the time has arrived when, in response to the urgent popular demand for better navigation facilities and for additional park space, the appropriations for this work should be made on a scale which will insure the completion of the entire project (including the increased channel depth and height of fill) within a few years.

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A considerable appropriation is now necessary for maintenance and for the removal of freshet deposits, while it is essential for economy that an appropriation sufficient for the final dredging of the tidal reservoir and for the construction of the reservoir inlet gates be made at one time, as the tidal reservoir will be inaccessible to a dredge after the gates are built, and the construction of the gates will prevent the present rapid shoaling in the reservoir.

It is proposed to apply the available balance to dredging in the channels and to relaying a portion of the sea wall and other work of maintenance early in the ensuing fiscal year. It is proposed to apply the amount estimated as a profitable expenditure in dredging in the channels and tidal reservoir, in the construction of the inlet gates, in the repair of the sea wall, the extension of the training dike, and the maintenance of the outlet gates.

Money statement.

July 1, 1904, balance unexpended	$83,981.03
Amount appropriated by river and harbor act approved March 3, 1905	50,000.00
	133,981.03
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	77,484.43
July 1, 1905, balance unexpended	56,496.60
July 1, 1905, outstanding liabilities	1,544.00
July 1, 1905, balance available	54,952.60
Amount (estimated) required for completion of existing project	469,020.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:	
For works of improvement	$250,000.00
For maintenance of improvement	150,000.00
	400,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

Previous projects.

June 11, 1870	$50,000	June 14, 1880	$40,000
March 3, 1873	50,000	March 3, 1881	50,000
June 18, 1878	50,000		
March 3, 1879	50,000	Total	290,000

Present project.

August 2, 1882	$400,000	June 13, 1902	$75,000
July 5, 1884	500,000	April 28, 1904 (allotted)	50,000
August 5, 1886	375,000	March 3, 1905	50,000
August 11, 1888	300,000		
September 19, 1890	260,000	Total	2,534,000
July 13, 1892	200,000		
August 18, 1894	150,000		
June 3, 1896	100,000		
March 3, 1899 (appropriated, $100,000; allotted Potomac River below Washington $26,000)	74,000		

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CONTRACTS IN FORCE.

Contractor: Atlantic, Gulf and Pacific Company, of New York, N. Y., for dredging.
Amount: 480,000 cubic yards, more or less.
Date of contract: September 28, 1903.
Approved: October 26, 1903.
Date for commencement: November 27, 1903.
Date for completion: August 30, 1904. Final payment on contract made August 10, 1904.
Rate: 12.6 cents per cubic yard for dredging in the Virginia channel, 12.6 cents per cubic yard for dredging from flats in Virginia channel, and 15 cents per cubic yard for dredging in the Washington channel.

Contractor: Atlantic, Gulf and Pacific Company, of New York, N. Y., for dredging.
Amount: 350,000 cubic yards.
Date of contract: July 19, 1904.
Approved: September 19, 1904.
Date for commencement: October 20, 1904.
Date for completion: December 31, 1904. Contract work completed October 1, 1904, and final payment made October 13, 1904.
Rate: 13.9 cents per cubic yard.

COMMERCIAL STATISTICS.

[Furnished by Mr. J. W. Averill, Washington, D. C.]

Receipts and shipments by water, calendar year 1904.

Articles.	Quantity.	Articles.	Quantity.
	Tons.		*Tons.*
Coal	244,977	Oysters	14,519
Cement	1,400	Piles	6,250
Fertilizers	7,500	Sand and gravel	218,790
Ice	54,775	Shingles	2,300
Laths	2,500	Stone	7,118
Lumber	59,568	Wood	37,500
Manure	8,500		
Melons	3,800	Total	681,497
Naphtha, oil, and gasoline	12,000		

In addition to the foregoing, the estimated amount of miscellaneous freight received and shipped by the Norfolk, Baltimore, and river steamers during the year, as obtained from the agents of the different lines, is 76,653 tons.

Number of vessels of various classes arriving and departing, calendar year 1904.

Steamers drawing from 5 to 15 feet, 100 to 600 tons	1,300
Vessels drawing from 10 to 21 feet, 400 to 2,300 tons	300
Vessels drawing from 4 to 10 feet, 30 to 400 tons	1,800
Barges and scows drawing from 4 to 12 feet, 100 to 700 tons	2,500

Alexandria ferryboats are not included in the above.

K 2.

IMPROVEMENT OF POTOMAC RIVER BELOW WASHINGTON, DISTRICT OF COLUMBIA.

WORK OF THE FISCAL YEAR ENDED JUNE 30, 1905.

An examination of the channels through the several shoals was made and a small amount of shoaling was observed at three of the

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bars. Examinations of Naval Magazine and Marshall Hall shoals were also made.

Proposals for dredging were invited October 13, 1904, and opened November 2, 1904. The contract was awarded to the lowest bidder, the Maryland Dredging and Contracting Company, of Baltimore, Md., at 9 cents per cubic yard.

Dredging under contract was commenced at Naval Magazine shoal December 2, but discontinued December 11, 1904, on account of the ice in the river. The dredging at this shoal was resumed March 22, 1905, and continued until April 17, when a channel 200 feet wide and 24 feet deep was completed through the same, and the plant was transferred to Mattawoman shoal, where dredging was begun April 19. The channel through this shoal was restored to its full dimensions by May 9, at which date the dredge was transferred to Marshall Hall shoal, where dredging was begun May 11 and continued until June 10, when the dredge was withdrawn and taken to Baltimore. In the meantime dredging was begun with a second dredge at Maryland Point shoal on May 11, 1905, and the channel through this shoal was restored to its full dimensions by May 24, and the dredge was at once taken to Lower Smiths Point shoal, where dredging was begun May 26, and the channel through the same was restored to its full dimensions by June 22, completing the work provided for under contract of November 18, 1904.

An agreement was made with the Maryland Dredging and Contracting Company on June 15, 1905, for completing the channel through Marshall Hall shoal at 11 cents per cubic yard, and work under this agreement was begun June 23, and was in progress at the close of the fiscal year.

The amount of material dredged from the several shoals under contract of November 18, 1904, during the year was as follows: Naval Magazine shoal, 31,006.7 cubic yards; Marshall Hall shoal, 57,394 cubic yards; Mattawoman shoal, 31,427 cubic yards; Lower Smiths Point shoal, 37,015.9 cubic yards, and Maryland Point shoal, 17,715.8 cubic yards; total, 174,559.4 cubic yards, while 8,274 cubic yards were dredged from Marshall Hall shoal under agreement of June 15, 1905, making a grand total of 182,833.4 cubic yards excavated during the year.

The total amount expended during the fiscal year was $13,293.58, all of which was applied to dredging under contract of November 18, 1904, and work incidental thereto.

The entire work is about 99 per cent completed, and no further appropriation, except for maintenance, is required therefor.

An increase in width of the channels to 400 feet is, however, regarded as very desirable. Should this be authorized the sum of $175,000 could be profitably expended in completing the same during the fiscal year ending June 30, 1907.

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Money statement.

July 1, 1904, balance unexpended		$17,845.55
Amount appropriated by river and harbor act approved March 3, 1905		10,000.00
		27,845.55
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$4,293.58	
For maintenance of improvement	9,000.00	
		13,293.58
July 1, 1905, balance unexpended		14,551.97
July 1, 1905, outstanding liabilities		346.00
July 1, 1905, balance available		14,205.97
July 1, 1905, amount covered by uncompleted contracts		6,182.75

APPROPRIATIONS.

March 3, 1899 (by allotment from appropriation of $100,000 for improving Potomac River, etc.)	$26,000
June 6, 1900	52,000
March 3, 1901	98,000
March 3, 1905	10,000
Total	186,000

CONTRACT IN FORCE.

Contractor: Maryland Dredging and Contracting Company, of Baltimore, Md., for dredging.
Amount: 166,000 cubic yards.
Date of contract: November 18, 1904.
Approved: December 13, 1904.
Date for commencement: January 21, 1905.
Date for completion (including dredging in Nomini Creek, Virginia, under the same contract): October 21, 1905.
Rate: 9 cents per cubic yard.

COMMERCIAL STATISTICS.

See report for improving Potomac River at Washington, D. C., and report for improvement of Anacostia River, District of Columbia, to which should be added a tonnage of about 300,000, due to trade at Alexandria, Quantico, and other points below Washington.

K 3.

IMPROVEMENT OF ANACOSTIA RIVER, DISTRICT OF COLUMBIA.

WORK OF THE FISCAL YEAR ENDED JUNE 30, 1905.

The dredging of the channel with the hydraulic dredge *Dewey*, which was in progress at the close of the last fiscal year, was prose-

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cuted continuously day and night, except for such delays as are incidental to work of this character, until January 16, 1905, when the limit of work which could be done under the present contract was reached and the work was discontinued. During the year a total of 423,106.9 cubic yards of material was excavated from the channel at a cost of 10.95 cents per yard, and deposited upon the flats in front of the hospital for the insane. As a result of this work a channel 20 feet deep at mean low tide and at least 300 feet wide (except at Buzzard Point, where the width is about 240 feet) has been completed for a distance of 9,130 feet upstream from the mouth of the Anacostia (or up to the lower limits of the navy-yard), and incidental to the improvement of the channel about 110 acres of flats have been filled by the deposit of excavated material to an average height of 4 feet above low tide. The wrecks of two vessels, which had been burned during the war of 1812, and an old timber platform and cluster of 80 piles were encountered within the limits of the channel dredged during the year and were removed.

The grapple dredge, which was engaged in raising the embankments at the close of the last fiscal year, continued this work until July 6, when these operations were discontinued. On August 6 the raising of the embankments with the grapple dredge was again resumed and continued the greater part of the time up to November 7, 1904, when the dredge was withdrawn and the embankments were kept up by men with shovels and by diking. The greater portion of this work was done on the side embankments without cost to the United States, but 3,478.1 cubic yards were excavated from the trench and deposited in the front embankment and paid for at a rate of 14.75 cents per yard.

The total amount of material dredged under contract with the Sanford & Brooks Company, of Baltimore, Md., dated January 3, 1903, was 1,129,623.8 cubic yards, of which 1,103,452.9 cubic yards were dredged from the channel and 26,170.9 cubic yards from the trench.

The modified harbor lines were approved by the Secretary of War July 1, 1904.

The total expenditure during the fiscal year amounted to $65,269.03, of which $65,219.03 was expended upon work in connection with the dredging operations and $50 on work in connection with the establishment of harbor lines.

The entire work is now about one-eighth completed.

BENEFITS FROM IMPROVEMENT.

It is anticipated that this improvement will be of great benefit to the General Government and to the city of Washington.

At the Washington Navy-Yard there has been established one of the finest gun shops in the world, and large sums have been expended in enlarging and increasing the facilities of the establishment. The improvement of the channel will render this navy-yard accessible to a large number of vessels of the Navy.

The trade and commerce of Washington are increasing, while the wharf facilities along the Potomac front are inadequate for the present traffic and afford no room for expansion. The improvement of the Anacostia will give the needed additional wharfage facilities and will afford abundant anchorage facilities which do not now exist in this vicinity.

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The greater part of the area of the Anacostia River now consists of wide and extensive flats, which in summer and fall are covered with a dense growth of eel grass and wild rice. The large volume of sewage flowing into this stream is carried over the flats and widely disseminated at high tide; and as the tide falls much of it remains lodged in the aquatic grasses, where it ferments in the intense heat of the summer and autumn. The result of this unsanitary condition is the prevalence of malarial diseases in the portions of the city and District of Columbia which border the river. The reclamation of Potomac flats, although not as yet entirely completed, has very largely corrected the unsanitary condition along that front, and gives promise of similar results on the Anacostia. Although merely incidental to the work of channel improvement, as affording the most convenient and economical means of disposing of the excavated material, this reclamation of the flats of the Anacostia below the Navy-Yard Bridge will also render available for park or other purposes about 460 acres of desirable land.

ACQUISITION OF LAND.

A small amount of land located below the Navy-Yard Bridge is required for the improvement. Although several Government reservations front on the river, the greater part of the shore is owned by private parties. It is especially desirable that such land as is required for the improvement be acquired, and that all matters as to riparian rights and ownership of the reclaimed lands be settled by the condemnation and purchase of a strip of land adjacent to the shore, or otherwise, before the flats at these localities are reclaimed. The land to be acquired is believed to be of but insignificant value at the present time.

As delays in proceedings of this character are of frequent occurrence, and a delay would result in seriously hampering the work of improvement, attention is thus early invited to this subject and prompt action by Congress is suggested.

It is proposed for the present to deposit material only in front of Government property, where legal complications can not arise, and all of these areas will very soon become filled.

APPROPRIATIONS.

For the successful and economical prosecution of this work, large and continuous appropriations should be made, as was clearly stated in presenting the original estimates for this work. The estimated unit price for dredging, which is considerably lower than the prices which have usually been paid for such work on the Potomac, is based upon this assumption, and if the appropriations should be small and made at irregular intervals the actual cost of the work would exceed the estimated cost.

It is proposed to apply the available balance and the additional appropriation recommended to dredging and properly depositing the excavated material. The widening and rectification of the channel at Buzzard Point, involving the removal of a hard gravel bar projecting into the channel and the excavation of the turning basin opposite the navy-yard are especially desirable at present.

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Money statement.

July 1, 1904, balance unexpended	$66,781.73
June 30, 1905, amount expended during fiscal year, for works of improvement	65,269.03
July 1, 1905, balance unexpended	1,512.70
Amount (estimated) required for completion of existing project	1,067,061.94
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	300,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

APPROPRIATIONS.

September 19, 1890 (allotment from appropriation for improving Potomac River)	$20,000
June 13, 1902	150,000
Total	170,000

CONTRACT IN FORCE.

Contractor: Sanford & Brooks Company, of Baltimore, Md., for dredging; amount, 36,000 cubic yards, more or less, in the trench, and 1,100,000 cubic yards, more or less, in the channel.

Date of contract: January 3, 1903.

Approved: January 21, 1903.

Date for commencement: February 20, 1903.

Date for completion: June 30, 1904; not less than 100,000 cubic yards to be dredged in each month, except that work may be suspended during the months of December, January, February, and March. Time limit for completion of the contract was waived. Final payment for work under the contract was made March 22, 1905.

Rate: 14.75 cents per cubic yard for dredging in the trench and 10.95 cents per cubic yard for dredging in the channel.

COMMERCIAL STATISTICS.

[Furnished by Mr. J. W. Averill, Washington, D. C.]

Receipts and shipments by water, 1904.

Articles.	Quantity.	Articles.	Quantity.
	Tons.		*Tons.*
Asphalt	2,400	Sand and gravel	141,592
Brick	1,500	Stone	22,535
Brick clay	36,000	Wood	4,200
Coal	14,776	Miscellaneous freight shipped by the United States navy-yard to and from Indian Head, Md.	26,956
Lumber	1,733		
Naphtha, oil, and gasoline	17,494		
Paving blocks	3,857		
Piles	6,562	Total	280,605
Railroad ties	1,000		

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Number of vessels of various classes arriving and departing, 1904.

Navy vessels drawing from 10 to 18 feet, 100 to 1,500 tons	25
Tugs drawing from 6 to 10 feet, 15 to 100 tons	1,800
Sailing vessels drawing from 4 to 10 feet, 30 to 300 tons	150
Barges and scows drawing from 3 to 12 feet, 100 to 700 tons	1,500
Total	3,475

K 4.

IMPROVEMENT OF BRETON BAY AND PATUXENT RIVER, MARYLAND.

(A) BRETON BAY.

WORK OF THE FISCAL YEAR ENDED JUNE 30, 1905.

No field work was done during the year. A small amount of miscellaneous office work was done.

The work is now about one-sixth completed.

The funds on hand will be applied to dredging in the channel and turning basin. No appropriation is asked for this stream for the next fiscal year.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1905	$6,000.00
July 1, 1905, balance unexpended	6,000.00
Amount (estimated) required for completion of existing project	24,480.00

APPROPRIATIONS.

Previous projects.

June 18, 1878	$5,000	August 5, 1886	$6,500
March 3, 1879	4,000	August 11, 1888	3,000
June 14, 1880	3,000	September 19, 1890	5,000
March 3, 1881	3,000		
August 2, 1882	5,000	Total	37,500
July 5, 1884	3,000		

Existing project.

June 13, 1902 (allotted)	$6,000
March 3, 1905	6,000
Total	12,000

COMMERCIAL STATISTICS.

Repeated efforts were made to secure commercial statistics for Breton Bay for the calendar year 1904, but without success. It is estimated that the tonnage for the calendar year of 1899 was 101,605 tons, consisting principally of wood, lumber, coal, farm produce, grain, tobacco, and general merchandise.

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(B) PATUXENT RIVER.

WORK OF THE FISCAL YEAR ENDED JUNE 30, 1905.

At the close of the last fiscal year dredging at Bristol bar was in progress under an agreement, dated June 3, 1904, with the Maryland Dredging and Contracting Company, of Baltimore, Md., for dredging at a rate of 25 cents per cubic yard. This dredging was continued until July 19, 1904, when the limit of work which could be done with the funds in hand was reached. The total amount of material excavated from the channel and turning basin during the year was 5,758 cubic yards, which was deposited at Marlboro Branch, Swan Point, and Lion Creek, respectively 1, 2½, and 5 miles below Bristol bar.

The total amount of dredging done under the agreement with the Maryland Dredging and Contracting Company was 11,882.5 cubic yards. The excavation of this material resulted in affording a channel 100 feet wide and 10 feet deep, and a turning basin about 240 feet wide, 350 feet long, and 10 feet deep, which is of much benefit to navigation.

The total amount of money expended during the year was $3,371.65, all of which was applied to dredging and expenses incidental thereto.

The entire project is now about three-tenths completed.

The Board of Engineers for Rivers and Harbors has considered the project for this work and submitted a report adverse to its continuance. In view of this report no estimate for continuing the work is submitted.

Money statement.

July 1, 1904, balance unexpended	$3,371.65
June 30, 1905, amount expended during fiscal year, for works of improvement	3,371.65
Amount (estimated) required for completion of existing project	7,500.00

APPROPRIATIONS.

August 11, 1888	$5,000
September 19, 1890	6,000
June 13, 1902 (allotted)	3,000
Total	14,000

COMMERCIAL STATISTICS.

[Furnished by Maryland, Delaware and Virginia Railway Company.]

Receipts and shipments by water, 1904.

Articles.	Quantity.	Articles.	Quantity.
	Tons.		*Tons.*
Coal	2,250	Oysters	31,922
Farm produce	10,683	Railroad ties	8,563
Grain	8,540	Tobacco	11,000
Ice	1,200	Wood	5,092
Lumber	10,870		
General merchandise	25,625	Total	115,745

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Arrival and departure of vessels, 1904.

Steam, drawing less than 10 feet	342
Sail, drawing less than 10 feet	3,500

K 5.

IMPROVEMENT OF YORK, MATTAPONI, AND PAMUNKEY RIVERS AND OCCOQUAN, NANDUA, AQUIA, AND CARTERS CREEKS, VIRGINIA.

(A) YORK RIVER.

WORK OF THE FISCAL YEAR ENDED JUNE 30, 1905.

Upon the completion of work on Rappahannock River, the United States plant was transferred to West Point for work upon the dike at York River. The plant reached West Point May 14, 1905, and considerable repair work was required before it was in condition to commence operations upon the dike.

The snag boat was hauled out on the marine railway at West Point May 23, and the necessary repairs and painting were completed June 19, subsequent to which a new boom was made.

The repairing of the dike was begun June 23 and was in progress at the close of the fiscal year. The work done resulted in repairing 32 breaks in the dike, and 10,500 feet B. M. of lumber were used in the work. This work was done by hired labor.

A survey of West Point bar was made in May, 1905.

The total expenditure during the fiscal year was $1,579.98, which was applied to the repair of the plant and work in connection with the repair of the dike. About $25 additional was applied to the survey.

The entire work is now about three-fifths completed.

It is proposed to apply the available balance and the additional appropriation recommended to dredging at West Point and Potopotank bars and to the repair of the dike at the former locality.

Money statement.

July 1, 1904, balance unexpended		$5,888.09
June 30, 1905, amount expended during fiscal year, for maintenance of improvement		1,579.98
July 1, 1905, balance unexpended		[a] 4,308.11
July 1, 1905, outstanding liabilities		750.00
July 1, 1905, balance available		3,558.11
Amount (estimated) required for completion of existing project		63,888.09
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$4,000.00	
For maintenance of improvement	3,000.00	
		7,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

[a] Under act approved March 3, 1905, $28,000 was appropriated in a lump sum for the improvement of this river in connection with certain other streams. Subsequent to the close of the fiscal year $3,111.91 from this appropriation was allotted for York River, Virginia, and this sum, together with the $3,558.11 above mentioned, is available for the improvement during the ensuing year.

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APPROPRIATIONS.

June 14, 1880	$10,000.00	June 13, 1902 (emergency allotment)	$5,000.00
March 3, 1881	25,000.00		246,926.98
August 2, 1882	25,000.00		
July 5, 1884	20,000.00		
August 5, 1886	18,750.00	Amount transferred to consolidated appropriation under act June 13, 1902	167.03
August 11, 1888	30,000.00		
September 19, 1890	30,000.00		246,759.95
July 13, 1892	35,000.00	March 3, 1905 (allotted)	3,111.91
August 18, 1894	20,000.00		
June 3, 1896	16,000.00	Total	249,871.86
March 3, 1899	10,000.00		
June 13, 1902 (allotted)	2,176.98		

These appropriations have been applied to work under the original project of 1880, the amended project of 1884, and the further amended project of 1887.

COMMERCIAL STATISTICS.

Year.	Quantity.	Year.	Quantity.
	Tons.		*Tons.*
1888	285,480	1892	345,559
1889	328,353	1893	351,390
1890	418,190	1894	379,808
1891	304,398		

Repeated efforts were made to obtain commercial statistics for years subsequent to 1894, but they could not be obtained.

It is stated that the principal line of steamers navigating this river carried 59,273 tons of freight during the year 1900, 55,951 tons during the year 1901, 61,934 tons in 1902, and 62,151 tons in 1903. The principal articles of commerce consist of farm produce, general merchandise, oysters, tobacco, fertilizer, canned goods, iron, lumber, etc.

(B) MATTAPONI RIVER.

WORK OF THE FISCAL YEAR ENDED JUNE 30, 1905.

An examination of the channels at Line Tree, Latane, Robinson, and Walker bars was made, which was the only field work undertaken during the year.

The entire work is now about two-sevenths completed.

It is proposed to apply the available balance and the additional appropriation recommended to the dredging and maintenance of the channels, to the repair of the dikes, and to snagging.

An appropriation of less than $3,000 can not be economically expended at this locality except in snagging.

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Money statement.

July 1, 1904, balance unexpended	$620.00
June 30, 1905, amount expended during fiscal year, for works of improvement	58.58
July 1, 1905, balance unexpended	[a] 561.42
Amount (estimated) required for completion of existing project	36,800.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:	
For works of improvement $2,000.00	
For maintenance of improvement 2,000.00	
	4,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

June 4, 1880	$2,500	August 18, 1894	$4,000
March 3, 1881	3,300	June 3, 1896	2,500
July 5, 1884	2,500	June 30, 1903 (allotted)	800
August 5, 1886	5,000	March 3, 1905 (allotted)	5,500
August 11, 1888	3,000		
September 19, 1890	3,000	Total	36,100
July 13, 1892	4,000		

COMMERCIAL STATISTICS.

Receipts and shipments by water, 1904.

Articles.	Quantity.
	Tons.
Farm produce	500
Grain	300
General merchandise	42,200
Flour	400
Total	43,400

(c) PAMUNKEY RIVER.

WORK OF THE FISCAL YEAR ENDED JUNE 30, 1905.

An examination of the channels at Buckland, Hogan, and Spring Bars was made, which was the only field work undertaken during the year.

The entire work is now about one-half completed.

It is proposed to apply the additional appropriation recommended to the dredging and maintenance of the channels, to the repair of the dikes, and to snagging.

[a] Under act approved March 3, 1905, $28,000 was appropriated in a lump sum for the improvement of this river in connection with certain other streams. Subsequent to the close of the fiscal year $5,500 from this appropriation was allotted for Mattaponi River, Virginia, and this sum, together with the $561.42 above mentioned, is available for the improvement during the ensuing year.

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An appropriation of less than $3,000 can not be economically expended at this locality except in snagging.

Money statement.

July 1, 1904, balance unexpended	$21.41
June 30, 1905, amount expended during fiscal year, for works of improvement	21.41
July 1, 1905, balance unexpended	(a)
Amount (estimated) required for completion of existing project	3,600.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:	
For works of improvement	$2,000.00
For maintenance of improvement	2,000.00
	4,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

June 14, 1880	$2,500	August 18, 1894	$2,000
March 3, 1881	2,500	June 3, 1896	2,000
August 2, 1882	2,500	April 28, 1903 (allotted)	1,000
August 5, 1886	5,000	March 3, 1905 (allotted)	3,400
August 11, 1888	3,000		
September 19, 1890	3,000	Total	29,900
July 13, 1892	3,000		

COMMERCIAL STATISTICS.

Repeated efforts were made to obtain commercial statistics for 1904, but they could not be obtained.

It is estimated that the commerce of the river in 1899 amounted to approximately 44,600 tons, consisting of wood, lumber, grain, ties, coal, and general merchandise, carried in sailing vessels.

(D) OCCOQUAN CREEK.

WORK OF THE FISCAL YEAR ENDED JUNE 30, 1905.

An examination of the channels was made and maps of the same were prepared.

The work is now nearly three-fourths completed.

It is proposed to apply the available balance and the additional appropriation recommended to the restoration and maintenance of the channels by dredging and to the construction and maintenance of the dikes.

a Under act approved March 3, 1905, $28,000 was appropriated in a lump sum for the improvement of this river in connection with certain other streams. Subsequent to the close of the fiscal year $3,400 from this appropriation was allotted for Pamunkey River, Virginia, and this sum is available for the improvement during the ensuing year.

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Money statement.

July 1, 1904, balance unexpended	$28.56
July 1, 1905, balance unexpended	[a] 28.56
Amount (estimated) required for completion of existing project	11,528.56
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:	
For works of improvement	$2,500.00
For maintenance of improvement	2,500.00
	5,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

APPROPRIATIONS.

Previous projects.

March 3, 1873	$5,000.00
June 23, 1874	5,000.00
March 3, 1875	5,000.00
June 18, 1878	10,000.00
Total	25,000.00

Existing project.

September 19, 1890	$10,000.00
July 13, 1892	5,000.00
August 18, 1894	5,000.00
June 3, 1896	2,500.00
March 3, 1899	2,500.00
June 13, 1902 (allotted)	2,600.00
March 3, 1905 (allotted)	5,971.44
	33,571.44
Amount transferred to consolidated appropriation under act of June 13, 1902	272.03
Total	33,299.41

COMMERCIAL STATISTICS.

[Furnished by Messrs. L. Ledman, Tyson Janney, W. S. Lynn, J. A. Selecman, G. W. Hunter, and C. L. Ruffin, of Occoquan, Va.]

Receipts and shipments by water, 1904.

Articles.	Quantity.	Articles.	Quantity.
	Tons.		*Tons.*
Coal	500	Railroad ties	5,000
Farm produce	100	Wood	5,000
Grain	1,000	Flour	20
Ice	50	Stone	7,000
Iron	10	Pine and oak piling	6,000
Lumber	800		
General merchandise	400	Total	25,880

[a] Under act approved March 3, 1905, $28,000 was appropriated in a lump sum for the improvement of this river in connection with certain other streams. Subsequent to the close of the fiscal year $5,971.44 from this appropriation was allotted for Occoquan Creek, Virginia, and this sum, together with the $28.56 above mentioned, is available for the improvement during the ensuing year.

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Arrival and departure of vessels, 1904.

Steam, drawing less than 10 feet	500
Sail, drawing less than 10 feet	400
Barges, flatboats, etc	300
Total	1,200

It is reported that the work done has lessened the cost of shipping, since vessels can now load more heavily at the wharves, whereas formerly part of the cargo had to be taken to them in lighter draft boats.

(E) NANDUA CREEK.

WORK OF THE FISCAL YEAR ENDED JUNE 30, 1905.

No field work was done during the year.

The sum authorized in the approved project has been expended, and the work projected has been 75 per cent completed.

The shifting character of the bar, which was fully understood from the inception of this project, indicates the uselessness of further expenditure upon this locality unless permanent regulating works are constructed, the cost of which would be out of all proportion to the interests involved.

The transfer of the available balance, allotted from the appropriation of June 13, 1902, from Nandua Creek to Carters Creek, Virginia, was requested December 7 and authorized December 13, 1904, and no further appropriation for Nandua Creek is asked.

Nandua Creek is regarded as unworthy of further improvement by the General Government.

Money statement.

July 1, 1904, balance unexpended		$0.25
Amount allotted from appropriation for river and harbor improvements, act of June 13, 1902		25.00
		25.25
June 30, 1905, amount expended during fiscal year, for works of improvement		12.87
July 1, 1905, balance unexpended (transferred to Carters Creek)		12.38

APPROPRIATIONS.

June 3, 1896		$3,000.00
March 3, 1899		3,000.00
June 13, 1902 (allotted)		150.00
		6,150.00
Amount transferred to consolidated appropriation under act June 13, 1902	$28.68	
Amount transferred to Carters Creek, Virginia	12.38	
		41.06
Total		6,108.94

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COMMERCIAL STATISTICS.

[Furnished by the Baltimore, Chesapeake and Atlantic Railway Company.]

Receipts and shipments by water, 1904.

Articles.	Quantity.
	Tons.
Fish and oysters	31
Produce	4,445
Merchandise	643
Total	5,119

(F) AQUIA CREEK.

WORK OF THE FISCAL YEAR ENDED JUNE 30, 1905.

An examination of Aquia Creek was made November 5–7, 1904, from which it was ascertained that, except for an insignificant amount of shoaling at some points along the channel edge, the channel is still of the full dimensions called for by the existing project, which is consequently completed. The amount of money expended upon this work during the year was $28.20.

The transfer of the available balance, allotted from the appropriation of June 13, 1902, from Aquia Creek to Carters Creek, Virginia, was requested December 7 and authorized December 13, 1904, and no further appropriation for Aquia Creek is asked.

Money statement.

July 1, 1904, balance unexpended	$100.00
June 30, 1904, amount expended during fiscal year	28.20
July 1, 1905, balance unexpended (transferred to Carters Creek)	71.80

APPROPRIATIONS.

Previous projects.

June 10, 1872	$1,000.00	
March 3, 1873	2,000.00	
March 3, 1875	2,000.00	
June 18, 1878	5,000.00	
		$10,000.00

Existing project.

September 19, 1890	$10,000.00	
July 13, 1892	5,000.00	
August 18, 1894	3,000.00	
June 3, 1896	3,000.00	
June 13, 1902 (allotted)	100.00	
	21,100.00	
Amount transferred to consolidated appropriation under act of June 13, 1902	$463.36	
Amount transferred to Carters Creek, Virginia	71.80	
	535.16	
Total		20,564.84
Aggregate		30,564.84

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COMMERCIAL STATISTICS.

Repeated efforts have been made to obtain commercial statistics for this work, but without success.

(G) CARTERS CREEK.

WORK OF THE FISCAL YEAR ENDED JUNE 30, 1905.

Dredging, under contract with John L. Grim, of Philadelphia, Pa., at 19¼ cents per cubic yard, was begun on the outer bar October 19, 1904, and the work provided for under this contract was completed March 30, 1905. The work was much delayed owing to repairs to the plant, lack of coal, and the unusual severity of the winter. From December 9 to 23 no work was done, as the tug was undergoing repairs, and nothing was done during February owing largely to lack of coal. The total amount of material excavated under this contract was 25,984.9 cubic yards, which resulted in securing a channel 140 feet wide and 15 feet deep through the bar at the mouth of the creek, while for a length of 600 feet this channel is 170 feet wide.

A public hearing relative to proposed harbor lines for Carters Creek was held at Weems, Va., September 14, and a report upon the same was submitted September 23, 1904. These harbor lines, with slight modifications, were approved February 13, 1905. Monuments marking the harbor lines were set in April, 1905.

The total expenditure for the fiscal year was $7,191.97.

The entire work is now about one-fifth completed.

It is proposed to apply the available balance and the additional appropriation recommended to the dredging and maintenance of the channels and in the construction of the jetty for the preservation of the outer channel.

Money statement.

July 1, 1904, balance unexpended	$7,380.69
Amount allotted from appropriation for river and harbor improvements, act of June 13, 1902	2,984.18
	10,364.87
June 30, 1905, amount expended during fiscal year, for works of improvement	7,191.97
July 1, 1905, balance unexpended	[a] 3,172.90
Amount (estimated) required for completion of existing project	16,111.52
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	8,000.00

[a] Under act approved March 3, 1905, $28,000 was appropriated in a lump sum for the improvement of this creek in connection with certain other streams. Subsequent to the close of the fiscal year $9,116.65 from this appropriation was allotted for Carters Creek, Virginia, and this sum, together with the $3,172.90 above mentioned, is available for the improvement during the ensuing year. Nine hundred dollars was also allotted from this appropriation for surveys of the several streams, of which sum $148.20 was expended during the fiscal year, and $363.42 was outstanding, leaving $388.38 available for surveys.

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APPROPRIATIONS.

June 13, 1902 (allotted)	$10,471.83
March 3, 1905 (allotted)	9,116.65
Total	19,588.48

CONTRACT IN FORCE.

Contractor: John L. Grim, Philadelphia, Pa., for dredging.
Amount: 22,000 cubic yards, more or less.
Date of contract: February 4, 1904.
Approved: February 15, 1904.
Date for commencement: April 1, 1904.
Date for completion (including dredging in Rappahannock River and Milford Haven, Virginia): April 30, 1905; extended to June 15, 1905. Final payment made June 16, 1905.
Rate: 19¼ cents per cubic yard.

COMMERCIAL STATISTICS.

Receipts and shipments by water, 1904.

Articles.	Reported by Mr. W. McD. Lee, Irvington, Va.	Reported by Mr. H. E. Owen, Weems, Va.	Reported by W. A. Dameron & Bro., Weems, Va.
	Tons.	*Tons.*	*Tons.*
Coal	5,000	6,100	4,000
Farm produce	60,000	60,600	45,000
Grain	2,000	4,200	3,500
Ice	2,500	4,500	2,500
Iron	600	650	175
Lumber	30,000	30,000	5,000
General merchandise	200,000	205,000	210,000
Oysters	3,500	7,400	72,000
Railroad ties	2,000	1,400	2,000
Tobacco	1,000	950	625
Wood	4,000	3,200	3,100
Flour	7,000	7,300	4,200
Canned goods		4,500	5,500
Guano	25,000	52,400	30,000
Oils			2,000
Brick	2,500	2,500	1,200
Fish for guano	12,050	12,050	6,625
Total	357,150	402,750	397,425

Arrival and departure of vessels, 1904.

Class.	Reported by Mr. W. McD. Lee.		Reported by Mr. H. E. Owen.		Reported by W. A. Dameron & Bro.	
	Number.	Tonnage.	Number.	Tonnage.	Number.	Tonnage.
Steam:						
Drawing 10 feet or more	1,600	160,000	810	97,200	660	528,000
Drawing less than 10 feet	7,600	76,000	3,756	18,780	2,800	210,000
Sail:						
Drawing 10 feet or more					60	8,400
Drawing less than 10 feet	16,000	160,000	7,800	390,000	7,300	146,000
Barges, flatboats, etc					125	100,000
Total	25,200	396,000	12,366	505,980	10,945	992,400

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K 6.

IMPROVEMENT OF NOMINI CREEK, VIRGINIA.

WORK OF THE FISCAL YEAR ENDED JUNE 30, 1905.

Under date of October 13, 1904, proposals were invited by public advertisement for dredging in Nomini Creek under the same contract, but at a separate price, with dredging in Potomac River below Washington, D. C. The proposals were opened November 2, 1904, and the contract was awarded to the lowest bidder, the Maryland Dredging and Contracting Company, of Baltimore, Md., at 15 cents per cubic yard.

Dredging under this contract was begun March 16, 1905, and prosecuted continuously, except for delays due to accidents to the plant, incident to work of this character, until May 8, 1905, when the work provided for under the contract was completed, and the channel from White Point out was restored to its full projected dimensions. The total amount of material excavated under this contract was 15,138.2 cubic yards, and the cost of this and the incidental work connected with it was $2,733.75. No other field work was done during the fiscal year.

The entire work is now about one-half completed.

It is proposed to apply the available balance and the additional appropriation recommended to the construction of the jetties and the maintenance of the channel by dredging.

An appropriation of less than $6,000 can not be economically expended at this locality.

Money statement.

July 1, 1904, balance unexpended		$2,733.75
Amount appropriated by river and harbor act approved March 3, 1905		4,000.00
		6,733.75
June 30, 1905, amount expended during fiscal year, for maintenance of improvement		2,497.62
July 1, 1905, balance unexpended		4,236.13
July 1, 1905, outstanding liabilities		9.05
July 1, 1905, balance available		4,227.08
July 1, 1905, amount covered by uncompleted contracts		227.08
Amount (estimated) required for completion of existing project		31,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$8,000.00	
For maintenance of improvement	2,000.00	
		10,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

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APPROPRIATIONS.

May 3, 1873	$10,000	September 19, 1890	$5,000
June 23, 1874	6,000	July 13, 1892	10,000
March 3, 1875	5,000	August 18, 1894	5,000
March 5, 1879	2,500	June 3, 1896	2,500
June 14, 1880	5,000	March 3, 1899	10,000
March 3, 1881	2,000	March 3, 1905	4,000
August 2, 1882	2,000		
August 11, 1888	5,000	Total	74,000

CONTRACT IN FORCE.

Contractor: Maryland Dredging and Contracting Company, of Baltimore, Md., for dredging.
Amount: 14,000 cubic yards.
Date of contract: November 18, 1904.
Approved: December 13, 1904.
Date for commencement: January 21, 1905.
Date for completion (including dredging in lower Potomac River): October 21, 1905.
Rate: 15 cents per cubic yard.

COMMERCIAL STATISTICS.

Receipts and shipments by water, 1904.

[Furnished by Mr. J. L. Healy, Templeman Crossroads, Va.]

Articles.	Quantity.	Articles.	Quantity.
	Tons.		*Tons.*
Coal	10	Oysters	1,500
Farm produce	1,500	Railroad ties	500
Grain	1,000	Wood	3,000
Iron	10	Flour	75
Lumber	1,015		
General merchandise	500	Total	9,110

Arrival and departure of vessels, 1904.

	Number.	Tonnage.
Steam, drawing less than 10 feet	4	200
Sail, drawing less than 10 feet	30	2,000
Barges, flatboats, etc	4	300
Total	38	2,500

It is reported that the improvement made thus far has been of great benefit to navigation.

K 7.

IMPROVEMENT OF RAPPAHANNOCK RIVER, VIRGINIA.

WORK OF THE FISCAL YEAR ENDED JUNE 30, 1905.

Dredging at Spottswood bar, under contract with John L. Grim, of Philadelphia, Pa., which was in progress at the close of the last

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fiscal year, was continued to October 1, 1904, when the contractor withdrew his grapple dredge from this work and transferred the same to Carters Creek.

Proposals for additional dredging at Fredericksburg and Spottswood bars, under an allotment from the appropriation of April 28, 1904, were opened July 11, 1904, and the contract was awarded to the lowest bidder, John L. Grim, of Philadelphia, Pa., at 33 cents per cubic yard, and on November 8, 1904, two supplemental contracts were made with Mr. Grim, whereby the use of the hydraulic method of dredging was permitted under his two contracts then in effect.

The hydraulic dredge arrived at Spottswood bar October 11, 1904, but owing to a lack of pontoons no work was undertaken until December, when the dredge was operated but three days. The failure to prosecute the work was due to leakage in the pump, miscellaneous repairs to the plant, shortage of coal, and ice in the river. After working nine days in January, 1905, dredging was suspended January 14 because of ice in the river, and was not resumed until March 18. On April 13, 1905, the contract of February 4, 1904, was completed, and work was begun under contract of July 22, 1904. On June 7, 1904, a channel 100 feet wide and 10 feet deep had been completed through Spottswood bar, except the upper 3,000 feet, which was 10 feet deep and 75 feet wide, and the dredge was taken to Fredericksburg bar, where dredging was commenced June 22 and was in progress at the end of the fiscal year.

Statement of dredging done during the fiscal year.

	Contract of Feb. 4, 1904.	Contract of July 22, 1904.
	Cubic yds.	*Cubic yds.*
Spottswood bar	32,920	4,800
Fredericksburg bar		95
Total	32,920	4,895
Price per cubic yard	$0.29½	$0.33

Repairing dikes was begun, by hired labor and use of the United States plant, on July 1, 1904, and continued until May 9, 1905, when all the repairs which were practicable with the funds available were completed, and on May 12 the plant was transferred to York River. In all about 210 linear feet of new dike were constructed and 4,800 linear feet of old dike were repaired during the fiscal year.

The total expenditure for the fiscal year was $24,964.27, of which $15,204.48 was applied to dredging under contract of February 4, 1904, $1,609.42 to dredging under contract of July 22, 1904, and $8,150.37 to dike construction and repair.

The entire project is now about 50 per cent completed.

During the year there were three freshets, rising to a height of about 8 feet above low tide at Fredericksburg and to about 6 feet at Spottswood.

MAINTENANCE OF IMPROVEMENT.

Fredericksburg bar is near the head of tidewater, and new deposits of sand are formed by each recurring freshet to such an extent that

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redredging is necessary about every year to maintain the channel in a navigable condition. The cost of removing these deposits is about $7,500 per annum.

Some of the old timber dikes have suffered greatly from decay, combined with the effect of ice and freshets, and although several of those which were in the worst condition have recently been repaired, there remains considerable repair work to restore all the dikes to satisfactory condition.

It is proposed to apply the available balance and the additional appropriation recommended to the dredging and maintenance of the channels, and the repair and construction of dikes, and to the survey required by law.

Money statement.

July 1, 1904, balance unexpended		$36,735.41
Amount appropriated by river and harbor act approved March 3, 1905		40,000.00
		76,735.41
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$1,500.00	
For maintenance of improvement	23,464.27	
		24,964.27
July 1, 1905, balance unexpended		51,771.14
July 1, 1905, outstanding liabilities		550.00
July 1, 1905, balance available		51,221.14
July 1, 1905, amount covered by uncompleted contracts		15,737.00
Amount (estimated) required for completion of existing project		49,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$20,000.00	
For maintenance of improvement	10,000.00	
		30,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

APPROPRIATIONS.

March 3, 1871	$15,000	August 11, 1888 ($15,000, of which $3,000 was for Urbana)	$12,000
June 10, 1872	15,000	September 19, 1890	15,000
March 3, 1873	15,000	July 13, 1892	20,000
June 23, 1874	7,000	August 18, 1894	10,000
March 3, 1875	5,000	June 3, 1896	8,000
August 14, 1876	10,000	March 3, 1899	15,000
August 18, 1878	13,500	June 13, 1902	25,000
March 3, 1879	10,000	April 28, 1904 (allotted)	25,000
June 14, 1880	25,000	March 3, 1905	40,000
March 3, 1881	15,000	Total	357,500
August 2, 1882	17,000		
July 5, 1884	20,000		
August 5, 1886	20,000		

CONTRACTS IN FORCE.

Contractor: John L. Grim, of Philadelphia, Pa., for dredging.
Amount: 50,000 cubic yards.
Date of contract: February 4, 1904.

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Approved: February 15, 1904.
Date for commencement: April 1, 1904.
Date for completion (including dredging in Carters Creek and Milford Haven, Va.): April 30, 1905. (Extended to June 15, 1905; work at this locality was completed April 13, 1905; final payment was made June 16, 1905.)
Rate: 29¾ cents per cubic yard.

Contractor: John L. Grim, of Philadelphia, Pa., for dredging.
Amount: 52,000 cubic yards.
Date of contract: July 22, 1904.
Approved: August 10, 1904.
Date for commencement: September 14, 1904.
Date for completion: April 30. (Extended to July 31, 1905.)
Rate: 33 cents per cubic yard.

COMMERCIAL STATISTICS.

[Furnished by the city council and Business Men's Association of Fredericksburg, Va.]

Articles.	Quantity.	Articles.	Quantity.
	Tons.		*Tons.*
Passengers and baggage	8,151	Oysters	2,250
Apples	100	Railroad ties	109,650
Coal	8,650	Cattle	340
Sumac	300	Tobacco	100
Farm produce	31,382	Wood	24,908
Bricks	2,000	Flour	6,375
Grain	28,271	Hay and straw	950
Ice	1,560	Fish	1,300
Manufactures	2,810	Fertilizers	19,730
Canned goods	4,975	Pickles	2,500
Lumber	118,345		
General merchandise	32,420	Total	395,202

Arrival and departure of vessels, 1904.

Steam:	
Drawing 10 feet or more	1,280
Drawing less than 10 feet	760
Sail:	
Drawing 10 feet or more	1,639
Drawing less than 10 feet	695
Barges, flatboats, etc	960
Total	5,334

It is reported that the work done on this improvement has greatly reduced freight rates, both by rail and water.

K 8.

IMPROVEMENT OF URBANA CREEK, VIRGINIA.

WORK OF THE FISCAL YEAR ENDED JUNE 30, 1905.

An examination of the channels was made, during the progress of which monuments were set to mark the harbor lines, at a total cost of $98.49. This was the only field work undertaken during the year.

The entire work is now about one-third completed.

As to further work on the project, see the current summary.

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Money statement.

Amount appropriated by river and harbor act approved March 3, 1905	$10,000.00
June 30, 1905, amount expended during fiscal year, for works of improvement	98.49
July 1, 1905, balance unexpended	9,901.51
Amount (estimated) required for completion of existing project	26,500.00

APPROPRIATIONS.

March 3, 1879	$5,000	July 13, 1892	$3,000
June 14, 1880	2,500	August 18, 1894	3,000
March 3, 1881	4,000	June 3, 1896	3,000
August 2, 1882	4,000	March 3, 1899	3,000
August 11, 1888 (included in an appropriation of $15,000 for Rappahannock River)	3,000	March 3, 1905	10,000
September 19, 1890	3,000	Total	43,500

COMMERCIAL STATISTICS.

Receipts and shipments by water, 1904.

Articles.	Reported by Mr. F. A. Bristow.	Reported by Mr. J. D. Gressitt.	Reported by Mr. W. H. Ryland.
	Tons.	*Tons.*	*Tons.*
Coal	900	1,000	9,000
Farm produce	125,500	145,000	160,000
Grain	20,000	19,000	23,000
Ice	200	150	15,000
Iron	800	875	800
Lumber	170,000	201,000	220,000
General merchandise	350,000	375,000	400,000
Oysters	100,000	120,000	120,000
Railroad ties	25,000	31,000	35,000
Wood	100,000	115,000	120,000
Flour	150,000	16,500	15,000
Guano		12,000	13,000
Fertilizer	10,000		
Total	1,052,400	1,036,525	1,130,800

Arrival and departure of vessels, 1904.

Class.	Reported by Mr. F. A. Bristow.		Reported by Mr. J. D. Gressitt.		Reported by Mr. W. H. Ryland.	
	Number.	Tonnage.	Number.	Tonnage.	Number.	Tonnage.
Steam:						
Drawing 10 feet or more	400	250	450	250	700	250
Drawing less than 10 feet	1,200	5-125	1,250	5-150	1,300	5-150
Sail:						
Drawing 10 feet or more	500	50-200	450	80-200	300	80-200
Drawing less than 10 feet	3,600	5-120	3,900	5-150	3,600	5-150
Barges, flatboats, etc	200	50-150	250	50-200	300	50-200

These statistics are not regarded as entirely correct.

A daily steamer line running from Carters Creek, or Irvington, to Urbana was established in 1896. It is reported that there have recently been established two new steamboat lines from Fredericksburg, Va., to this creek; that the

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Weems Steamboat Company sends two steamers a week into the creek now, and that a line of steamers between Norfolk and Fredericksburg makes daily trips in and out of the creek. The work done on this improvement has greatly reduced freight rates and permitted the use of larger vessels.

K 9.

IMPROVEMENT OF HARBOR AT MILFORD HAVEN, VIRGINIA.

WORK OF THE FISCAL YEAR ENDED JUNE 30, 1905.

Dredging, under contract with John L. Grim, of Philadelphia, Pa., was begun April 25, 1905, and prosecuted continuously, except for a few delays incident to this class of work, until June 7, 1905, when the work specified was completed.

Under this contract a total of 15,305.4 cubic yards of material was excavated from the inner bar, completing the channel through the same to the full projected dimensions. An examination of the channel through the outer bar showed that the full width and depth had been maintained and that no redredging of this channel was required.

The approved project is hence entirely completed except a small amount of miscellaneous office work.

The amount expended during the fiscal year was $3,788.28, which was all applied to dredging and other work incident thereto.

The work projected being completed, no further appropriation is asked.

Money statement.

July 1, 1904, balance unexpended	$8,814.75
June 30, 1905, amount expended during fiscal year, for works of improvement	3,788.28
July 1, 1905, balance unexpended	5,026.47

APPROPRIATIONS.

March 3, 1899	$12,500.00
June 13, 1902	5,000.00
Total	17,500.00
Amount of judgment recovered	3,032.97
Total	20,532.97

CONTRACT IN FORCE.

Contractor: John L. Grim, Philadelphia, Pa., for dredging.
Amount: 13,500 cubic yards, more or less.
Date of contract: February 4, 1904.
Approved: February 15, 1904.
Date for commencement: April 1, 1904.
Date for completion (including dredging in Carters Creek and Rappahannock River, Virginia): April 30, 1905. Time limit for completion of contract extended to June 15, 1905. Work at this locality was completed June 7, 1905.
Rate: 19¼ cents per cubic yard.

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COMMERCIAL STATISTICS.

[Furnished by Baltimore, Chesapeake and Atlantic Railway Company.]

Receipts and shipments by water, 1904.

Articles.	Quantity.	Articles.	Quantity.
	Tons.		*Tons.*
Coal	15	Mill products	121
Farm produce	265	Fertilizer	40
Grain	50	Live stock	35
Ice	10	Fish	133
Wood	4	Crabs	118
General merchandise	946	Oysters	15,995
Flour	244	Calves	50
Lumber	11		
Iron	84	Total	18,071

K 10.

IMPROVEMENT OF JAMES RIVER, VIRGINIA.

WORK OF THE FISCAL YEAR ENDED JUNE 30, 1905.

During the fiscal year work has been in progress under a contract with J. Clements Shafer, approved March 4, 1903. The quantities of work done are as follows:

Dredging, 147,114.42 cubic yards, at 28 cents	$41,192.04
Rock excavation, 4,692.82 cubic yards, at $5	23,464.10
Transporting material:	
31,192.60 cubic yards, at 16 cents	4,990.82
118,267.74 cubic yards, at 18 cents	21,288.19
Total	90,935.15

The above work advanced the contract from 35 per cent completed at the beginning to 73 per cent completed at the close of the fiscal year.

From a comparison of contract unit prices with those upon which the original estimate of cost was based, it seems reasonable to conclude that the execution of the entire project has advanced pro rata with the expenditures, ex maintenance, and that it is now 40 per cent completed.

It is proposed to apply the available funds and the sum recommended as a profitable expenditure for the ensuing fiscal year to the development of the projected channel and to the turning basin, as required by law. Work will be done mainly above the city line of Richmond and at Dutch Gap, and mainly on the following guiding lines:

To procure in the upper part a depth equal to that in the lower before entering upon a general deepening.

To keep rock excavation somewhat in advance of dredging.

To make timely repairs of existing works in order to prevent injury to the channel by their inefficiency.

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Money statement.

July 1, 1904, balance unexpended	$243,879.58
Amount appropriated by river and harbor act approved March 3, 1905	200,000.00
	443,879.58
June 30, 1905, amount expended during fiscal year, for works of improvement	110,530.74
July 1, 1905, balance unexpended	333,348.84
July 1, 1905, outstanding liabilities	1,245.00
July 1, 1905, balance available	332,103.84
July 1, 1905, amount covered by uncompleted contracts	85,113.00
Amount (estimated) required for completion of existing project	3,692,443.15
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905 Submitted in compliance with requirements of sundry civil act of June 4, 1897.	300,000.00

APPROPRIATIONS.

July 11, 1870	$50,000	July 5, 1884	$75,000
March 3, 1871	50,000	August 5, 1886	112,500
June 8, 1872	50,000	August 11, 1888	225,000
March 3, 1873	75,000	September 19, 1890	200,000
June 23, 1874	50,000	July 13, 1892	200,000
March 3, 1875	50,000	August 18, 1894	100,000
August 14, 1876	60,000	June 3, 1896	120,000
June 18, 1878	70,000	March 3, 1899	150,000
March 3, 1879	75,000	June 13, 1902	300,000
June 14, 1880	75,000	March 3, 1905	200,000
March 3, 1881	60,000		
August 2, 1882	75,000	Total	2,422,500

CONTRACT IN FORCE.

Contractor: J. Clements Shafer, of Richmond, Va., for dredging, removing rock, constructing, repairing, and degrading jetties, and constructing dikes in James River, Virginia.

Date of contract: February 4, 1903.

Approved: March 4, 1903.

Date for commencement: April 5, 1903.

Date for completion: April 5, 1905. Time limit for completion of contract has been waived.

Amount and rate: Clearing and enlarging channel, 164,620 cubic yards of earth excavation, at 28 cents per cubic yard, cobblestone 28 cents per cubic yard, soft rock 28 cents per cubic yard, and hard rock $5 per cubic yard; degrading jetties, earth 28 cents per cubic yard, hard rock $3.50 per cubic yard; conveying 128,000 cubic yards at 16 cents per cubic yard, transporting 6,226 cubic yards at 9½ cents per cubic yard, and transporting 102,000 cubic yards at 18 cents per cubic yard; dike and jetty construction and jetty repairs, 5,399 linear feet of pine piles 12 to 35 feet long at 27 cents per linear foot in place, 2,441 linear feet of oak piles 16 to 25 feet long at 45 cents per linear foot in place, 1,068 linear feet of oak piles 30 to 35 feet long at 45 cents per linear foot in place, 23,728 feet B. M. white-oak wales at $48 per 1,000 feet B. M. in place, 4,500 feet B. M. white-oak string pieces at $48 per 1,000 feet B. M. in place, 93,384 feet B. M. pine sheet piling at $34.50 per 1,000 feet B. M. in place, and 40,500 feet B. M. oak sheet piling at $48 per 1,000 feet B. M. in place.

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COMMERCIAL STATISTICS.

Receipts and shipments by water, 1904.

Articles.	Port of Richmond, Va.			Points on James River other than Richmond, Va.			Total tonnage.
	Receipts.	Shipments.	Amount.	Receipts.	Shipments.	Amount.	
Asphalt blocks, brick, etc	30,884	.....	30,884	2,380	15,315	17,695	48,579
Coal	4,086	.....	4,086	3,550	175	3,725	7,761
Cement, lime, etc	44,426	.....	44,426	697	.....	697	45,123
Cattle	.....	.....	.....	68	38	106	106
Cord wood	9,891	3,330	13,221	1,201	48,162	49,363	62,584
Fertilizer and fertilizer material	7,951	3,980	11,931	2,773	32	2,805	14,736
Flour	.....	.....	.....	184	16	200	200
Fish and oysters	1,618	.....	1,618	61	160	221	1,839
Groceries	.....	.....	.....	2,755	.....	2,755	2,755
Grain	1,207	.....	1,207	320	2,024	2,344	3,551
Hardware	.....	.....	.....	8,477	30	8,507	8,507
Hay, straw, etc	134	.....	134	357	940	1,297	1,431
Hogs	.....	.....	.....	12	74	86	86
Horses	.....	.....	.....	41	60	101	101
Ice	.....	.....	.....	410	.....	410	410
Lumber	44,455	177	44,632	825	138,315	139,140	183,772
Oil	29,144	.....	29,144	101	.....	101	29,245
Peanuts	.....	.....	.....	24	1,495	1,519	1,519
Potatoes	.....	.....	.....	34	171	205	205
Railroad ties	.....	6,536	6,536	.....	13,071	13,071	19,607
Salt	1,850	.....	1,850	1,310	.....	1,310	3,160
Sand	1,845	.....	1,845	.....	.....	.....	1,845
Unclassified freight	49,239	32,906	82,145	4,464	315	4,779	[a] 86,924
Total	226,680	46,929	273,609	30,044	220,398	250,437	524,046

[a] Includes estimated commerce for Scotland wharf, assumed to be the same as for the calendar year of 1902. Three written requests were made for the information, but no reply was received.

Arrival and departure of vessels, 1904, port of Richmond, Va.

	Number.	Tonnage.
Steam, drawing 5 to 16 feet	1,062	940,778
Sail, drawing 4 to 17 feet	246	45,104
Barges, etc	546	159,118
Total	1,854	1,145,000

Returns of arrivals and departures of vessels for points on James River below Richmond, Va., were too incomplete for report.

K 11.

PROTECTION OF JAMESTOWN ISLAND, VIRGINIA.

WORK OF THE FISCAL YEAR ENDED JUNE 30, 1905.

Sealed proposals, invited under date of July 16, 1904, were opened August 15, 1904. A contract was made with Richard Parrott, of Newburgh, N. Y., for constructing shore protection, October 7, 1904, approved by the Chief of Engineers, United States Army, October 29, 1904. Work under the contract was begun November 18, 1904, and was carried on continuously, except when prevented by unfavor-

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able weather, from December 15, 1904, to January 4, 1905, inclusive, and when the shore was covered with heavy ice, from February 2 to February 20, 1905, inclusive.

The work under contract, when completed, will protect about 1,125 linear feet of bank. The part of it accomplished during the past fiscal year consists of removing 95 per cent of the shore protection of 1895 from the bank to be protected, removing parts of the jetties from the space to be covered by the protection wall, and constructing about 95 per cent of the oak buttress. The last named is the most difficult part of the work.

In addition to the above, about 65 per cent of the stone formerly constituting the protection of 1895 was reduced to backing and about 700 concrete blocks molded. As neither the blocks nor the backing have yet been laid in place—a prerequisite to their being paid for—they are omitted from the following statement of extent and cost of work completed during the fiscal year.

Statement of extent and cost of work.

294.76 cubic yards stone protection of 1895 removed, at 40 cents	$117.90
60 linear feet jetties of 1895 removed, at $2	120.00
1,873.5 linear feet round oak piles, driven and cut off, at 30 cents	562.05
33,830.55 feet B. M. sheet piling, driven, sawed off, and attached to wales, at $60	2,029.83
4,712 feet B. M. wales, framed and bolted in place, at $60	282.72
589.6 feet B. M. string pieces, framed and bolted in place, at $60	35.38

Money statement.

July 1, 1904, balance unexpended	$15,261.92
June 30, 1905, amount expended during fiscal year, for works of improvement	3,546.27
July 1, 1905, balance unexpended	11,715.65
July 1, 1905, outstanding liabilities	135.17
July 1, 1905, balance available	11,580.48
July 1, 1905, amount covered by uncompleted contracts	10,503.00

APPROPRIATIONS.

August 18, 1894	$10,000
June 8, 1896	15,000
April 28, 1904	15,000
Total	40,000

CONTRACT IN FORCE.

Contractor: Richard Parrott, of Newburgh, N. Y., for constructing shore protection.

Date of contract: October 7, 1904.

Approved: October 29, 1904.

Date for commencement: December 15, 1904.

Date for completion: September 15, 1905.

Amount and rate: Removing 335 cubic yards stone protection of 1895, at 40 cents per cubic yard; removing 60 linear feet of jetties of 1895, at $2 per linear

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foot; for grading 1,750 cubic yards, including embankment only, at 30 cents per cubic yard; for 650 cubic yards broken stone backing made from stone furnished by the United States, at 70 cents per cubic yard; for 575 cubic yards broken stone backing for which stone is furnished by contractor, at $2.70 per cubic yard; for 681 cubic yards concrete blocks laid in place, at $9 per cubic yard; for 20 cubic yards monolith concrete laid in place, at $9 per cubic yard; for 1,860 linear feet round oak piles driven and cut off, at 30 cents per linear foot; for 41,652 feet B. M. 3-inch oak sheet piling, driven, sawn off, and attached to wales, at $60 per M feet B. M.; for 4,872 feet B. M. white-oak wales, framed and bolted in place, at $60 per M feet B. M.; for 2,318 feet B. M. white-oak string pieces, framed and bolted in place, at $60 per M feet B. M.; for 370 steel cramps, leaded in place, at $1 each; for 20 cubic yards riprap stone, in place, at $2.50 per cubic yard.

K 12.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

WORK OF THE FISCAL YEAR ENDED JUNE 30, 1905.

Sunken raft in Potomac River near Swann Point, Maryland.—About the middle of July, 1904, this raft sank while being towed up the river, and was abandoned after an unsuccessful attempt to tow it ashore.

The raft was reported to this office as an obstruction to navigation on August 26, 1904, and it was ascertained that it had been legally abandoned by its owners.

On August 27 these facts were communicated to the Chief of Engineers, and by indorsement of August 30, 1904, an allotment of $50 was made from the indefinite appropriation made by section 20 of the river and harbor act of March 3, 1899, for an examination of the sunken raft. The examination was made on September 6 and 7 and it was found that there were about 300 piles in the raft, which had sunk in water 24 feet deep. The free ends of some of the piles projected above the water surface and constituted a dangerous obstruction to navigation. The piles were at once buoyed, and a report upon the examination was submitted September 9, 1904, recommending a further allotment of $600 for the removal of the obstruction. This allotment was made by indorsement of September 16, 1904.

The removal of the wreck was delayed mainly owing to the failure of the owner of a derrick boat, which it was proposed to use on this work, to keep his agreement as to the time at which his boat would be available and subsequently to his final refusal to hire his boat for the work.

On November 17 the tug which had last worked upon the raft was procured and sent to the scene of the wreck, the intention being to break up the raft with dynamite and sink the buoyant piles with sand in bags. The buoy which was left had disappeared and no trace of the piles could be found.

It was learned from oyster dredgers working in the vicinity that the piles had become water-logged and had sunk to the bottom, where they no longer constitute an obstruction to navigation and will soon be destroyed by the teredo.

The total expenditure in connection with this work was $97.33.

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Wreck of scow in Potomac River at Washington, D. C.—This scow, which was loaded with old iron, while being towed up the river collided with the fenders of the Long Bridge and sank in the Virginia channel of Potomac River a short distance above the bridge. The scow sank in water 22 feet deep and had a depth of 16 feet over it.

The wreck was reported to this office as an obstruction to navigation on September 9, 1904, and it was ascertained that it had been legally abandoned by its owners.

On September 13, 1904, these facts were communicated to the Chief of Engineers, with an estimate of the cost of removing the wreck, and by indorsement of September 16, 1904, an allotment of $300 was made from the indefinite appropriation made by section 20 of the river and harbor act of March 3, 1899, for its removal.

During November, 1904, the wreck was removed. A portion of the iron was first removed by a diver and use of a derrick boat, after which it was jacked up between two scows, floated, and taken to Easbys Point, District of Columbia.

Under authority of the Chief of Engineers, dated February 17, 1905, the scow was repaired, and is in use on the Potomac River improvement. The other articles recovered from the wreck were sold under public notice of June 5, 1905, this method being authorized by the Chief of Engineers, and the proceeds, amounting to $43.14, were deposited in the Treasury.

The work was done by hired labor, at a total cost of $300.

K 13.

ESTABLISHMENT OF HARBOR LINES IN CARTERS CREEK AT WEEMS, VIRGINIA.

WEEMS, VA., *April 14, 1904.*

DEAR SIR: We want to establish harbor lines in the port of Weems.

The entrance to this place is very narrow, although, except at one place, we have 12 to 14 feet of depth. Wharves are being built and more contemplated, and as there is no restriction as to how far they go out, they go out to the channel and thereby injure our harbor. Please let us know if you can help us to protect our commerce by establishing harbor lines.

Respectfully, yours,

H. E. OWEN.

SECRETARY OF WAR.

[Sixth indorsement.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS, U. S. ARMY,
Washington, February 10, 1905.

Respectfully returned to the Secretary of War.

This is a request for establishment of harbor lines at the port of Weems, Carters Creek, Virginia.

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The matter has been referred for consideration by the engineer officers in local charge, who have carefully investigated the subject, including the making of a special survey of the locality and the holding of a public hearing.

From reports herewith it appears that Carters Creek is a shipping point of some importance and a valuable harbor of refuge, which should be preserved from encroachment by wharves built from the shore.

The lines selected by the district officer and approved at the public hearing are delineated and described on the accompanying tracing.[a]

I recommend that these lines be approved by the Secretary of War, and that he place his approval on the tracing[a] which has been prepared for his signature.

A. MACKENZIE,
Brig. Gen., Chief of Engineers, U. S. Army.

NOTE.—The lines referred to above and shown on the map mentioned were approved by the Secretary of War February 13, 1905, the approval being noted on the map.

REPORT OF LIEUT. COL. SMITH S. LEACH, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Washington, D. C., December 7, 1904.

GENERAL: In compliance with the requirements of the second indorsement[a] on letter of Mr. F. C. Warman, dated September 20, 1904, relative to the establishment of harbor lines at Carters Creek, Va., I have the honor to submit the following report.

Appended is a modified description of the harbor lines to comply with the requirements of the second indorsement. The tracing[a] has been modified to correspond with this description, and a blueprint[a] is inclosed showing the lines as originally proposed, that the records may be preserved intact.

* * * * * * *

HARBOR LINES FOR THE PORT OF WEEMS.

LEFT BULKHEAD LINE.

Commencing at a point marked "A" on the map, which point is a monument marked "CHL–A," located on Crab Point; thence on straight line AB S. 44° W. 300 feet to point B (said line AB is perpendicular to line AA". A" is a monument marked "CHL–A"" at Weems); thence on straight line BC S. 27° W. 330 feet to point C; thence on straight line CD S. 10° W. 500 feet to point D.

LEFT WHARF LINE.

Commencing at a point marked *e* on the map, whence point A, above described, bears S. 44° W., and is distant 400 feet; thence on straight line *ea* S. 70° 34′ W. 447.2 feet to point *a*, whence the left wharf line is parallel to and 200 feet channelward from the left bulkhead line above described.

RIGHT BULKHEAD LINE.

Commencing at a point marked A′ on the map, whence a point on line AA" 300 feet southeasterly from point A" bears S. 44° W. and is distant 500 feet; thence on straight line A′B′ S. 44° W. 1,180 feet to point B′; thence on straight line B′D′ S. 10° W. 700 feet to point D′.

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[a] Not printed.

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RIGHT WHARF LINE.

The right wharf line is parallel to and 200 feet channelward from the right bulkhead line.

HARBOR LINES NEAR CARTERS CREEK FISH GUANO COMPANY'S WHARF.

LEFT BULKHEAD LINE.

Commencing at a point marked F on the map, whence a monument marked "CHL F–G" bears N. 38° E. and is distant 600 feet, and point A, above described, bears S. 38° W.; thence on straight line F–G S. 38° W. 500 feet to point G; thence on straight line GH S. 2° E. 500 feet to point H.

LEFT WHARF LINE.

The left wharf line is parallel to and 100 feet channelward from the left bulkhead line.

Very respectfully, your obedient servant,

SMITH S. LEACH,
Lieut. Col., Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

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APPENDIX L.

IMPROVEMENT OF NORFOLK HARBOR, VIRGINIA, AND ITS APPROACHES, AND OF CERTAIN WATERWAYS AND HARBORS IN SOUTHEASTERN VIRGINIA AND NORTHEASTERN NORTH CAROLINA.

REPORT OF CAPT. E. EVELETH WINSLOW, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1905, WITH OTHER DOCUMENTS RELATING TO THE WORK.

IMPROVEMENTS.

1. Harbor at Norfolk and its approaches, Virginia.
2. Western branch of Elizabeth River, Virginia.
3. Hampton Roads, Virginia.
4. Nansemond River, Virginia.
5. Pagan River, Virginia.
6. Appomattox River, Virginia.
7. Harbor at Cape Charles City, Virginia.
8. Waterway from Norfolk, Virginia, to the sounds of North Carolina.
9. Inland water route from Norfolk, Virginia, to Albemarle Sound, North Carolina.
10. Perquimans River, North Carolina.
11. Edenton Bay, North Carolina.
12. Roanoke River, North Carolina.
13. Removing sunken vessels or craft obstructing or endangering navigation.

ENGINEER OFFICE, UNITED STATES ARMY,
Norfolk, Va., July 20, 1905.

GENERAL: I have the honor to transmit herewith my annual report upon the works of river and harbor improvement, now in my charge here, for the fiscal year ended June 30, 1905.

Very respectfully, your obedient servant,

E. EVELETH WINSLOW,
Captain, Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

L 1.

IMPROVEMENT OF HARBOR AT NORFOLK AND ITS APPROACHES, VIRGINIA.

(A) GENERAL IMPROVEMENT.

During the fiscal year 1905 work was confined to redredging the Sewall Point channel, which forms the approach to the harbor.

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This was done under contract at the rate of 7.7 cents per cubic yard, scow measurement.

The redredging of the above-mentioned channel was commenced March 1, 1905, and to the close of the fiscal year 344,455 cubic yards, scow measurement, had been removed. Eight thousand feet in length of this channel was redredged for a width of 180 feet and 8,000 additional feet for a width of 135 feet. All this dredging was carried to a depth of 28 feet below mean low water.

The cost of the dredging and the attendant expenses were paid partly from a balance of an appropriation for improving the harbor and partly from an allotment made from the appropriation for emergency work by the act of April 28, 1904.

It is proposed to apply the unexpended balance to dredging in front of the piers at Pinner Point and in the eastern branch of Elizabeth River, Virginia, between the Norfolk and Western and Campostella bridges.

The amount estimated for the completion of the project will be expended in dredging at the last-named locality and at Berkley flats. As the material at Berkley flats is now known to be much harder than was anticipated when the estimate was made, it is not expected that the balance of the estimate will suffice for the completion of the project, which is now about 92 per cent completed.

Money statement.

July 1, 1904, balance unexpended		$21,050.55
Amount appropriated by river and harbor act approved March 3, 1905		40,000.00
Amount received from sale of property		1.61
Amount allotted from appropriation for maintenance of river and harbor improvements, act of April 28, 1904		30,000.00
		91,052.16
June 30, 1905, amount expended during fiscal year, for maintenance of improvement		[a] 26,281.84
July 1, 1905, balance unexpended		64,770.32
July 1, 1905, outstanding liabilities		2,670.92
July 1, 1905, balance available		62,099.40
July 1, 1905, amount covered by uncompleted contracts		21,029.33
Amount (estimated) required for completion of existing project		33,828.97
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$33,828.97	
For maintenance of improvement	23,945.59	
		57,774.56
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and o. section 7 of the river and harbor act of 1899.		

(B) HOSPITAL POINT.

Work on the removal of this point and the dredging of the areas on the north and south sides of it lying between the 25-foot contour of the harbor and a line 75 feet out from the established pierhead

[a] Expended from regular appropriation for maintenance in current fiscal year, $17,054.41.

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line was continued throughout the fiscal year. Dredging was carried to a depth of from 20 to 25 feet below mean low water over an area of 22 acres, 957,904 cubic yards of material being removed at a cost of 9¾ cents per cubic yard. At the end of the last fiscal year 216 feet of the sea wall across the point had been built, and this was extended 262 feet during the present fiscal year, completing the wall. The cost of demolishing the old sea wall and rebuilding the new one was $6,585.

The project is about two-thirds completed.

Money statement.

July 1, 1904, balance unexpended	$174,391.43
June 30, 1905, amount expended during fiscal year, for works of improvement	103,389.64
July 1, 1905, balance unexpended	71,001.79
July 1, 1905, outstanding liabilities	5,050.26
July 1, 1905, balance available	65,951.53
July 1, 1905, amount covered by uncompleted contracts	63,662.44

APPROPRIATIONS.

Improving harbor at Norfolk, Va.:	
August 14, 1876	$35,000.00
June 18, 1878	50,000.00
March 3, 1879	75,000.00
June 14, 1880	50,000.00
March 3, 1881	75,000.00
August 2, 1882	75,000.00
July 5, 1884	25,000.00
August 5, 1886	50,000.00
August 11, 1888	50,000.00
September 19, 1890	150,000.00
July 13, 1892	150,000.00
August 18, 1894	100,000.00
June 3, 1896	100,000.00
June 13, 1902	30,000.00
March 3, 1903	183,957.00
March 3, 1905	40,000.00
Allotment of November 23, 1904, from act of April 28, 1904, for "Emergencies in River and Harbor Works"	30,000.00
Improving Elizabeth River, Virginia:	
July 7, 1898	$360,000.00
Received from sale of property	1.61
Total	1,628,958.61
Amount turned into surplus fund of the Treasury from appropriation of July 7, 1898	483.58
Aggregate	1,628,475.03

CONTRACTS IN FORCE.

(A) *General improvement.*

With Coastwise Dredging Company, for dredging, dated January 26, 1905; approved March 7, 1905; work commenced March 1, 1905; date for expiration, October 31, 1905. Price, 7.7 cents per cubic yard, scow measurement.

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(B) *Hospital Point.*

With Sanford & Brooks Company, for dredging, etc., dated January 14, 1904; approved January 30, 1904; work commenced February 1, 1904; date for expiration, July 31, 1905. Prices: For dredging, 9¼ cents per cubic yard, scow measurement; for removing wharf, buildings, etc., and reconstructing same, $3,485; for demolishing sea wall and rebuilding same, $6,585; for removing trees, etc., $370; for repairing drives and walks, $250.

COMMERCIAL STATISTICS.

The following statistics relative to the commerce of the harbor at Norfolk, Va., during the calendar year 1904, were compiled from statements furnished by parties making shipments over this waterway:

Articles.	Quantity.	Value.	Articles.	Quantity.	Value.
	Tons.			*Tons.*	
Brick	16,100	$28,200.00	Ice	885	$4,756.00
Clay	23,400	5,850.00	Logs	209,593	369,344.00
Chemicals	91,500	681,000.00	Lumber	222,600	3,141,730.88
Coal	4,359,383	13,084,149.00	Pig iron	10,145	1,461,000.00
Coke	141,932	283,864.00	Miscellaneous	5,660,379	800,702,475.00
Fertilizer	30,000	600,000.00			
Grain	15,055	396,231.80	Total	10,780,972	820,708,600.68

Greatest draft vessel using channel during calendar year 1904 was 30 feet 4 inches.

L 2.

IMPROVEMENT OF WESTERN BRANCH OF ELIZABETH RIVER, VIRGINIA.

No operations were carried on during the fiscal year.
The project has been completed.

Money statement.

July 1, 1904, balance unexpended	$333.27
July 1, 1905, balance unexpended	333.27

APPROPRIATION.

June 3, 1896	$45,000

COMMERCIAL STATISTICS.

The following statistics, indicating the commerce of the river during the calendar year 1904, were compiled from statements furnished by shippers:

Articles.	Quantity.	Value.
	Tons.	
Logs and manufactured lumber	15,000	$90,000
Merchandise and produce	1,145,598	11,465,980
Copper ore	11,841	59,205
Total	1,173,439	11,615,185

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L 3.

IMPROVEMENT OF HAMPTON ROADS, VIRGINIA.

The work of dredging at this locality was continued until February 3, 1905, when the channel to be obtained under the adopted project was completed. In the present fiscal year the excavation amounted to 548,391 cubic yards of material, scow measurement, and the channel, which had been dredged to a depth of 30 feet at mean low water at the close of the last fiscal year, was widened 185 feet for 12,000 feet of its length and 140 feet for the balance of its length, 3,000 feet. The total yardage removed and deposited in obtaining a channel 500 feet wide and 30 feet deep at mean low water through the bar in the vicinity of Middle Ground light was 1,443,237, 264,594 cubic yards of which were paid for at the original contract price of 9 cents per cubic yard, scow measurement, and 1,178,643 cubic yards at the supplemental contract rate of 14½ cents per cubic yard, scow measurement.

It is expected that in the future a small annual appropriation will be necessary for the maintenance of this channel, especially at its upper end. The length of time that has elapsed since the completion of the channel has not been sufficient to enable an estimate to be made of the annual cost of maintenance.

The unexpended balance of the appropriation will be reserved for examinations from time to time of the channel and its vicinity.

Money statement.

July 1, 1904, balance unexpended	$112,551.90
June 30, 1905, amount expended during fiscal year, for works of improvement	110,923.32
July 1, 1905, balance unexpended	1,628.58

APPROPRIATIONS.

June 13, 1902	$10,000
March 3, 1903	215,000
Total	225,000

CONTRACT IN FORCE.

With Coastwise Dredging Company, for dredging, dated May 18, 1903; approved June 6, 1903; work commenced July 6, 1903; date of expiration, February 3, 1905. Price, 9 cents per cubic yard, scow measurement.

SUPPLEMENTAL CONTRACT.

With Coastwise Dredging Company, modifying provisions of above contract as to locality for dumping material, dated November 30, 1903; approved by Chief of Engineers, United States Army, December 15, 1903, and by Assistant Secretary of War, December 21, 1903. Price, 5½ cents per cubic yard, scow measurement, in addition to the 9 cents per cubic yard stipulated in the above-mentioned contract.

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COMMERCIAL STATISTICS.

The following statistics were compiled from statements of the shippers at Newport News, Va., and indicate the traffic by way of Hampton Roads, Virginia, during the calendar year 1904:

Articles.	Quantity.	Value.
	Tons.	
Coal	3,335,463	$9,808,899.50
Grain	36,249	869,976.00
Miscellaneous	837,069	68,384,500.00
Total	4,208,781	79,063,375.50

Greatest draft vessel using channel during calendar year 1904 was 31 feet.

L 4.

IMPROVEMENT OF NANSEMOND RIVER, VIRGINIA.

No work was done in the fiscal year 1905 nor were any expenditures made.

The existing project is about 50 per cent completed.

It is expected to apply the amount recommended to dredging a channel through shoals below the Western Branch of the river.

Expended for maintenance, fiscal year 1904, $9,266.85.

Money statement.

July 1, 1904, balance unexpended		$56.04
July 1, 1905, balance unexpended		56.04
Amount (estimated) required for completion of existing project		10,266.85
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$10,266.85	
For maintenance of improvement	1,000.00	
		11,266.85
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

APPROPRIATIONS.

March 3, 1873	$15,000	July 13, 1892	$10,000
March 23, 1874	10,000	August 18, 1894	10,000
March 3, 1875	5,000	June 3, 1896	5,000
March 14, 1876	5,000	March 3, 1899	5,000
June 18, 1878	2,000		
August 11, 1888	10,000	Total	87,000
September 19, 1890	10,000		

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COMMERCIAL STATISTICS.

The following statistics relative to the commerce of the Nansemond River, Virginia, during the calendar year 1904 were compiled from statement of parties making shipments over this stream:

Articles.	Quantity.	Value.
	Tons.	
Coal	1,000	$5,500
Manufactured lumber	9,080	151,000
Oyster shells	400	500
Miscellaneous	11,689	292,225
Total	22,119	449,225

L 5.

IMPROVEMENT OF PAGAN RIVER, VIRGINIA.

No work was done nor were any expenditures made during the fiscal year.

The act of March 3, 1905, contained the following provision affecting this improvement:

The Secretary of War may, in his discretion, expend the balance remaining to the credit of said improvement with a view to securing a channel width of not less than forty feet and such depth as may be obtained without exceeding said balance.

It is thought the balance available will be sufficient to secure a depth of 10 feet at mean low water over the width specified by the law, and it is proposed to expend the balance in obtaining a channel of these dimensions.

Money statement.

July 1, 1904, balance unexpended	$10,002.10
July 1, 1905, balance unexpended	10,002.10

APPROPRIATIONS.

June 14, 1880	$5,000
March 3, 1881	5,000
June 13, 1902	10,870
Total	20,870

COMMERCIAL STATISTICS.

The following statistics represent the commerce of Pagan River, Virginia, during the calendar year 1904:

Articles.	Quantity.	Value.
Peanuts (tons)	31,391	$2,823,650
Oysters (do)	1,785	16,000
Coal (do)	1,500	5,250
Miscellaneous (do)	50,352	3,776,400
Total (do)	85,028	6,621,300
Horses and mules (head)	100	30,000
Aggregate		6,651,300

The Old Dominion Steamship Company operates two steamers on this river as far as Smithfield Va., each making a round trip daily, except Sundays, from Norfolk, Va.

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L 6.

IMPROVEMENT OF APPOMATTOX RIVER, VIRGINIA.

(A) MAINTENANCE.

Freshets having caused the filling in of the channel dredged during the preceding fiscal year, the amount of $12,000 was provided for redredging it from the appropriation for emergency work in the act of April 28, 1904.

The work done consisted in the removal of 4,400 cubic yards of material, place measurement, at the contract price of 37 cents per cubic yard. Dredging was carried over a distance of 1,205 feet with a width of 40 feet to a depth of 12 feet at mean high water.

Upon the completion of the work of diverting the freshet water from the upper river, the channel of the lower or navigable part should have a channel of the projected width and depth and the amount estimated as needed " for works of improvement " should be provided for the purpose.

The available funds will be expended for maintenance of the improvement, the project for which is about 85 per cent completed.

Money statement.

July 1, 1904, balance unexpended	$4. 70
Amount appropriated by river and harbor act approved March 3, 1905	10, 000. 00
Amount allotted from appropriation for maintenance of river and harbor improvements, act of April 28, 1904	12, 000. 00
	22, 004. 70
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	599. 23
July 1, 1905, balance unexpended	21, 405. 47
July 1, 1905, outstanding liabilities	1, 465. 20
July 1, 1905, balance available	19, 940. 27
July 1, 1905, amount covered by uncompleted contracts	8, 534. 80
Amount (estimated) required for completion of existing project	48, 090. 00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:	
For works of improvement $48, 090. 00	
For maintenance of improvement 10, 000. 00	
	58, 090. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(B) AT PETERSBURG.

The only work done under the contract for this section was the building of the highway bridge. This was completed in November, 1904. Other work done was only for the benefit of the contractor in excavating a dammed basin so that an hydraulic pump might have water with which to lift the material.

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During the year the sum of $150 was expended in the purchase of a small additional section of land, and $300 for legal expenses connected with the purchase of this and other land.

Sufficient funds have been appropriated for all the work contemplated, if it can be performed at the present contract rates.

Money statement.

July 1, 1904, balance unexpended	$189,844.34
June 30, 1905, amount expended during fiscal year, for works of improvement	19,502.69
July 1, 1905, balance unexpended	170,341.65
July 1, 1905, outstanding liabilities	476.00
July 1, 1905, balance available	169,865.65
July 1, 1905, amount covered by uncompleted contracts	124,840.52

APPROPRIATIONS.

March 3, 1871	$50,000.00	June 3, 1896	$5,000.00
June 10, 1872	40,000.00	March 3, 1899	5,000.00
March 3, 1873	30,000.00	June 13, 1902	32,500.00
June 23, 1874	30,000.00	March 3, 1903	175,000.00
March 3, 1875	30,000.00	March 3, 1905	10,000.00
August 14, 1876	30,000.00	"Emergencies in River and Harbor Works:"	
June 18, 1878	30,000.00	June 6, 1900	5,000.00
March 3, 1879	20,000.00	April 28, 1904	12,000.00
June 14, 1880	20,000.00		
March 3, 1881	20,000.00	Total	673,330.00
August 2, 1882	35,000.00		
July 5, 1884	25,000.00	Repaid to appropriation for "Emergencies in River and Harbor Works"	331.70
August 5, 1886	18,750.00		
August 11, 1888	15,000.00		
September 19, 1890	15,000.00		
July 13, 1892	15,080.00	Aggregate	672,998.30
August 18, 1894	5,000.00		

CONTRACTS IN FORCE.

At Petersburg.

With Atlantic Dredging Company, for dredging and building embankments, dam, highway bridge, railroad bridge, piers, and flume, dated July 14, 1904; approved July 30, 1904; work commenced October 3, 1904; date for expiration, October 3, 1906. Prices: Section A, (*a*) 40 cents per cubic yard, measured in the cut; (*b*) 22 cents per cubic yard, measured in the cut; Section B, 40 cents per cubic yard, measured in the cut; Section C (*a*), 50 cents per cubic yard, measured in the fill; (*b*) 18 cents per cubic yard, measured in the fill; Section D, 18 cents per cubic yard, measured in the cut; rock for dam: $1.70 per gross ton for large, $1.70 per gross ton for medium, $1.90 per gross ton for crushed stone; railroad bridge, piers, and abutments, for concrete, $10 per cubic yard, measured in place; for coping, $20 per square yard of horizontal area; for fill behind abutments, 40 cents per cubic yard, measured in the fill; highway bridge, $14,000; flume, $2,000; revetment, $1.50 per square yard.

Maintenance.

With Atlantic Dredging Company, for dredging, dated February 1, 1905; approved February 16, 1905; work commenced June 5, 1905; date for expiration, July 15, 1905. Price: 37 cents per cubic yard, measured in place.

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COMMERCIAL STATISTICS.

The following statistics relative to the commerce of the Appomattox River, Virginia, during the calendar year 1904, were compiled from statement furnished by W. N. Mays, harbor master:

Articles.	Quantity.	Value.	Articles.	Quantity.	Value.
	Tons.			*Tons.*	
Coal	3,295	$21,455	Lumber	23,402	$280,020
Grain	119	3,850	Railroad ties	9,583	34,514
Fertilizer	2,743	34,430	General merchandise	1,500	140,770
Peanut hulls	396	1,980			
Peanuts	141	11,380	Total	42,337	510,424
Wood	1,158	2,525			

Vessels.

Class.	Number.	Average draft.	Average tonnage.
		Feet.	
Steam	572	7	100
Sail	126	9	100
Barges	184	9	350
Total	882		

L 7.

IMPROVEMENT OF HARBOR AT CAPE CHARLES CITY, VIRGINIA.

No work was done during the fiscal year, the expenditures being for incidentals in connection with future work.

The project is about 70 per cent completed. The balance unexpended and any future appropriations will be applied to dredging and jetty construction.

Money statement.

July 1, 1904, balance unexpended		$1.53
Amount appropriated by river and harbor act approved March 3, 1905		25,000.00
		25,001.53
June 30, 1905, amount expended during fiscal year, for works of improvement		29.01
July 1, 1905, balance unexpended		24,972.52
Amount (estimated) required for completion of existing project		42,340.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905		42,340.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

APPROPRIATIONS.

September 19, 1890	$25,000
July 13, 1892	10,000
March 3, 1899	20,000
June 13, 1902	20,000
March 3, 1905	25,000
Total	100,000

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COMMERCIAL STATISTICS.

The following statement represents the commerce of the harbor at Cape Charles City, Va., during the calendar year 1904, and was prepared from statements supplied by lines and individuals handling the freight:

Merchandise and produce:		
Quantity	tons	1,404,146
Value		$14,041,460

L 8.

IMPROVEMENT OF WATERWAY FROM NORFOLK, VIRGINIA, TO THE SOUNDS OF NORTH CAROLINA.

The only work done in the fiscal year 1905 was performed by the U. S. snag boat *Roanoke* in the latter part of March and the early part of April. From the Deep Creek section of this waterway 4 logs, 16 feet long, and 1 pile, 65 feet long, were taken from the channel and placed on the bank; and from the Turners Cut section 31 logs, 16 feet long; 1 pile, 60 feet long; 1 pile, 75 feet long; 13 snags, and 91 stumps were removed and similarly disposed of.

All work of improvement projected has been completed. Occasionally some work will be necessary to free the navigable channel of sunken and floating obstructions. It is intended to apply the balance unexpended to this work as conditions may demand.

Money statement.

July 1, 1904, balance unexpended	$2,486.81
Amount appropriated by river and harbor act approved March 3, 1905	3,000.00
	5,486.81
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	927.69
July 1, 1905, balance unexpended	4,559.12
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	2,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

APPROPRIATIONS.

March 3, 1899	$25,000
June 6, 1900	200,000
March 3, 1901	29,870
March 3, 1905	3,000
Total	257,870

COMMERCIAL STATISTICS.

The following statistics were compiled from a statement furnished by the Lake Drummond Canal and Water Company, and indicate the traffic through the

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Dismal Swamp Canal, Virginia and North Carolina, during the calendar year 1904:

Articles.	Quantity.	Value.	Articles.	Quantity.	Value.
Lumber....feet B. M..	111,712,132	$1,452,257	Sand .....tons..	20,800	$4,160
Gum logs.....feet..	1,681,052	16,810	Stone .....do...	400	200
Pine piles .....do...	723,699	43,422	Shingles ....number..	1,720,000	8,608
Mill logs.....do...	2,198,320	21,983	Lime.....tons..	591	5,910
Juniper logs ...cords..	12,087	60,435	Railroad ties..number..	16,492	8,246
Laths .....number..	115,000	575	Bricks .....do...	14,000	112
Wood .....cords..	183	549	Oysters .....bushels..	1,156	578
Poles.....number..	1,850	3,700	Salt .....tons..	1,516	4,548
Corn .....bushels..	19,641	9,820	Hay .....do...	12	192
Fertilizer .....tons..	27,505	550,110	Shells .....bushels..	1,000	40
Coal .....do...	5,473	21,894	Iron.....tons..	412	45,320
Machinery .....do...	87	17,400	Posts .....number..	497	199
Molasses. ....barrels..	50	500	Potatoes.....barrels..	4,604	9,388
Staves.....number..	5,017	150	Miscellaneous ..tons..	48,885	586,620
Gum logs .....cords..	88	443			
Pine logs.....do...	1,184	5,923	Total	.....	2,880,087

Vessels.

Class.	Number.	Average draft.	Average tonnage.
		Feet.	
Steamers	1,759	8	48
Barges	825	9	302
Schooners	799	7	50
Yachts	42	6	29
Lighters	813	7	.....
Rafts	a 48	.....	.....
Launches	94	.....	.....
Steam hoisters	8	.....	.....
Scows	224	.....	.....
Dredges	3	.....	.....
House boats	5	.....	.....

[a] Averaging 115,324 feet pine piles and 507,564 feet mill logs.

L 9.

IMPROVEMENT OF INLAND WATER ROUTE FROM NORFOLK HARBOR, VIRGINIA, TO ALBEMARLE SOUND, NORTH CAROLINA, THROUGH CURRITUCK SOUND.

The only work done on this improvement during the fiscal year was the removal of sunken obstructions in the channel by the U. S. snag boat *Roanoke*. The obstructions referred to were 1,099 logs, 7 piles, 6 stumps, and 13 snags, which were taken out of the navigable channel and placed on the banks.

As some of the logs were valuable, they were offered for sale under public notice, and the sum of $100 was received for them and deposited to the credit of the appropriation for this improvement.

The project is about 95 per cent completed. Some dredging is necessary at localities where the projected channel dimensions have not been attained. The unexpended balance will accomplish this work and also leave a small amount for the removal of sunken logs. The amount recommended is also desired for the latter work after the expenditure of the present balance.

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Money statement.

July 1, 1904, balance unexpended	$2,939.32
Amount appropriated by river and harbor act approved March 3, 1905	22,000.00
Amount received from sale of property	100.00
	25,039.32
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	2,935.52
July 1, 1905, balance unexpended	22,103.80
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	5,000.00

APPROPRIATIONS.

For southern branch Elizabeth River, Virginia:		
March 3, 1873	$15,000.00	
June 23, 1874	10,000.00	
March 3, 1875	5,000.00	
August 14, 1876	5,000.00	
June 18, 1878	5,000.00	
		$40,000.00
For North Landing River, Virginia and North Carolina:		
March 3, 1879	25,000.00	
June 14, 1880	15,000.00	
March 3, 1881	7,500.00	
August 2, 1882	8,000.00	
		55,500.00
For Currituck Sound, Coinjock Bay, and North River bar, North Carolina:		
June 18, 1878	20,000.00	
March 3, 1879	25,000.00	
June 14, 1880	25,000.00	
March 3, 1881	30,000.00	
August 2, 1882	20,000.00	
July 5, 1884	5,000.00	
August 5, 1886	10,000.00	
August 11, 1888	7,500.00	
		142,500.00
For inland water route, etc.:		
September 19, 1890	10,000.00	
July 13, 1892	9,000.00	
August 18, 1894	10,000.00	
June 3, 1896	10,000.00	
March 3, 1899	8,000.00	
June 13, 1902	23,400.00	
March 3, 1905	22,000.00	
		92,400.00
Total		330,400.00
Amount received from sale of property		2,269.69
Aggregate		332,669.69

COMMERCIAL STATISTICS.

The following statistics relative to the commerce of the inland water route from Norfolk Harbor, Virginia, to Albemarle Sound, North Carolina, during the

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calendar year 1904 were compiled from statements furnished by the Albemarle and Chesapeake Canal Company:

	Tons.
Lumber, logs, shingles, merchandise, etc	[a] 144,041

Vessels.

Class.	Number.	Average draft.	Average tonnage.
		Feet.	
Steam	2,014	4–9	41
Sail	368	4–9	44
Barges and lighters	707	4–9	162
Rafts	326	.....	.....

L 10.

IMPROVEMENT OF PERQUIMANS RIVER, NORTH CAROLINA.

No work has been done; the expenditures during the fiscal year were for contingencies.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1905	$11,250.00
June 30, 1905, amount expended during fiscal year, for works of improvement	34.75
July 1, 1905, balance unexpended	11,215.25

APPROPRIATIONS.

August 14, 1876	$2,500
March 3, 1905	11,250
Total	13,750

COMMERCIAL STATISTICS.

The following statistics relative to the commerce of Perquimans River, North Carolina, during the calendar year 1904 were compiled from statements furnished by the shippers making shipments over this stream:

Articles.	Quantity.	Value.
	Tons.	
Cotton	700	$175,000
Cotton seed	3,000	45,000
Guano	2,000	25,000
Fish	175	25,000
Peanuts	200	15,000
Potatoes	1,125	15,000
Lumber	3,100	38,000
Logs	12,000	85,000
Miscellaneous	16,000	100,000
Total	38,300	523,000

Vessels.

Vessels, barges, lighters, etc., navigating this stream during the calendar year 1904 had an average depth of from 4 to 8 feet and an average tonnage of 85 tons.

[a] Value not known.

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L 11.

IMPROVEMENT OF EDENTON BAY, NORTH CAROLINA.

No work was done or expenditures made.
The project is practically completed.

Money statement.

July 1, 1904, balance unexpended	$220.63
July 1, 1905, balance unexpended	220.63

APPROPRIATIONS.

June 18, 1878	$4,000
March 3, 1879	1,000
July 5, 1884	10,000
August 5, 1886	2,000
June 13, 1902	6,000
Total	23,000

COMMERCIAL STATISTICS.

The following statistics relative to the commerce of Edenton Bay, North Carolina, during the calendar year 1904, were compiled from statements furnished by transportation lines handling the freight:

	Tons.
Merchandise and produce	[a] 137,172

L 12.

IMPROVEMENT OF ROANOKE RIVER, NORTH CAROLINA.

The U. S. snag boat *Roanoke* was engaged in the removal of channel and overhanging obstructions on this river between September 11, 1904, and January 16, 1905, during which time 48 trees, 32 logs, 68 snags, and 4 stumps were taken out of the river and placed upon the bank. In addition, 165 trees overhanging the river were destroyed and the pieces hauled out on the bank. In the latter part of May and early part of June the snag boat, while en route to Looking Glass bar, removed 5 trees which had come into the channel since the former visit of the boat.

At Looking Glass bar a shoal had formed, and the snag boat, which is also equipped with a dredge bucket, on June 7, 1905, commenced the excavation of a channel through this shoal. To the close of the fiscal year 7,065 cubic yards had been removed and thrown aside, giving a channel 32 feet wide through the bar for a distance of 1,274 feet, and for 205 feet of its length it was given an additional width of 32 feet. The depth obtained in these cuts was 6 feet at mean low water.

It is proposed to apply the unexpended balance and the amount recommended to the dredging of shoals, the removal of channel obstructions, and the construction of a dam, near Weldon, N. C.

The project is considered to be about 80 per cent completed.

[a] Value not known.

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Money statement.

July 1, 1904, balance unexpended	$5,826.63
Amount appropriated by river and harbor act approved March 3, 1905	10,000.00
Amount received from sale of property	13.75
	15,840.38
June 30, 1905, amount expended during fiscal year, for works of improvement	5,178.86
July 1, 1905, balance unexpended	10,661.52
July 1, 1905, outstanding liabilities	446.00
July 1, 1905, balance available	10,215.52
Amount (estimated) required for completion of existing project	31,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:	
For works of improvement	$31,000.00
For maintenance of improvement	5,000.00
	36,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

March 3, 1871	$20,000.00	August 18, 1894	$30,000.00
June 10, 1872	10,000.00	June 3, 1896	10,000.00
March 3, 1873	10,000.00	March 3, 1905	10,000.00
June 23, 1874	5,000.00		
August 2, 1882	5,000.00	Total	238,000.00
July 5, 1884	3,000.00	Amount received from sale of property	1,351.75
August 5, 1886	20,000.00		
August 11, 1888	40,000.00	Aggregate	239,351.75
September 19, 1890	25,000.00		
July 13, 1892	50,000.00		

COMMERCIAL STATISTICS.

The following statistics show the commerce of Roanoke River, North Carolina, during the calendar year 1904, and were compiled from statements obtained from the shippers:

Articles.	Amount.	Value.
	Tons.	
Lumber	80,240	$178,000
Logs	2,250	16,000
Shingles	300	15,000
Total	32,790	209,000

L 13.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

Wreck, J. B. Taylor.—The removal of this wreck from the Appomattox River, Virginia, was authorized June 5, 1905, at a cost not to exceed $300. Proposals for performing the work have been solicited by public notice.

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APPENDIX M.

IMPROVEMENT OF CERTAIN RIVERS AND HARBORS IN NORTH CAROLINA.

REPORT OF CAPT. R. P. JOHNSTON, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1905, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Scuppernong River, North Carolina.
2. Fishing Creek, North Carolina.
3. Pamlico and Tar rivers, North Carolina.
4. Contentnia Creek, North Carolina.
5. Neuse and Trent rivers, North Carolina.
6. Inland Waterway, between Newbern and Beaufort, North Carolina.
7. Harbor at Beaufort, North Carolina.
8. Beaufort Inlet, North Carolina.
9. Inland Waterway, between Beaufort Harbor and New River, North Carolina.
10. Inland Waterway, between New River and Swansboro, North Carolina.
11. New River, North Carolina.
12. Northeast (Cape Fear) and Black rivers, and Cape Fear River above Wilmington, North Carolina.
13. Cape Fear River, North Carolina, at and below Wilmington.

WAR DEPARTMENT,
UNITED STATES ENGINEER OFFICE,
Wilmington, N. C., August 10, 1905.

GENERAL: I have the honor to transmit herewith my annual report for the fiscal year ending June 30, 1905, on the river and harbor works in the Wilmington, N. C., district. * * *

Very respectfully,

R. P. JOHNSTON,
Captain, Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

M 1.

IMPROVEMENT OF SCUPPERNONG RIVER, NORTH CAROLINA.

References.—See page 235 of the current summary.

No active operations of improvement were carried on during the year.

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Up to June 30, 1905, about 60 per cent of the approved project of 1902 had been accomplished.

For present condition of the stream, see page 235, current summary report.

With the available balance of $5,032.96, which is ample, it is proposed to widen the cut across the bar at the mouth of the river to the project width and restore any deterioration existing in present cut.

Additional appropriations of $2,000 annually for maintenance are recommended.

Money statement.

July 1, 1904, balance unexpended	$32.96
Amount appropriated by river and harbor act approved March 3, 1905	5,000.00
July 1, 1905, balance unexpended	5,032.96
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	2,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

Prior to 1887	$8,000
June 13, 1902	10,000
March 3, 1905	5,000
Total appropriated	23,000

COMMERCIAL STATISTICS FOR THE YEAR ENDING DECEMBER 31, 1904.

Class of goods.	Tons.	Class of goods.	Tons.
Cotton	500	Fish	38
Cotton seed	1,665	Timber	24,340
Rice, rough	11	Lumber	16,000
Hay	38	Fertilizers	1,000
Potatoes	1,500	Machinery	50
Vegetables	200	General merchandise	5,000
Cattle	125	Coal and minerals	290
Horses	25	Peanuts	140
Hogs	500		
Poultry	23	Total	51,473
Eggs	28		

Gain over last year, 5,260 tons; transportation lines established during the year, 1; number of passengers, 10,000.

Statement of vessels navigating Scuppernong River, North Carolina, during the calendar year ending December 31, 1904.

Class of vessels.	Number.	Aggregate net tonnage.	Draft.
			Feet.
Steamers	19	954	4 to 8
Barges	8	1,560	5 to 7

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M 2.

IMPROVEMENT OF FISHING CREEK, NORTH CAROLINA.

References.—See page 236 of current summary.

Work of improvement completed.

During the fiscal year there were removed from the stream between November 25 and December 16, 1904, from its mouth to the third milepost, 34 large snags, 17 stumps, 6 logs, and 30 trees; 9 trees were cut from the banks and hauled back, and 1 cord of brush was cut. Work of maintenance was suspended on December 16, 1904, for want of available funds.

The expenditures of the year were $456.76 for maintenance.

The proposed application of the available balance of $534.30 is to maintain the natural channel as far up as Beech Swamp. No additional appropriations are recommended at present, since the stream is not now considered worthy of further improvement, nor even of maintenance.

Money statement.

July 1, 1904, balance unexpended	$500.14
Amount appropriated by river and harbor act approved March 3, 1905	500.00
	1,000.14
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	456.76
July 1, 1905, balance unexpended	543.38
July 1, 1905, outstanding liabilities	9.08
July 1, 1905, balance available	534.30

APPROPRIATIONS.

September 19, 1890	$10,000
July 13, 1892	5,000
March 3, 1899	7,750
June 13, 1902	2,000
March 3, 1905	500
Total	25,250

COMMERCIAL STATISTICS FOR THE YEAR ENDING DECEMBER 31, 1904.

Class of goods.	Tons.	Class of goods.	Tons.
Cotton	11	General merchandise	5
Cotton seed	260	Peanuts	24
Cotton-seed meal	157		
Timber	1,000	Total	1,806
Fertilizers	349		

Loss over last year, 2,862½ tons.

Statement of vessels navigating Fishing Creek, North Carolina, during the calendar year ending December 31, 1904.

Class of vessels.	Number.	Aggregate net tonnage.	Draft.
			Feet.
Steamer	1	46	2
Naphtha launch	1	5	2

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M 3.

IMPROVEMENT OF PAMLICO AND TAR RIVER, NORTH CAROLINA.

[One river called Pamlico below and Tar above Washington.]

References.—See page 237 of current summary.

The project for the work below Washington is about 85 per cent completed; that for the work above Washington (to Greenville) has been completed and is in good order. The stretch above Greenville has deteriorated for lack of maintenance.

The disbursements for the year were $9,060.49, of which $1,653.84 was for outstanding liabilities of last year, leaving $7,406.65 pertaining to present fiscal year. If to this the present outstanding liabilities of $350.84 be added we obtain $7,757.49 as the cost of the work performed during the year.

This sum is made up as follows:

For dredging by U. S. dredge *Scuppernong*	$6,680.78
For snagging by U. S. hoister *Trent*	1,076.71

The dredge *Scuppernong* removed from the channel 84,502 cubic yards of material, 158 logs, and 368 stumps. In addition to the above, the hoister *Trent* operated between .0 to 22 mile posts, removing 30 large snags, 9 stumps, 12 logs, and 18 trees, and 43 trees were cut and hauled back from the banks, 10 trees trimmed, and 8¼ cords of brush were cut. Between the 55 and 56 mile posts, 5 large snags, 3 stumps, 1 log, and 4 trees were removed from the channel, and 1 tree was cut and hauled back from the bank; 41 stumps were removed from the channel below Washington by the hoister *Trent*.

A survey was made during the year of the shoal immediately below Folk Point, the cost of which was charged to dredging.

The proposed application of the available balance is to complete the channel below Washington and to restore and maintain the channel between Washington and the mouth of Fishing Creek, 56⅓ miles above, as far as funds will permit.

An additional appropriation of $6,000 annually is recommended for the purpose of maintenance.

Money statement.

July 1, 1904, balance unexpended		$9,058.95
Amount appropriated by river and harbor act approved March 3, 1905		8,000.00
Amount received from sales		123.10
		17,182.05
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$8,006.43	
For maintenance of improvement	1,054.06	
		9,060.49
July 1, 1905, balance unexpended		8,121.56
July 1, 1905, outstanding liabilities		350.84
July 1, 1905, balance available		7,770.72
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905		6,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

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APPROPRIATIONS.

Date.	Amount.	Aggregate.	Date.	Amount.	Aggregate.
July 4, 1836, to July 7, 1838	$10,000.00	$10,000.00	August 11, 1888	$10,000.00	$68,000.00
August 14, 1876	15,000.00	15,000.00	September 19, 1890	10,000.00	78,000.00
May 8, 1879	6,000.00	21,000.00	July 13, 1892	10,000.00	88,000.00
June 14, 1880	9,000.00	30,000.00	August 18, 1894	10,000.00	98,000.00
March 3, 1881	8,000.00	38,000.00	June 3, 1896	5,000.00	103,000.00
August 2, 1882	10,000.00	48,000.00	March 3, 1899	15,000.00	118,000.00
July 5, 1884	5,000.00	53,000.00	June 13, 1902	35,500.00	153,500.00
August 5, 1886	5,000.00	58,000.00	March 3, 1905	8,000.00	161,500.00
			Sales	172.65	161,672.65

COMMERCIAL STATISTICS FOR THE YEAR ENDING DECEMBER 31, 1904.

Class of goods.	Tons.	Class of goods.	Tons.
Cotton	6,829	Clams	5
Cotton seed	14,438	Wood	22,880
Cotton-seed oil	1,098	Timber	232,350
Cotton-seed meal	4,016	Lumber	146,143
Cotton-seed hulls	1,029	Shingles	808
Tobacco, leaf	29	Fertilizers	19,175
Rice, rough	124	Machinery	573
Grains	12,599	General merchandise	29,406
Hay	2,714	Coal and minerals	5,857
Potatoes	9,852	Tar	14
Vegetables	152	Peanuts	35
Cattle	108	Rafting gear	350
Horses	85	Lime	1,500
Hogs	25	Shells	1,875
Poultry	49	Brick	384
Eggs	121		
Fish	633	Total	514,401
Oysters	145		

Decrease since last year, 330,976 tons. Transportation lines established during the year, none. Number of passengers, 15,000.

Statement of vessels navigating Pamlico and Tar river, North Carolina, during the calendar year ending December 31, 1904.

Class of vessel.	Number.	Aggregate net tonnage.	Draft.
			Feet.
Steamers	31	1,585	2 to 8
Schooners	79	2,650	2 to 8
Barges	51	16,241	2 to 8
Naphtha launches	12	120	2 to 5

M 4.

IMPROVEMENT OF CONTENTNIA CREEK, NORTH CAROLINA.

Reference.—See page 239 of current summary.

The work of improvement is completed.

The work of the past year has been exclusively that of maintenance of the portion of the stream between its mouth and Snowhill by the removal of only those obstructions the removal of which was absolutely necessary to prevent the suspension of navigation. Four large snags, 1 stump, 3 logs, and 15 trees were removed from the channel,

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and 12 trees and one-half cord of brush were removed from the banks; the total expenditure being $395.62. In addition to the above, a survey of the alleged shoal at the mouth of Woods Slough, between the fifth and sixth milepost, was made. The progress of the work was twice interrupted, once by low water and once by freshet, adding to the cost of same.

It is proposed to apply the available balance to maintenance of the channel between the mouth of the creek and Snowhill.

During the past year interested parties have expressed a desire to have the maintenance extended to Speights Bridge, but it is doubtful if boats would utilize this portion of the stream if improved.

Additional appropriations of $2,000 annually for maintenance are recommended.

Money statement.

July 1, 1904, balance unexpended	$102.23
Amount appropriated by river and harbor act approved March 3, 1905	1,000.00
Amount allotted from appropriation for maintenance of river and harbor improvements, act of April 28, 1904	500.00
	1,602.23
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	368.80
July 1, 1905, balance unexpended	1,233.43
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	1,500.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

APPROPRIATIONS.

Date.	Amount.	Aggregate.	Date.	Amount.	Aggregate.
March 3, 1881	$10,000	$10,000	Allotted from emergency appropriation, act of June 13, 1902	$500	$71,500
August 2, 1882	10,000	20,000			
July 5, 1884	5,000	25,000			
August 5, 1886	15,000	40,000	Alloted January 27, 1905, from emergency appropriation, act of April 28, 1904	500	72,000
August 11, 1888	5,000	45,000			
September 19, 1890	7,000	52,000			
July 13, 1892	7,000	59,000			
August 18, 1894	10,000	69,000	March 3, 1905	1,000	73,000
March 3, 1899	2,000	71,000			

COMMERCIAL STATISTICS FOR THE YEAR ENDING DECEMBER 31, 1904.

Class of goods.	Tons.	Class of goods.	Tons.
Cotton	600	Lumber	1,000
Cotton seed	2,200	Shingles	600
Cotton-seed meal	300	Fertilizers	6,810
Grains	50	General merchandise	1,200
Hay	50	Rafting gear	5
Vegetables	80		
Timber	2,125	Total	15,010

Gain over last year, 1,168 tons. Number of passengers, 1,000.

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Statement of vessels navigating Contentnia Creek, North Carolina, during the year ending December 31, 1904.

Class of vessels.	Number.	Aggregate net tonnage.	Draft.
Steamers	7	346	*Feet.* 2 to 4

M 5.

IMPROVEMENT OF NEUSE AND TRENT RIVERS, NORTH CAROLINA.

(A) NEUSE RIVER.

References.—See page 240 of current summary.

The disbursements of the year were $3,880.13, to which add outstanding liabilities of $2,812.93, which makes a total of $6,693.06.

This sum is made up as follows:

For dredging	$4,522.57
For snagging	2,170.49

Dredging was carried on at the confluence of the Neuse and Trent rivers, resulting in a cut 100 feet wide, 650 feet long, and 8 feet deep at dead low water, widening previous dredging to 166⅔ feet for this distance. Beyond this a cut 66⅔ feet wide, 950 feet long, and 8 feet deep at dead low water was made, widening previous cut to 133⅓ feet, from which cuts there were removed a total of 19,359 cubic yards of material, 28 logs, and 206 stumps.

Snagging operations were carried on at Newbern and between Newbern and Kinston, resulting in the removal from the channel at Newbern of 2 large snags, 55 stumps, and 4 logs. Four large snags, 31 stumps, and 5 logs were removed from the river immediately above the site of draw in the Pamlico, Oriental and Western Railroad bridge, and between Newbern and Kinston there were removed from the channel 12¾ cords of brush, 58 large snags, 16 stumps, 57 logs, 52 trees, and 4 old piles. From the banks 56 trees were cut and hauled back, 6 trees trimmed, and 28½ cords of brush cut.

It is proposed with the available balance to complete the dredging at and below Newbern and maintain the channel to Kinston.

Further annual appropriations of $8,000 are recommended for maintenance.

Money statement.

July 1, 1904, balance unexpended		$2,117.58
Amount appropriated by river and harbor act approved March 3, 1905		17,000.00
Amount allotted from appropriation for maintenance of river and harbor improvements, act of April 28, 1904		500.00
Amount received from sales		100.00
		19,717.58
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$2,380.46	
For maintenance of improvement	1,499.67	
		3,880.13
July 1, 1905, balance unexpended		15,837.45
July 1, 1905, outstanding liabilities		2,812.93
July 1, 1905, balance available		13,024.52

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Amount (estimated) required for completion of existing project..... $82,500.00

Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:
For works of improvement..... $40,000.00
For maintenance of improvement..... 8,000.00
48,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

APPROPRIATIONS.

Date.	Amount.	Aggregate.	Date.	Amount.	Aggregate.
June 18, 1878	$40,000.00	$40,000.00	June 13, 1902	[a]$13,500.00	320,000.00
March 3, 1879	45,000.00	85,000.00	Allotted from appropriations for emergencies in river and harbor works, act June 13, 1902	2,000.00	322,000.00
June 14, 1880	45,000.00	130,000.00			
March 3, 1881	30,000.00	160,000.00			
August 2, 1882	30,000.00	190,000.00			
July 5, 1884	20,000.00	210,000.00	Allotted from appropriations for emergencies in river and harbor works, act April 28, 1904	500.00	322,500.00
August 5, 1886	22,500.00	232,500.00			
August 11, 1888	15,000.00	247,500.00			
September 30, 1890	20,000.00	267,500.00			
July 13, 1892	15,000.00	282,500.00			
August 18, 1894	7,000.00	289,500.00			
June 3, 1896	7,000.00	296,500.00	March 3, 1905	[b]17,000.00	339,500.00
March 3, 1899	10,000.00	306,500.00	Sales	148.90	339,648.90

[a] Allotted from appropriation of $20,000 for Neuse and Trent rivers, North Carolina.
[b] Allotted from appropriation of $40,000 for Neuse and Trent rivers, North Carolina.

COMMERCIAL STATISTICS FOR THE YEAR ENDING DECEMBER 31, 1904.

Class of goods.	Tons.	Class of goods.	Tons.
Cotton	8,581	Rosin	333
Cotton seed	9,861	Turpentine, spirits	127
Cotton-seed oil	15	Wood	1,207
Cotton-seed meal	2,069	Timber	101,075
Cotton-seed hulls	10	Lumber	232,474
Tobacco, leaf	2,375	Shingles	4,993
Rice, rough	360	Fertilizers	55,655
Grains	16,729	Machinery	418
Hay	4,295	General merchandise	25,388
Potatoes	8,903	Coal and minerals	8,710
Vegetables	5,960	Tar	2
Cattle	12	Peanuts	3
Horses	75	Rafting gear	1,129
Hogs	12	Brick	750
Poultry	26	Cross-ties	5,900
Eggs	103	Fish oil	33
Fish	2,525		
Oysters	3,370	Total	501,571
Clams	3,013		

Gain over last year, 15,010 tons. Number of passengers, 20,770. Transportation lines established during the year, none.

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Statement of vessels navigating Neuse River, North Carolina, during calendar year ending December 31, 1904.

Class of vessels.	Number.	Aggregate net tonnage.	Draft.
			Feet.
Steamers	67	3,808	2 to 8
Schooners, sloops, etc	149	4,467	2 to 8
Naphtha launches	17	111	2 to 4
Barges	85	11,880	6 to 8

(B) TRENT RIVER.

References.—See page 241 of current summary.

The work of the year consisted of dredging and snagging. The shoals immediately below Trenton were dredged with the snag boat *Trent*, which was rigged with a half cubic yard orange-peel bucket. Cuts 30 feet wide, 3 to 4 feet deep, aggregating 875 feet in length, were made, from which there were removed 939 cubic yards of material, at a total cost of $569.29, or 61.6 cents per cubic yard, measured in situ. By snagging, the removal of five large snags, 5 stumps, 37 logs, and 5 trees from the channel was effected, and 1 tree was hauled back from the bank. The cost of the snagging was $740.74. In addition to the above expenses $100 was expended on the purchase of a launch for the Newbern subdistrict, this being the pro rata part of the cost chargeable to this stream. The total expenses of the year amounted to $1,410.03, which includes the payment of liabilities outstanding at the end of the last fiscal year.

The amount available at present is sufficient to complete the project, it is thought. This improvement will require an annual expenditure of $2,500 for maintenance, and the appropriation of the same is recommended.

It is proposed to apply the available funds to maintenance of channel between Newbern and Trenton by snagging and dredging, repairs to turning basin at Trenton and dredging at Newbern in accordance with the project submitted in the report on examinations and surveys, published in the Annual Report for 1897, page 1427.

Money statement.

July 1, 1904, balance unexpended	$1,215.50
Amount appropriated by river and harbor act approved March 3, 1905	23,000.00
Amount received from sales	100.00
	24,315.50
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	1,410.03
July 1, 1905, balance unexpended	22,905.47
July 1, 1905, outstanding liabilities	62.50
July 1, 1905, balance available	22,842.97
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	2,500.00

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APPROPRIATIONS.

Date.	Amount.	Aggregate.	Date.	Amount.	Aggregate.
March 3, 1879	$7,000.00	$7,000.00	June 3, 1896	$2,000.00	$66,500.00
June 14, 1880	10,000.00	17,000.00	March 3, 1899	2,500.00	69,000.00
March 3, 1881	5,000.00	22,000.00	June 13, 1902	[a]6,500.00	75,500.00
August 2, 1882	10,000.00	32,000.00	Allotted from appropriation for emergencies in river and harbor works, act		
July 5, 1884	10,000.00	42,000.00			
August 5, 1886	3,500.00	45,500.00			
August 11, 1888	5,000.00	50,500.00			
September 19, 1890	5,000.00	55,500.00	June 13, 1902	1,000.00	76,500.00
July 13, 1892	5,000.00	60,500.00	March 3, 1905	[b]23,000.00	99,500.00
August 18, 1894	4,000.00	64,500.00	Sales	148.90	99,648.90

[a]Allotted from $20,000 appropriated for Neuse and Trent rivers, North Carolina.
[b]Allotted from appropriation of $40,000 for Neuse and Trent rivers, North Carolina.

COMMERCIAL STATISTICS FOR THE YEAR ENDING DECEMBER 31, 1904.

Class of goods.	Tons.	Class of goods.	Tons.
Cotton	8,578	Clams	3,005
Cotton seed	4,230	Rosin	333
Cotton-seed oil	15	Turpentine, spirits	127
Cotton-seed meal	1,920	Wood	2,031
Tobacco, leaf	2,391	Timber	99,325
Rice, rough	360	Lumber	99,814
Grains	2,552	Shingles	220
Hay	3,789	Fertilizers	17,034
Potatoes	2,585	Machinery	338
Vegetables	3,717	General merchandise	25,343
Cattle	61	Coal	2,646
Horses	75	Tar	14
Hogs	22	Peanuts	7
Poultry	26	Rafting gear	490
Eggs	101		
Fish	635	Total	284,935
Oysters	3,101		

Gain over last year, 33,880 tons; passengers, 19,311.

Statement of vessels navigating Trent River, North Carolina, during calendar year ending December 31, 1904.

Class of vessels.	Number.	Aggregate net tonnage.	Draft.
			Feet.
Steamers	68	3,220	2 to 8
Barges	32	10,558	6 to 8
Launches	16	97	2 to 4
Schooners	125	3,619	2 to 8

M 6.

IMPROVEMENT OF WATERWAY BETWEEN NEWBERN AND BEAUFORT, NORTH CAROLINA.

References.—See page 243 of current summary.

The project is about 30 per cent completed.

During the past year a cut 8,250 feet long, 30 feet wide, and 5 feet deep at mean low water was dredged from the mouth of Harlowe Creek to the 5-foot contour in Newport River.

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For a distance of 4,650 feet from the mouth of this creek the material, which was of soft mud, flowed back into the cut to a considerable extent, and it became necessary to redredge 1,850 feet of this length.

There was removed a total of 26,357 cubic yards of material at a total cost of $4,604.75. The snag boat *Trent* thoroughly cleared the approaches to the canal in Clubfoot and Harlowe creeks of obstructions by removing 1 large snag, 3 stumps, and 38 logs, at a total cost of $546.15, making the total cost of operations for the year $5,150.90, which included $213.86 office and contingent expenses. Deducting this latter amount leaves $4,937.77 expended on the actual work upon this waterway.

The improvement of this waterway is handicapped by the fact that the canal connecting the head of Clubfoot Creek with that of Harlowe Creek is owned by a corporation, which does nothing toward maintaining it. While the available depth through the canal at low water is at present greater than in the approaches, the canal is obstructed by logs which have been dropped from passing rafts, and considerable work is needed to make navigation through it safe.

It is unfortunate that the title to this canal is not vested in the United States, since the commercial importance of this waterway is such as to fully warrant its improvement by the United States to the extent contemplated in the original project of 1883, unless the route connecting the heads of Adams and Core creeks is to be improved in accordance with the project and estimate set forth in House Document 563, Fifty-eighth Congress, second session. To complete the modified project of 1884 will cost $57,000.

Further appropriations other than $2,000 annually for maintenance are not recommended until the title to the canal is acquired by the United States.

It is proposed to apply the available balance to maintenance.

References.—Annual Reports, 1884, page 1065; 1890, page 1130; 1896, page 113.

Money statement.

July 1, 1904, balance unexpended	$6,300.00
June 30, 1905, amount expended during fiscal year, for works of improvement	5,150.90
July 1, 1905, balance unexpended	1,149.10
Amount (estimated) required for completion of existing project	57,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	57,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

APPROPRIATIONS.

Date.	Amount.	Aggregate.
August 2, 1882	$10,000	$10,000
August 5, 1886	10,000	20,000
August 11, 1888	15,000	35,000

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COMMERCIAL STATISTICS FOR CALENDAR YEAR ENDING DECEMBER 31, 1904.

Class of goods.	Tons.	Class of goods.	Tons.
Cotton	984	Wood	1,016
Cotton seed	1,459	Timber	33,750
Cotton-seed meal	205	Lumber	32,451
Grains	477	Shingles	300
Hay	558	Fertilizers	1,219
Potatoes	278	Machinery	30
Vegetables	60	General merchandise	6,055
Cattle	12	Coal and minerals	60
Hogs	26	Tar	2
Poultry	6	Peanuts	3
Eggs	7	Cross-ties	1,200
Fish	450	Rafting gear	480
Oysters	694		
Clams	237	Total	82,019

A decrease of 7,632 tons over last year. Number of passengers, 250. Transportation lines established during the year, 1.

Statement of vessels navigating waterway between Newbern and Beaufort, N. C., during the year ending December 31, 1904.

Class of vessel.	Number.	Aggregate net tonnage.	Draft.
			Feet.
Launch, naphtha	15	75	2 to 4
Steamers	10	426	4 to 6
Schooners, sloops, etc	75	900	2 to 4
Barges	11	275	5 to 7

M 7.

IMPROVEMENT OF HARBOR AT BEAUFORT, NORTH CAROLINA.

Reference.—See page 244 of current summary.

The expenditures of the year were $2,606.54, and the work was as follows:

Under an allotment from the appropriation for emergencies in river and harbor act of April 28, 1904, the Bulkhead shoal was redredged, resulting in a cut 650 feet in length, 100 feet wide, and 7 feet deep at mean low water (thus restoring the project depth and width across the shoal). Twelve thousand two hundred and twenty-seven cubic yards of material was removed, at a total cost of $1,605.11.

In addition to the above, grass and trees were set out at Fort Macon; 2,160 linear feet of sand fences constructed; 4,024 linear feet of sand fences raised; 1,806 linear feet repaired, and 9,670 linear feet filled under, at a total cost of $672.76. At Shackelford Point, 672 linear feet of sand fences were constructed; 128 linear feet raised; 962 linear feet repaired; 1,916 linear feet filled under, and 452 linear feet of plank groynes were constructed to prevent erosion of the shore on the inner or sound side of the point, at a total cost of $372.69.

It is proposed to apply the available balance to maintaining the sand fences at Fort Macon and Shackelford Point.

The additional appropriation of $2,000 annually is recommended to extend the sand fences and to maintain the Bulkhead channel to Beaufort.

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Money statement.

July 1, 1904, balance unexpended	$772.05
Amount appropriated by river and harbor act approved March 3, 1905	2,000.00
Amount allotted from appropriation for maintenance of river and harbor improvements, act of April 28, 1904	1,000.00
	3,772.05
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	2,606.54
July 1, 1905, balance unexpended	1,165.51
July 1, 1905, outstanding liabilities	267.07
July 1, 1905, balance available	898.44
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	2,000.00

Submitted in compliance with requirments of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

APPROPRIATIONS.

Date.	Amount.	Aggregate.	Date.	Amount.	Aggregate.
July 4, 1896	$5,000	$5,000	June 3, 1896	$5,000	$155,000
			June 13, 1902	3,000	158,000
March 3, 1880	30,000	30,000	Allotted from appropriation for emergencies in river and harbor works, act April 28, 1904	1,000	159,000
August 2, 1882	25,000	55,000			
July 5, 1884	20,000	75,000			
August 5, 1886	15,000	90,000			
August 11, 1888	35,000	125,000	March 3, 1905	2,000	161,000
September 19, 1890	15,000	140,000	Sales	350	161,350
July 13, 1892	10,000	150,000			

COMMERCIAL STATISTICS FOR THE YEAR ENDING DECEMBER 31, 1904.

Class of goods.	Tons.	Class of goods.	Tons.
Cotton	949	Lumber	3,650
Cotton seed	1,124	Shingles	380
Cotton-seed meal	238	Fertilizers	1,590
Grains	295	Machinery	25
Hay	330	General merchandise	21,108
Potatoes	476	Coal	220
Vegetables	10	Tar	2
Cattle	12	Peanuts	8
Hogs	26	Fish oil	187
Poultry	8	Soft crabs	500
Eggs	7	Brick	337
Fish	4,006	Cross-ties	5,000
Oysters	11,589	Shells	625
Clams	2,940		
Wood	5,942	Total	62,226

Gain over last year, 1,426 tons. Number of passengers, 11,050. Transportation lines established during the year, none.

Statement of vessels navigating the harbor at Beaufort, N. C., for the calendar year ending December 31, 1904.

Class of vessels.	Number.	Aggregate net tonnage.	Draft.
			Feet.
Steamers	20	1,000	3 to 10
Schooners, sloops, etc	320	5,418	2 to 10
Launches and yachts	106	862	2 to 6

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M 8.

IMPROVEMENT OF BEAUFORT INLET, NORTH CAROLINA.

Reference.—See page 245 of current summary.

No work has been done on this improvement, except a survey of the bar for the purpose of establishing ranges for dredging. Efforts to secure a suitable dredge for this work have thus far failed, but the dredge *Cape Fear*, now engaged at the mouth of the Cape Fear River, will probably be transferred to Beaufort bar at an early date.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1905	$45,000.00
June 30, 1905, amount expended during fiscal year, for works of improvement	138.67
July 1, 1905, balance unexpended	44,861.33
July 1, 1905, outstanding liabilities	62.33
July 1, 1905, balance available	44,799.00

APPROPRIATION.

Date.	Amount.	Aggregate.
March 3, 1905	$45,000	$45,000

COMMERCIAL STATISTICS FOR THE YEAR ENDING DECEMBER 31, 1904.

Class of goods.	Tons.
Fish	1,500
Lumber	1,500
General merchandise	1,000
Total	4,000

M 9.

IMPROVEMENT OF WATERWAY BETWEEN BEAUFORT HARBOR AND NEW RIVER, NORTH CAROLINA.

Reference.—See page 245 of current summary.

The project is about 85 per cent completed.

The expenditures of the year were $4,464.46, which included $831.18 outstanding indebtedness of last year, and $3,633.28 expenditures of the present year for operating expenses, surveys, and superintendence, resulting in the removal up to October 1, 1904, when the work was suspended, of 12,873.6 cubic yards of material.

The work of the past year consisted in dredging the cut 30 feet wide and 200 feet long between Shell Point and Broad Creek Cut, completing the channel to 60 feet wide for this distance, and extending this cut 800 feet eastwardly, 60 feet wide, 3 to 4 feet deep, to the 3-foot contour, from which point the project depth existed for 1,000

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feet easterly. From the 3-foot contour on the east of this pocket a cut was made 1,100 feet long, 60 feet wide, and 4 feet deep to the west end of the original Broad Creek Cut.

Broad Creek Cut, 2,700 feet long, was widened 20 feet—from 40 to 60 feet—throughout its length, to a depth of 3 to 4 feet. Sanders Creek Cut has been widened 20 feet—from 40 to 60 feet—3 to 4 feet deep, for a distance of 4,150 feet.

This work was done at a cost of 23.728 cents per cubic yard. The work was done by Government plant and hired labor.

It is proposed to apply the available balance to the completion of the 60-foot channel.

It will require annually $2,500 to maintain the improvement after completion, which appropriation is recommended.

Money statement.

July 1, 1904, balance unexpended		$6,775.12
June 30, 1905, amount expended during fiscal year, for works of improvement		4,464.46
July 1, 1905, balance unexpended		2,310.66
Amount (estimated) required for completion of existing project		18,040.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$18,040.00	
For maintenance of improvement	2,500.00	
		20,540.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

APPROPRIATIONS.

Date.	Amount.	Aggregate.	Date.	Amount.	Aggregate.
August 5, 1886	$10,000	$10,000	August 18, 1894	$2,500	$42,500
August 11, 1888	5,000	15,000	June 3, 1896	1,000	43,500
September 19, 1890	15,000	30,000	June 13, 1902	9,500	53,000
July 13, 1892	10,000	40,000			

Statement of vessels navigating waterway between Beaufort Harbor and New River, North Carolina, for calendar year ending December 31, 1904.

Class of vessels.	Number.	Aggregate net tonnage.	Draft.
			Feet.
Steamers	2	102	3
Sailing vessels	85	800	2 to 4
Launches	35	350	2.5 to 4

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COMMERCIAL STATISTICS FOR THE YEAR ENDING DECEMBER 31, 1904.

Class of goods.	Tons.	Class of goods.	Tons.
Cotton	288	Turpentine:	
Cotton seed	505	Crude	2,500
Cotton-seed oil	25	Spirits	200
Cotton-seed meal	70	Wood	1,394
Grain	170	Timber	2,500
Hay	83	Lumber	12,440
Potatoes	128	Shingles	43
Vegetables	11	Fertilizers	755
Cattle	50	Machinery	95
Horses	25	General merchandise	3,125
Hogs	15	Coal and minerals	10
Poultry	4	Tar	32
Eggs	10	Peanuts	17
Fish	3,454	Fish oil	6
Oysters	1,274	Soft crabs	50
Clams	2,953	Cross ties	5,000
Rosin	71	Escallops	75
		Total	37,323

Gain over last year, 1,231 tons. Transportation lines established during the year, none. Number of passengers, 750.

M 10.

INLAND WATERWAY BETWEEN NEW RIVER AND SWANSBORO, NORTH CAROLINA.

See page 246 of the current summary.

The only expenditures on this waterway during the year were for making a hasty examination with a view to determining whether the conditions had materially changed since the survey of 1891. This examination indicated that existing conditions are practically the same as in 1891.

Money statement.

July 1, 1904, balance unexpended	$4,376.27
June 30, 1905, amount expended during fiscal year, for works of improvement	191.16
July 1, 1905, balance unexpended	4,185.11
Amount (estimated) required for completion of existing project	38,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905	38,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

APPROPRIATION.

Date.	Amount.	Aggregate.
Appropriation, September 19, 1890	$5,000	$5,000

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COMMERCIAL STATISTICS FOR THE YEAR ENDING DECEMBER 31, 1904.

Class of goods.	Tons.
Cotton	30
Fish	100
Oysters	150
Clams	500
Salt	50
Total	830

No report last year.

Statement of vessels navigating waterway between New River and Swansboro, N. C., during the calendar year ending December 31, 1904.

Class of vessels.	Number.	Aggregate net tonnage.	Draft.
Sailing vessels	10	125	*Feet.* 2-4

M 11.

IMPROVEMENT OF NEW RIVER, NORTH CAROLINA.

References.—See page 247 of current summary.

Project was completed in 1895.

The work of the past year has been the collection of commercial statistics.

Congress having authorized the expenditure of the available balance, under date of March 3, 1905, the same will be expended in rebuilding dike with oyster shells, dredging to restore project width, and necessary surveys.

No further appropriations are recommended at present.

Money statement.

July 1, 1904, balance unexpended	$3,231.49
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	12.97
July 1, 1905, balance unexpended	3,218.52

APPROPRIATIONS.

Date.	Amount.	Aggregate.	Date.	Amount.	Aggregate.
July 4, 1836, to July 7, 1838		$50,000.00	August 11, 1888	$3,000.00	$23,000.00
			September 19, 1890	5,000.00	28,000.00
August 2, 1882	$5,000.00	5,000.00	July 13, 1892	5,000.00	33,000.00
July 4, 1884	5,000.00	10,000.00	Sales	.10	33,000.10
August 5, 1886	10,000.00	20,000.00			

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COMMERCIAL STATISTICS FOR THE YEAR ENDING DECEMBER 31, 1904.

Class of goods.	Tons.	Class of goods.	Tons.
Cotton	130	Timber	1,000
Cotton seed	210	Lumber	500
Grains	15	Shingles	25
Hay	40	Fertilizers	800
Potatoes	5	General merchandise	1,018
Fish	1,400	Tar	2
Oysters	300	Peanuts	25
Clams	180		
Rosin	7	Total	5,812
Turpentine:			
Crude	125		
Spirits	30		

Loss over last year, 365 tons.

Statement of vessels navigating New River, North Carolina, during the calendar year ending December 31, 1904.

Class of vessels.	Number.	Aggregate net tonnage.	Draft.
			Feet.
Schooners	3	40	2.5 to 5
Naphtha launches	16	60	2.0 to 3
Sharpies	19	55	1.0 to 2

M 12.

IMPROVEMENT OF NORTHEAST AND BLACK RIVERS AND CAPE FEAR RIVER ABOVE WILMINGTON, NORTH CAROLINA.

(A) NORTHEAST RIVER.

References.—See page 248 of current summary.

Work on project 60 per cent completed.

The work of the year consisted of maintenance by snagging, repairing and caring for plant, and collecting commercial statistics. The work was done by hired labor and Government plant.

Active operations were carried on during the months of September and June. The worst obstructions were removed between Wilmington and the sixtieth mile board and between the sixty-eighth and seventy-third mile boards, and the river thoroughly snagged and the banks trimmed between the sixtieth and sixty-eighth mile boards. No work was done above the seventy-third mile board. There were removed from the channel 836 large snags, and on the banks 822 trees were cut and hauled back.

There was spent on this improvement during the year $1,118.04.

At present a draft of 6 feet can be carried up 48 miles to Bannerman's bridge at lowest stages, and 3 feet to Croom's bridge, 8 miles above. From Croom's bridge, 47 miles up, to Kornegay's bridge it is navigable for small boats and rafts for about eight months during the year.

The minimum low-water channel depth to Bannerman's bridge is 6 feet, to Croom's bridge 3 feet, to Hallsville 0.5 foot, to Kornegay's bridge 0.1 foot. The channel is badly obstructed by snags above the sixty-eighth mile board.

With the available balance it is proposed to maintain the natural channel up to Hallsville.

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The appropriations during several years past have not been sufficient to properly maintain this stream.

Additional appropriations of $3,000 annually are recommended for the maintenance of the natural channel.

Money statement.

July 1, 1904, balance unexpended	$814.44
Amount appropriated by river and harbor act approved March 3, 1905	2,000.00
	2,814.44
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	574.90
July 1, 1905, balance unexpended	2,239.54
July 1, 1905, outstanding liabilities	543.14
July 1, 1905, balance available	1,696.40
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	3,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

APPROPRIATIONS.

September 19, 1890, for North East (Cape Fear) River, North Carolina	$5,000.00
July 13, 1892, for North East (Cape Fear) River, North Carolina	5,000.00
August 18, 1894, for North East (Cape Fear) River, North Carolina	5,000.00
March 3, 1899, for North East River, North Carolina	2,000.00
June 13, 1902, for North East River, North Carolina	[a] 2,000.00
Other receipts, March 4, 1897, sales to Cape Fear River	243.33
Allotted from emergency appropriation June 13, 1902	500.00
March 3, 1905 (allotment)	2,000.00
Total	21,743.33

COMMERCIAL STATISTICS FOR THE YEAR ENDING DECEMBER 31, 1904.

Class of goods.	Tons.	Class of goods.	Tons.
Cotton	372	Tar	420
Cotton seed	160	Wood	4,500
Cotton-seed meal	123	Timber	71,879
Cotton-seed oil	5	Lumber	50
Rice, rough	8	Shingles and shingle blocks	313
Grains	135	Poles and piles	480
Hay and straw	24	Cross-ties	2,656
Potatoes	45	Brick	3,750
Peanuts	75	Fertilizer	14,325
Fruits and vegetables	10	General merchandise	4,000
Cattle	25	Coal	792
Hogs	18	Machinery	85
Eggs	6		
Poultry	12	Total	105,800
Fish	2		
Rosin	1,120		
Turpentine:			
Crude	150		
Spirits	260		

Increase since last year, 3,617 tons. Transportation lines established during the year, 1. Number of passengers, 800.

[a] Allotted from joint appropriation of $10,000 for North East and Black rivers, North Carolina, and Cape Fear River, North Carolina, above Wilmington.

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Freight transported.

Calendar year ending December 31—	Tons.	Calendar year ending December 31—	Tons.
1890	40,956	1898	59,422
1891	30,295	1899	48,269
1892	37,429	1900	56,748
1893	40,368	1901	66,873
1894	41,096	1902	100,186
1895	39,721	1903	102,188
1896	65,163	1904	105,800
1897	63,398		

Statement of vessels navigating North East (Cape Fear) River, North Carolina, during the calendar year ending December 31, 1904.

Class of vessels.	Number.	Aggregate net tonnage.	Draft.
			Feet.
Steamers	2	68	2 to 3.5
Steam tugs	10	172	2.5 to 7.5
Flats	a 45	3,375	1.5 to 4

a About.

(B) BLACK RIVER.

References.—See page 249 of current summary.

Work on project completed.

Work done during the year has consisted of maintenance by snagging, repairing, and caring for plant, and collecting commercial statistics. The work was done by hired labor and Government plant.

Active operations were carried on during the months of August, November, February, and May. The worst obstructions were removed from the river between the mouth and Clear Run, which is the head of steamboat navigation. There were removed from the channel 568 large snags, and from the banks 698 trees were cut and hauled back. Repairs were made to the snag boat *H. G. Wright* during a part of April and May.

There was spent for this improvement during the year $1,022.41, of which $838.65 was for snagging, etc., the balance for repairs to plant.

With the available balance, it is proposed to maintain the natural channel as far up as Clear Run.

Additional appropriations of $3,000 annually are recommended for maintenance. The small appropriations of the past five or six years have not been sufficient to properly maintain this stream.

Money statement.

July 1, 1904, balance unexpended		$1,050.24
Amount appropriated by river and harbor act approved March 3, 1905		2,000.00
		3,050.24
June 30, 1905, amount expended during fiscal year, for maintenance of improvement		991.95
July 1, 1905, balance unexpended		2,058.29
July 1, 1905, outstanding liabilities		30.46
July 1, 1905, balance available		2,027.83

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Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905	$3,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

Date.	Amount.	Aggregate.	Date.	Amount.	Aggregate.
August 5, 1886	$3,000.00	$3,000.00	Allotted from emergency appropriation, June 13, 1902	$500.00	$20,500.00
July 13, 1892	10,000.00	13,000.00			
August 17, 1894	2,000.00	15,000.00			
June 3, 1896	1,000.00	16,000.00	March 3, 1905	2,000.00	22,500.00
March 3, 1899	2,000.00	18,000.00			
June 13, 1902	[a] 2,000.00	20,000.00	Other receipts, sales, etc	243.34	22,743.34

[a] Allotted from joint appropriation of $10,000 for Northeast and Black rivers, North Carolina, and Cape Fear River, North Carolina, above Wilmington.

COMMERCIAL STATISTICS FOR THE YEAR ENDING DECEMBER 31, 1904.

Class of goods.	Tons.	Class of goods.	Tons.
Cotton	225	Tar	840
Cotton seed	120	Wood	6,500
Cotton-seed meal	100	Timber	40,250
Grains	150	Lumber	120
Hay and straw	75	Shingles	1,875
Potatoes	36	Poles and piles	614
Cattle	31	Cross-ties	6,500
Hogs	15	Brick	38
Eggs	9	Fertilizer	1,360
Poultry	28	General merchandise	10,000
Fish	2	Peanuts	24
Rosin	3,160	Machinery	35
Turpentine:			
Crude	120	Total	72,677
Spirits	450		

Decrease since last year, 1,446 tons; transportation lines established during the year, none; number of passengers, 775. All of the above passed over 12 miles of Cape Fear River, North Carolina, above Wilmington, but is not included in the report for that river.

Freight transported.

Calendar year ending December 31—	Tons.	Calendar year ending December 31—	Tons.
1885	48,650	1897	31,144
1890	61,311	1898	38,139
1891	79,429	1899	48,533
1892	56,051	1900	58,087
1893	45,003	1901	61,069
1894	41,130	1902	72,224
1895	63,262	1903	74,123
1896	69,033	1904	72,677

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Statement of vessels navigating Black River, North Carolina, during the calendar year ending December 31, 1904.

Class of vessels.	Number.	Aggregate net tonnage.	Draft.
			Feet.
Steamers	4	95	2.5 to 3.5
Steam tugs	5	49	3.5 to 4.5
Flats	About40	3,000	1.5 to 4.5

(c) CAPE FEAR ABOVE WILMINGTON.

References.—See page 250 of current summary.

The project of 1881 has been about 30 per cent completed, and no work under it, except for maintenance, has been done for several years. It has been superseded by the canalization project of 1902.

The work done during the year has consisted of maintenance by snagging, doing preliminary work necessary for determining sites for locks and dams under the canalization project, caring for plant, and collecting commercial statistics. The work was done by hired labor and Government plant.

Under maintenance, snagging operations were carried on between the mouth of Black River and Fayetteville, during October and November. There were removed from the channel 834 large snags and 2 trees. The cost of maintenance during the year was $892.02.

Under the canalization project, the survey for the purpose of determining the locations of sites for locks and dams, in progress at the beginning of the year, was completed in September, with the exception of making the necessary borings, etc., to determine the exact locations of the proposed sites and putting in permanent bench marks. The survey was hindered by frequent freshets, which also caused the delay in investigating proposed sites. One hundred and ninety-five cross sections were taken, 96,702 linear feet of traverse line run, 103,500 linear feet of river level line run, 97,000 linear feet of level line run, 95,100 linear feet of channel soundings taken, 208 cross sections sounded, and 38,918 linear feet of level line rerun, completing the survey for about 77 miles. The cost of the survey during the year was $2,869.93, which includes outstanding liabilities at the end of the year, but does not include those at the end of the preceding year.

Total actually spent on maintenance and survey during the year, $3,761.95.

With the available balance it is proposed to maintain the natural channel up to Fayetteville, make the necessary investigations to determine the exact locations of sites for proposed locks and dams under the canalization project for obtaining 8 feet depth to Fayetteville, purchase sites for locks and dams when locations are determined, and establish permanent bench marks along the river.

Additional appropriations are recommended of $8,000 annually for the maintenance of the present channel to Fayetteville and of $400,000 for the construction of the first lock and dam. It is not believed advisable to begin the construction of a lock and dam until funds are available for its completion under one contract. The appropriations for maintenance of late years have not been sufficient to properly maintain the natural channel.

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Money statements.

MAINTENANCE.

July 1, 1904, balance unexpended	$1,350.12
Amount appropriated by river and harbor act approved March 3, 1905	5,000.00
	6,350.12
June 30, 1905, amount expended during fiscal year, for maintenance of improvement	892.02
July 1, 1905, balance unexpended	5,458.10
Amount that can be profitably expended in fiscal year ending June 30, 1907, for maintenance of improvement, in addition to the balance unexpended July 1, 1905 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	8,000.00

CANALIZATION.

July 1, 1904, balance unexpended	$44,303.52
June 30, 1905, amount expended during fiscal year, for works of improvement	3,693.07
July 1, 1905, balance unexpended	40,610.45
July 1, 1905, outstanding liabilities	5.00
July 1, 1905, balance available	40,605.45
Amount (estimated) required for completion of existing project	1,300,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, for works of improvement, in addition to the balance unexpended July 1, 1905 Submitted in compliance with requirements of sundry civil act of June 4, 1897.	400,000.00

APPROPRIATIONS.

Date.	Amount.	Aggregate.	Date.	Amount.	Aggregate.
March 3, 1881	$30,000.00	$30,000.00	June 13, 1902	[a]$56,000.00	$198,250.00
August 2, 1882	30,000.00	60,000.00	Allotted from emergency appropriation for North East, Cape Fear, and Black rivers, March 3, 1905	[b]5,000.00	203,250.00
July 5, 1884	5,000.00	65,000.00			
August 5, 1886	11,250.00	76,250.00			
August 11, 1888	12,000.00	88,250.00			
September 19, 1890	15,000.00	103,250.00			
July 13, 1892	15,000.00	118,250.00	Other receipts: Sales to other appropriations during 1897	414.33	203,664.33
August 18, 1894	14,000.00	132,250.00			
June 3, 1896	5,000.00	137,250.00			
March 3, 1899	5,000.00	142,250.00			

[a] Six thousand dollars allotted from joint appropriation of $10,000 for North East and Black rivers, North Carolina, and Cape Fear River, North Carolina, above Wilmington.
[b] Five thousand dollars allotted from joint appropriation of $9,000 for North East, Cape Fear, and Black rivers, North Carolina.

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COMMERCIAL STATISTICS FOR THE YEAR ENDING DECEMBER 31, 1904.

Class of goods.	Tons.	Class of goods.	Tons.
Cotton	1,875	Wood	10,000
Cotton seed	240	Timber	51,477
Cotton-seed meal	110	Lumber	1,050
Cotton-seed oil	2	Shingles	1,875
Grain	103	Fertilizers	23,486
Rice, rough	15	Machinery	125
Hay and straw	50	General merchandise	24,400
Potatoes	30	Coal and minerals	1,000
Cattle	81	Brick	6,500
Horses	13	Peanuts	15
Hogs	30	Fish	5
Poultry	20	Fruit and vegetables	25
Eggs	25	Cross-ties	18,750
Rosin	1,840	Poles and piles	3,553
Turpentine:		Tobacco, leaf	3
Crude	600	Pine straw	800
Spirits	450		
Tar	1,980	Total	150,016

Decrease since last year, 6,676 tons. There was a considerable gain in the fertilizer tonnage, but a loss in general merchandise, timber, poles, and cross-ties. In other items there was not much variation. Transportation lines established during the year, none. Number of passengers, 3,000 (estimated).

All of Black River commerce (72,677 tons) passed over 12 miles of this river, but is not included in the above.

Freight transported.

Calendar year ending December 31—	Tons.	Calendar year ending December 31—	Tons.
1880	50,000	1897	91,841
1890	120,000	1898	99,943
1891	88,688	1899	114,877
1892	72,810	1900	129,622
1893	92,757	1901	124,113
1894	85,497	1902	167,534
1895	103,727	1903	156,692
1896	99,367	1904	150,016

Statement of vessels navigating Cape Fear River, North Carolina, above Wilmington, during the calendar year ending December 31, 1904.

Class of vessel.	Number.	Aggregate net tonnage.	Draft.
			Feet.
Steamers	6	439	3 to 4
Steam tugs	7	177	3.5 to 7
Flats (about)	40	8,000	1.5 to 4.5

M 13.

IMPROVEMENT OF CAPE FEAR RIVER, NORTH CAROLINA, AT AND BELOW WILMINGTON.

References.—See page 251 of current summary.

Work on this project is about 62 per cent completed.

The operations for the year have been the work of the suction dredge *Cape Fear* on the Ocean Bar and Snows Marsh channels and of the clam-shell dredge *Ajax* on the river channels; also the repairing of New Inlet and Swash Defense dams, making minor surveys,

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and repairing and caring for plant. All work was done by United States plant and hired labor.

The disbursements of the year were $56,200.77, of which $3,453.21 was for outstanding liabilities of last year, leaving $52,747.56 pertaining to the present fiscal year. If to this the present outstanding liabilities, $7,299.85, be added, we obtain the sum of $60,047.41.

To arrive at the cost of the year's work, the sum of $1,932.11, received from rents and sales, is deducted, leaving $58,115.30 the actual cost of the following work:

481,180 cubic yards of sand removed by dredge *Cape Fear*, at 4.8—cents	$23,026.20
486,927 cubic yards of sand and mud removed by dredge *Ajax*, at 6.7 cents	32,775.42
71 stumps removed by dredge *Ajax*. 44 logs removed by dredge *Ajax*. (The cost of this work is included in the above-named sum of $32,775.42. As it is not practicable to arrive at the exact cost of removing these logs and stumps, it is in this estimate considered merely as an incidental to the dredging.)	
Repairs to New Inlet dam	860.23
(These repairs consisted chiefly of recoping the surface by readjusting the stones, 57 tons of new stone being added.)	
Repairs to Swash Defense dam	1,453.45
(These repairs consisted of recoping and the addition of 470 tons of new stone.)	
Total	58,115.30

It will be noted that the above figures include superintendence and inspection, surveys, office expenses, repairs to plant, purchase of supplies, etc., in fact every item of expense in any way chargeable to this work.

It does not, however, include depreciation of plant. The first cost of the *Cape Fear* was about $61,000, and that of the *Ajax*, with her scows and tenders, about $72,000. If deterioration be figured at 5 per cent of the first cost (a liberal estimate, since the plant is always kept in good repair), the cost of dredging by the *Cape Fear* amounts to $0.05\frac{4}{10}$ cents per yard and the cost of dredging by the *Ajax* amounts to $0.07\frac{5}{10}$— cents per yard. The average cost of the year's work by the two dredges amounts to $6\frac{4}{10}$ cents per yard, deterioration and all expenses being included.

For details of the above work see report of Assistant Engineer R. C. Merritt, appended.

With the available balance it is proposed to restore New Inlet and Swash Defense dams, maintain the present dredged channels, and continue the project to obtain 20 feet depth and 270 feet width from Wilmington to the ocean, make surveys necessary for the proper prosecution of the work, and make the examination called for by the act of March 3, 1905, to determine whether any modifications in the project are desirable.

Additional appropriations are recommended of $250,000 for continuing the improvement under the project and of $50,000 for maintenance of the improvement.

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Money statement.

July 1, 1904, balance unexpended		$60,413.13
Amount appropriated by river and harbor act approved March 3, 1905		150,000.00
Amount received from rents and sales during fiscal year		1,932.11
		212,345.24
June 30, 1905, amount expended during fiscal year:		
For works of improvement	$14,000.00	
For maintenance of improvement	42,200.77	
		56,200.77
July 1, 1905, balance unexpended		156,144.47
July 1, 1905, outstanding liabilities		7,299.85
July 1, 1905, balance available		148,844.62
July 1, 1905, amount covered by uncompleted contracts		5,235.00
Amount (estimated) required for completion of existing project		835,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1907, in addition to the balance unexpended July 1, 1905:		
For works of improvement	$250,000.00	
For maintenance of improvement	50,000.00	
		300,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

ABSTRACT OF CONTRACT.

Contract (emergency) with Linehan, Carroll & Co., dated May 23, 1905, for 2,000 tons of stone, at $1.60 per ton. Delivery to begin within ten days after signature to contract (May 23, 1905) and to be completed within six weeks from date of commencement.

APPROPRIATIONS.

Date.	Amount.	Aggregate.	Date.	Amount.	Aggregate.
March 2, 1829, to July 22, 1854		[a] $368,228.92	August 11, 1888	$245,000	$2,105,000.00
			September 19, 1890	170,000	2,275,000.00
			July 13, 1892	200,000	2,475,000.00
July 11, 1870	$100,000	$100,000.00	August 18, 1894	200,000	2,675,000.00
March 3, 1871	75,000	175,000.00	June 3, 1896	195,000	2,870,000.00
June 10, 1872	100,000	275,000.00	March 3, 1899	150,000	3,020,000.00
March 3, 1873	100,000	375,000.00	June 13, 1902	150,000	3,170,000.00
June 23, 1874	150,000	525,000.00	Allotted from maintenance appropriation act April 28, 1904	30,000	3,200,000.00
March 3, 1875	150,000	675,000.00			
August 14, 1876	132,500	807,500.00	March 3, 1905	150,000	3,350,000.00
June 18, 1878	160,000	967,500.00	Other receipts: Sales and rents to other appropriations		22,375.30
March 3, 1879	100,000	1,067,500.00			
June 14, 1880	70,000	1,137,500.00			
March 3, 1881	140,000	1,277,500.00			
August 2, 1882	225,000	1,502,500.00	Total		3,372,375.30
July 5, 1884	200,000	1,702,500.00			
August 5, 1886	157,500	1,860,000.00			

[a] Balance of $3,728.07 turned over to surplus fund.

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COMMERCIAL STATISTICS FOR YEAR ENDING DECEMBER 31, 1904.

Exports, foreign and coastwise.

[Furnished by Wilmington Chamber of Commerce and Col. J. L. Cantwell.]

	Tons.
Cotton	71,249
Manufactured cotton and yarn goods	1,132
Lumber	87,835
Gum logs	6,400
Cross-ties	21,950
Wood, poplar	2,160
Shingles	6,396
Rosin	14,977
Tar	6,517
Turpentine:	
Spirits	3,983
Crude	5,051
Pitch	222
Peanuts	1,825
Miscellaneous (estimated)	65,000
Total	294,697

Exports, internal.

[Furnished by steamboat, flat, and raft men.]

Miscellaneous	80,523
Total exports (foreign, coastwise, and internal)	375,220

Imports, foreign and coastwise.

[Furnished by importers and manufacturers.]

	Tons.
Fertilizer	90,764
Coal	11,323
Salt	5,530
Oil	16,892
Cement	6,712
Molasses	800
Grain, corn, and rice	800
Miscellaneous (naval stores, cotton, general merchandise, etc.)	100,000
Total	232,821

Imports, internal.

[Furnished by steamboat, flat, and raft men.]

	Tons.
Cotton	1,972
Tar	3,220
Turpentine:	
Spirits	1,160
Crude	870
Rosin	6,120
Lumber and timber	164,826
Cross-ties	27,906
Shingles	4,063
Telegraph poles and piles	4,646
Wood	21,000
Brick	10,250
Miscellaneous	1,937
Total	247,970
Total imports (foreign, coastwise, and internal)	480,791

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SUMMARY.

Exports.

	Tons.
Foreign and coastwise	294,697
Internal	80,523

Imports.

Foreign and coastwise	232,821
Internal	247,970
Total commerce	856,011

Increase since last year, 12,674 tons. Transportation lines established during the year, 1.

Statement of foreign and coastwise vessels of 100 tons and over at the port of Wilmington, N. C., for the calendar year ending December 31, 1904.

[Furnished by Capt. E. D. Williams, harbor master.]

Class of vessel.	American.		Foreign.		Total.	
	Number.	Tonnage.	Number.	Tonnage.	Number.	Tonnage.
Steamers	107	137,596	44	82,530	151	220,126
Barks	5	2,667	10	7,546	15	10,213
Brigs	2	930	2	622	4	1,552
Barges	6	10,774			6	10,774
Schooners	92	42,975	11	2,304	103	45,279
Total	212	194,942	67	93,002	279	287,944

The above does not include vessels which took cargoes to Southport, Fort Caswell, or the fish factories, or vessels coming to Southport in distress for supplies or for a harbor, the total estimated tonnage of which is 40,000 tons.

Vessels owned by the United States Government are not included. No record is made of steamboats plying on the rivers above and below Wilmington, or of small vessels and steam tugs of less than 100 tons.

Foreign commerce for the calendar year 1904.

[Furnished by the collector of customs of the port of Wilmington, N. C.]

Class of goods.		Quantity.	Value.	
			Exports.	Imports.
Cotton	bales	276,794	$15,241,288	
Rosin	barrels	59,006	149,538	
Tar	do	97	209	
Spirits of turpentine	gallons	13,754	26,350	
Lumber	M feet	3,731	58,711	
Shingles	M	1,044	5,205	
Miscellaneous	tons		20,282	
Kainit	do	19,790		$117,678
Potash (M. and S. of)	do	5,029		180,013
Molasses	tierces	12,937		99,941
Miscellaneous	tons	16,296		260,060
Total			15,501,583	657,692

Freight transported.

Calendar year ending December 31—	Tons.	Calendar year ending December 31—	Tons.
1889	220,000	1897	595,426
1889	325,512	1898	627,899
1890	346,557	1899	631,853
1891	344,443	1900	699,356
1892	341,468	1901	727,359
1893	392,965	1902	841,631
1894	437,623	1903	843,337
1895	618,054	1904	856,011
1896	673,208		

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Cotton steamers loaded at the port of Wilmington, N. C., during the calendar year ending December 31, 1904.

[Furnished by Messrs. Alexander Sprunt & Son.]

Name of steamer.	Registered tonnage.	Draft loaded.	Bales.
		Feet.	
Oceano	3,050	18.9	17,098
Axminster	1,230	14.6	5,919
City of Gloucester	1,573	18.4	8,054
Naparima	1,043	16.6	4,935
Roda	1,587	17.4	8,528
Harbart	2,149	20.0	11,670
Janeta	2,179	18.6	11,000
Cayo Blanco	1,736	17.6	8,643
Ursula Bright	2,114	17.0	11,150
Rosneath	1,123	17.6	4,470
Guiseppe Carvaja	1,097	16.0	8,662
Falka	1,107	14.5	5,075
Tolosa	2,099	18.4	10,000
Huelva	1,690	16.6	8,105
Ras Dara	2,495	18.0	12,982
Vera	1,854	17.0	8,968
Reigate	2,504	18.6	12,011
Skerryvore	2,199	19.0	10,243
David Mainland	1,201	15.0	5,739
Anglo Canadian	2,679	20.6	15,783
Skidby	2,421	19.6	11,901
Daleby	2,358	17.6	12,250
Fernfield	2,025	18.0	9,842
Kingswood	1,209	15.0	6,700
Anglo Saxon	2,671	20.6	17,228
Miramar	1,561	17.6	7,695
Makta	1,548	17.6	7,814
Greatham	1,531	18.0	7,561
Tolosa	2,099	18.6	10,948
Total	54,127	.....	276,794

REPORT OF MR. R. C. MERRITT, ASSISTANT ENGINEER.

WILMINGTON, N. C., *June 30, 1905.*

CAPTAIN: I have the honor to submit the following report of operations for the improvement of the Cape Fear River, North Carolina, at and below Wilmington, for the fiscal year ending June 30, 1905:

CONDITION AT BEGINNING OF YEAR.

To July 1, 1904, dredging had been done at the various shoals, as follows: (The depths refer to mean low water.)

Name of shoal.	Distance below Wilmington.	Length dug.	Width dug.	Depth dug.	Remarks.
	Miles.	*Feet.*	*Feet.*	*Feet.*	
Wilmington	0.0	3,200	270	20	In addition, an average width of 150 feet between channel and harbor lines had been dug 20 feet deep.
Aligator Creek	1.5	9,800	148	20	
Brunswick River	3	8,600	185 to 222	20	Upper 1,000 feet 222 feet wide; lower 7,600 feet 185 feet wide; slight shoaling.
Logs and Big Island	7	16,700	148	20	Slight shoaling.
Keg Island	9.5	4,000	148	20	Do.
Lilliput	11	17,200	148	20	Slight shoaling near upper end.
Old Brunswick Cove	13.5	5,000	148	20	Slight shoaling in middle reach.
Midnight	16	14,500	148	20	
Reaves Point	19	2,000	148	20	
Snows Marsh	20	9,600	233 to 270	16 to 18	18-foot channel about 150 feet wide.
Ocean bar	30	6,000	200	20	Shoaled; width of 20-foot channel was 200 feet at narrowest place.

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These channels have been previously dredged to 16 feet depth for the full width of 270 feet, excepting Snows Marsh channel, where the bottom width was 233 feet, and Keg Island shoal, where the natural depth exceeded 16 feet.

New Inlet dam was in fair condition, excepting near the Zekes Island shore connection, where settlement had occurred and some of the large stone coping was out of place. Swash Defense dam was considerably damaged for the greater portion of its length. Snows Marsh dike was almost obliterated. The old Woodbury jetty, opposite Baldhead Point, had been removed to a depth of 25 feet.

OPERATIONS FOR THE YEAR.

The operations for the year have principally consisted of the work of the suction dredge *Cape Fear* on the Ocean Bar and Snows Marsh channels, and the clamshell dredge *Ajax* on the river channels, making repairs to New Inlet and Swash Defense dams, making minor surveys, and repairing and caring for plant. All work was done by hired labor and United States plant.

The suction dredge *Cape Fear* was employed on the Ocean Bar channel when weather permitted and at other times on Snows Marsh channel. From January 21 to February 20 the dredge was detained at Wilmington making repairs to boiler, machinery, and tail shaft.

The amount of work done by the *Cape Fear* during the year and the location of the same is as follows:

	Cubic yards.
Ocean Bar channel	352,968
Snows Marsh channel	128,212
Total	481,180

The cost of this work may be summarized as follows:

OPERATING DREDGE.

Labor, operating	$8,695.41
Minor repairs	2,411.23
Machine supplies	478.46
Fuel	5,615.18
Subsistence	1,700.25
Property, rope, etc	303.91
Special repairs	971.53
Repairs to windmill	7.73
Total	20,183.70
Deduct as follows:	
Received from Savannah district for rent	1,557.50
Total cost of operating	18,626.20

Other expenses chargeable to this work:

Superintendence and surveys	$1,500.00	
Rent, watching yard, etc., at Wilmington (part)	400.00	
Operating steamer *Mercur* and launch *Nancy* (part), inspection and survey boats	1,300.00	
Main office expenses (part)	1,200.00	
Total cost of other expenses chargeable to this work		4,400.00
Total cost of operating and other expenses		23,026.20

Cost per cubic yard for operating, 3.9 cents.

Cost per cubic yard for operating and other expenses, 4.8 cents.

The cost of this dredging per cubic yard is very low, which is due to the fact that $1,557.50 due from the Savannah district for repairs to the dredge made last year was paid this year and credited to this year's work, and also to the

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fact that no very extensive repairs were made to the plant during the year and all other expenses were kept at a minimum. If we do not deduct the $1,557.50 paid by the Savannah district, it will make the cost 4.2 cents per cubic yard for operating and 5.1 cents per cubic yard for operating and all other expenses, which is the actual cost of the work during the year.

The clam-shell dredge *Ajax* has been continuously at work during the year on restoring to 20 feet depth, at mean low water, the shoaled portion of the river channels that had been previously dug to that depth, and increasing the width of the 20-foot channel at Alligator Creek Shoal.

The amount of work done by this dredge during the year and the location of the same is as follows:

Name of shoal.	Cubic yards.	Stumps.	Logs.
Wilmington shoal	1,884	.....	5
Alligator Creek	149,545	15	31
Brunswick River	22,234	.....	1
Logs and Big Island	26,145	3	1
Keg Island	27,666	28	1
Lilliput	190,057	25	5
Old Brunswick Cove	55,788	.....	.....
Midnight	13,608	.....	.....
Total	486,927	71	44

The cost of this work may be summarized as follows:

Operating dredge *Ajax:*		
Labor, operating	$5,612.18	
Minor repairs	2,210.81	
Machine supplies	534.49	
Fuel	2,741.01	
Subsistence	1,114.26	
Property, rope, etc	1,621.81	
Repairs to mud scows	1,072.16	
Repairs to coal scow	10.00	
		$14,916.72
Operating tug *Caswell:*		
Labor, operating	3,703.00	
Minor repairs	783.89	
Machine supplies	321.66	
Fuel	2,831.84	
Subsistence	847.34	
Property, rope, etc	446.52	
		8,934.25
Operating tug *Cynthia:*		
Labor, operating	809.00	
Minor repairs	925.24	
Machine supplies	48.28	
Fuel	321.46	
Subsistence	156.65	
Property, rope, etc	303.65	
		2,564.28
Total cost		26,415.25
Deduct as follows:		
Received from sale of old junk		374.61
Total cost for operating this plant		26,040.64

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Other expenses chargeable to this work:

Superintendence and surveys	$2,150.00	
Rent, watching yard, etc., at Wilmington (part)	747.17	
Operating steamer *Mercur* and launch *Nancy* (part), inspection and survey boats	1,700.00	
Repairing channel ranges	437.61	
Main office expenses (part)	1,700.00	
Total cost of other expenses chargeable to this work		$6,734.78
Total cost of operating and other expenses		32,775.42

Cost of dredging per cubic yard for operating, excluding logs and stumps, 5.3 cents.

Cost of dredging per cubic yard for operating and other expenses, excluding logs and stumps, 6.7 cents.

Repairs were started on New Inlet dam in May of this year and are now in progress, consisting of patching coping where damaged by storm near Zekes Island, shore connection, with stone received from the old Woodbury jetty, and 57 tons of ballast rock were also purchased and used in making repairs.

The cost of this work may be summarized as follows:

Labor	$388.88
Subsistence	123.07
Fifty-seven tons ballast rock, at $1	57.00
Sand bags	27.50
Fuel	8.73
Repairs to plant	51.74
Repairs to quarters	22.47
Property and rope	50.00
Steamer *Mercur*:	
Towing (part)	15.00
Superintendence (part)	30.00
Superintendence	74.84
Main office expenses	10.00
Total cost of repairs	860.23

Repairs were started on Swash Defense dam in June and are still in progress. The repairs made so far consist of placing rubblestone, in pieces weighing from 25 to 200 pounds, on low places along the dam, and relaying a small amount of the coping.

The cost of this work may be summarized as follows:

Labor	$111.00
Subsistence	30.00
470 $\frac{55}{224}$ tons stone, at $1.60	752.46
Unloading stone at Wilmington	91.95
Fuel	10.00
Repairs to plant	50.00
Repairs to quarters	40.00
Property and rope	132.43
Steamer *Mercur*:	
Towing (part)	154.73
Superintendence (part)	20.00
Superintendence	50.00
Main office expenses	10.88
Total cost of repairs	1,453.45

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The cost of operating the survey and inspection boat *Mercur* and launch *Nancy* during the year was as follows:

Labor, operating	$1,297.56
Minor repairs	433.09
Machine supplies	141.05
Fuel	517.30
Subsistence	490.57
Property, rope, etc	72.43
Operating launch *Nancy*	267.73
Total cost	3,219.73

This amount has been charged into the cost of the work as follows:

Cape Fear, dredging	$1,300.00
Ajax, dredging	1,700.00
Repairs to new inlet dam	45.00
Repairs to swash defense dam	174.73
Total	3,219.73

The cost of renting and watching yard at Wilmington, N. C., during the year was $1,147.17, and has been charged into the cost of the work as follows:

Cape Fear, dredging	$400.00
Ajax, dredging	747.17
Total	1,147.17

Repairs were made to channel ranges during the year at a cost of $437.61, all of which was charged into the cost of the dredging done by the dredge *Ajax*.

The cost of superintending the work during the year was $3,774.84, which amount was charged into the cost of the work as follows:

Cape Fear, dredging	$1,500.00
Ajax, dredging	2,150.00
Repairs to new inlet dam	74.84
Repairs to swash defense dam	50.00
Total	3,774.84

The amount charged to this improvement for the expenses of your office during the year was $2,920.88, which has been charged into the cost of the work as follows:

Cape Fear, dredging	$1,200.00
Ajax, dredging	1,700.00
Repairs to new inlet dam	10.00
Repairs to swash defense dam	10.88
Total	2,920.88

SUMMARY OF WORK AND EXPENDITURES.

Total amount spent during the year		$60,047.41
Deduct as follows:		
Received from the Savannah district	$1,557.50	
Received from sale of old junk	374.61	
		1,932.11
Total cost of work done during year		58,115.30
481,180 cubic yards of sand removed by dredge *Cape Fear*, at 4.8 cents	$23,026.20	
486,927 cubic yards of sand and mud removed by dredge *Ajax*, at 6.7 cents	32,775.42	
71 stumps removed by *Ajax*.		
44 logs removed by *Ajax*.		
Repairs to Swash Defense dam	1,453.45	
Repairs to New Inlet dam	860.23	
		58,115.30

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Of this amount $14,000 was spent on continuing the improvement, and the balance was for maintenance.

PRESENT CONDITION OF WORK.

Across the Ocean bar there is a 20-foot, mean low-water channel, with a least width of 250 feet. There has been little or no easterly movement of the channel in the vicinity of the old Woodbury jetty since its removal last year.

The 18-foot low-water channel at Snows Marsh shoal has been maintained and slightly improved during the year. At Wilmington, Logs and Big Island, Keg Island, Lilliput, Old Brunswick Cove, and Midnight shoals the portion of the channel previously dredged to 20 feet depth has been restored to that depth. At the lower end of Brunswick River shoal, where shoaling had taken place, the channel has been restored to 20 feet depth for a width of 148 feet. At Alligator Creek shoal the width of the 20-foot channel has been increased from 148 to 259 feet for 6,000 feet of its length and 222 feet for the remaining 3,800 feet of its length. Shoaling has taken place in some of these channels since their restoration. Reaves Point channel is in approximately the same condition as at the beginning of the year.

New Inlet and Swash Defense dams are in slightly better condition than at the beginning of the year.

The whole of Snows Marsh training dike is about obliterated .

The sea beaches remain in practically the same condition as for the past several years.

Very respectfully, your obedient servant,

R. C. MERRITT,
Assistant Engineer.

Capt. R. P. JOHNSTON,
Corps of Engineers.

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INDEX.

[The references in roman are to volume and those in arabic to page.]

A.

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B.

Digitized by Google

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