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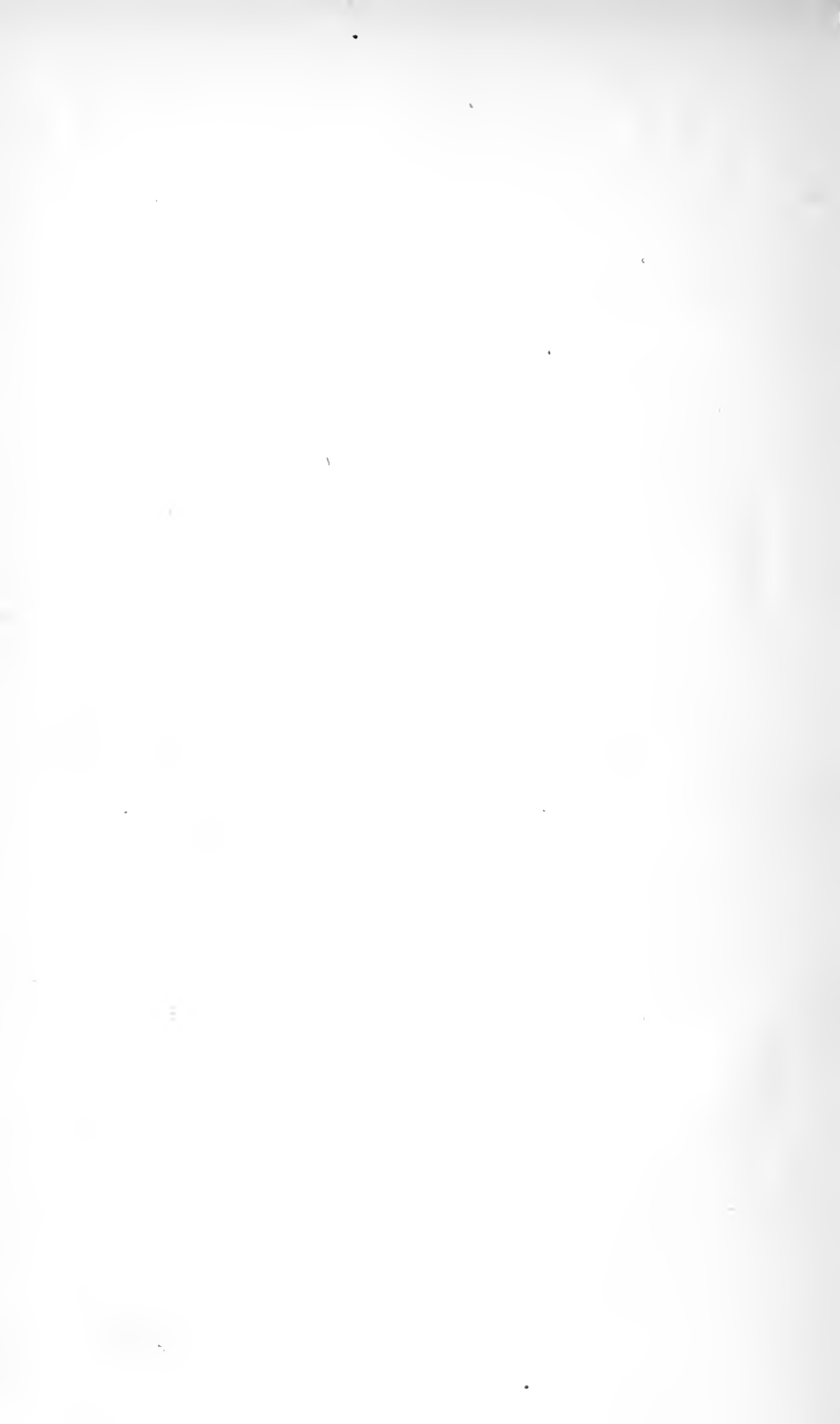
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CITY OF BOSTON.



REPORT

OF THE

COCHITUATE WATER BOARD

TO THE

CITY COUNCIL OF BOSTON,

FOR THE YEAR ENDING APRIL 30, 1871.

140 798
The Water Board.

May 10. 73.



CITY OF BOSTON.



In Common Council, April 20, 1871.

ORDERED: That the Cochituate Water Board be authorized to submit their annual report in print, and that the expense connected therewith be charged to the appropriation for printing.

Sent up for concurrence.

MATTHIAS RICH, *President.*



In Board of Aldermen, April 24, 1871.

Concurred.

CHAS. E. JENKINS, *Chairman.*



Approved April 25, 1871.

WILLIAM GASTON, *Mayor.*



A true copy.

Attest:

S. F. McCLEARY, *City Clerk.*



CITY OF BOSTON.

CITY HALL, COCHITUATE WATER BOARD OFFICE,
MAY 18, 1871.

TO THE CITY COUNCIL OF THE CITY OF BOSTON :

The Cochituate Water Board, in compliance with the provisions of the City Ordinance, herewith submit their annual report for the year ending April 30, 1871, together with the reports of the Clerk of the Board, City Engineer, Water Registrar, and the Superintendents of the Eastern and Western Division, to which they would refer the City Council for detailed statements of the progress and condition of the Water Works during the year.

It gives us pleasure to say that the works are in a very satisfactory condition. The average level of the water of the lake for the year ending January 1, 1871, having been $10\frac{9}{100}$ feet above the level of the bottom of the conduit, shows a loss of $1\frac{1}{100}$ feet from the previous year.

The levels during the latter part of the year show the supply to have been far below the usual average. In the month of January the Board were so much alarmed by the long-continued drought and the consequent low state of the water, that they purchased an Engine and two Andrews' Pumps and placed them in position for use in forcing water from the lower and deeper parts of the lake into the conduit. The citizens, realizing the importance of the subject, adopted a rigid system of economy, and we were thus enabled to continue the requisite supply without resorting to the use of the pumps. The lowest point ($4\frac{1}{12}$ feet) was reached on the 18th day of February, 1871. That the twelve months ending April 30, 1871, was remarkable as a year of short sup-

ply of water will be the more fully realized by comparison. The average depth of the water at the lake for the year ending April 30, 1870, was $12\frac{20}{100}$ feet above the bottom of the conduit, while the average for the year ending April 30, 1871, was only $8\frac{92}{100}$ feet.

The average daily consumption has been 15,007,700 gallons, being a decrease of 62,700 gallons as compared with the previous year. This decrease can only be accounted for by the fact that the citizens were fully aware of the diminished supply, and regulated its use accordingly.

The income from water rates has been $\$734,790\frac{74}{100}$, being an increase over the previous year of $\$105,339\frac{26}{100}$, and the estimated income for year ending April 30, 1872, is $\$750,000$.

The expenses have been as follows:—

For the current expenses		\$238,431 80
Interest and premium on the water debt		685,266 48
		<u>\$923,698 28</u>
The Treasurer has credited the Water Works for the same year		<u>\$782,610 00</u>
The balance shows an expenditure over and above receipts of		\$141,088 28
Add expended on Chestnut Hill reservoir during the year	\$329,957 80	
Less receipts	6,513 37	
		<u>\$323,444 43</u>
Add expended in laying main and service pipes in Wards 13, 14, 15, and 16	\$342,387 09	
Less receipts	983 03	
		<u>\$341,404 06</u>
<i>Amount carried forward,</i>		<u>\$805,936 77</u>

<i>Amount brought forward,</i>	\$805,936 77
Cost of works to May 1, 1870, including interest and premium on the water debt, less amounts received for water rates, rents, sales of land, etc.	\$9,765,959 87
Gross cost to May 1, 1871	\$10,571,896 64
Deduct amount transferred from water debt to City debt to May 1, 1871, namely, three per cent. on the outstanding loans of each year, with compound interest	\$1,352,000 00
Making the net cost to May 1, 1871	<u>\$9,219,896 64</u>

By the figures it will be seen that the income has not been sufficient to pay the interest on the water debt and the current expenses by the sum of \$141,088 28, which exceeds the deficiency of the previous year by the sum of \$62,221 56.

During the past year changes have been made in the manner of arranging the Sinking Fund of the city, and the sum of \$1,352,000 has been credited to the Water Works.

By the transfer of this sum, the interest account for this department will be considerably reduced, and the works become more nearly self-supporting.

EASTERN DIVISION.

This Division comprises that portion of the works lying east of the Brookline reservoir, including the distributing pipes and reservoirs in the city, and is under the superintendence of Mr. E. R. Jones.

During the year there has been laid one hundred and twenty-nine thousand and forty feet of main pipe, equal to about twenty-four and one half miles, being thirty-nine thousand seven hundred and eighty-one feet more than was laid the previous year, and making the total amount laid since the

commencement of the work, one hundred and ninety-four and one half miles.

There are connected with these mains one thousand nine hundred and thirty-seven gates, and two thousand one hundred and seventy-four fire hydrants; seven hundred and twenty-four of the latter are of the Lowry pattern.

The number of gates added during the year has been two hundred and twenty, and the number of fire hydrants two hundred and seven, of which one hundred and fifty-three were of the Lowry pattern.

The number of service pipes laid has been two thousand two hundred and twenty-four, — an increase of nineteen over the previous year.

The total number of service pipes, on May 1, was thirty-two thousand six hundred and ninety-five.

The repairs during the year show a large increase over the year preceding, when there had been a marked reduction. The greater portion of the increase of leaks was from frost and rust, and of the expense the increase has been in repairs on the main pipe and streets.

The work has been pushed forward in the Highlands and in the Dorchester district as rapidly as the circumstances and the means at the disposal of the Board would permit. Hindrances were met with in the delivery of the pipes, the nature of the soil, and in the delay in making the appropriation. Yet it appears that in the seven weeks making the close of the year more than six miles of pipe was laid. The pipe of the larger sizes has all been laid, including the twenty-inch main from Upham's Corner, Ward 16, to the reservoir in South Boston. Nearly three-fifths of the whole amount of pipe laid was in Wards 13, 14, 15 and 16.

The length of main pipe laid to Deer Island was twenty-seven thousand four hundred and eighty-eight feet. The Mystic water was let into this line of pipes on the 29th of April, and when the new mains in East Boston are laid and

the connections are made, an abundant supply of water will be furnished to the Island.

To provide a better supply and more direct communication with the low service in the western part of the city, a sixteen-inch main has been laid through a portion of Charles street, connecting with the forty-inch main at the foot of the Common, and to connect with the twelve-inch on Cambridge street; and a thirty-inch gate has been established for the same purpose in Hancock street, near Derne street. The Frog pond is also connected with the forty-inch main by a line of twelve-inch pipes for the supply of the fountain at low service.

HIGH SERVICE.

The high-service supply, which worked so well in the Highland district, was made applicable to the supply on Beacon Hill, and the water was let on the 4th of June, last year. Since the 6th of June the water has been in use, and has proved adequate to the supply of the dwellings in their upper stories.

DISTRIBUTING RESERVOIRS.

The Beacon Hill reservoir having been superseded in the supply of that section of the city, by the high service, will no longer be needed, and the Board will recommend its sale at a proper time. Its capacity is only that of one-fifth of a day's supply to the city, and with the laying of the proposed forty-eight inch main to the city direct from the Chestnut Hill reservoir, the supply of water it is believed will be equal to any emergency which would require the use of this reservoir for reserve purposes in storage of water. The sale of this property it is anticipated will realize a sum sufficient to pay the cost of laying the new main from the Chestnut Hill reservoir.

The repairs on the East Boston reservoir prove to have

been thorough, the reservoir having been fully tested by filling it to its greatest capacity without causing any leakage. The grading of Brooks and White streets having been completed, the embankments were graded to conform to the streets, and an iron fence erected, which appears to be in good condition.

The improvements around the stand-pipe have been completed, a retaining wall built on Fort Avenue and the driveway gravelled and rolled.

WESTERN DIVISION.

This division comprises the Lake and that portion of the works lying between the Lake and the gate-house at the Brookline reservoir, and is under the charge of Mr. Albert Stanwood, as superintendent.

A favorable opportunity was afforded by the low state of the water at the lake during the past season, to make the repairs which were needed; and nearly eight hundred feet of slope wall, to protect the banks, was constructed, new timber put in at the upper and lower dam, and other repairs were made. An engine-house for use, in case of necessity for pumping, has been constructed on the north side of the gate-house. The house and the other buildings are in good condition. More than thirty-five hundred feet of fence has been put up, and nearly as much more will be required the present year. Additional bank wall will also be constructed by the side of the Saxonville Branch Railroad.

The new dam at Pegan brook has been constructed and the brook cleaned out. The gate-chamber at Dudley pond has been reconstructed, and the Willow bridge culvert repaired satisfactorily in the removal of obstructions to the free flow of the water. Examinations of the conduit show that its condition does not change materially, the water

having been shut off but twice during the past year for repairs, etc., namely, once to repair a leak and once to change the screens at the lake. The waste weirs are all in good condition, but the east pipe chamber at Newton Lower Falls requires attention.

CHESTNUT HILL RESERVOIR.

The Bradlee basin was completed, and a formal letting on of water took place on the 25th October last, the twenty-second anniversary of the introduction of the Cochituate water into the city. The water was allowed to flow in a portion of each day until November 2d, when the low stage of water in the lake required its cessation until March. From the 14th March to 1st May all of the water not needed for the daily supply of the city was allowed to flow into the basin. On the first of May the depth of water was about fourteen feet. The capacity of the Bradlee basin is 550,583,485 gallons, and of the Lawrence basin 180,888,944 gallons.

Much work has been done the present season in grading the ground where the old stables stood, in fencing, completing the sidewalk, and putting the grounds in order around the reservoirs. The land damages have all been settled.

BROOKLINE RESERVOIR.

Repairs have been made at this reservoir in repointing the walls, painting the gate-house, pruning the trees, etc., and proper care taken of the grounds. It is proposed to clean out the basin when the water can be drawn off, which will probably be done the present season.

WATER REGISTRAR'S DEPARTMENT.

The total number of water-takers now entered for the year, is thirty-six thousand one hundred and thirty-two, showing

an increase since January 1, 1870, of four thousand six hundred and thirty-two. The number of cases in which the water was turned off for non-payment of rates, was seven hundred and forty. Of this number six hundred and two have been turned on again, the numbers turned off and remaining off being about the same as those of last year.

The number of meters now applied to the premises of water-takers is one thousand and seventy-six, being a decrease from last year of thirteen.

The number of the various kinds of water-fixtures on the premises of water-takers January 1, 1871, was 130,234, being an increase over the previous year of 11,962.

CHARLES H. ALLEN, *Pres't.*
NATHANIEL J. BRADLEE.
GEORGE LEWIS.
JOHN A. HAVEN.
LEONARD R. CUTTER.
AMOS L. NOYES.
SYDNEY SQUIRES.

REPORT OF THE CLERK.

OFFICE OF THE COCHITUATE WATER BOARD,
BOSTON, May 5, 1871.

CHARLES H. ALLEN, Esq.,

President of the Cochituate Water Board:

SIR: The following is a statement of the Expenditures and Receipts of this department for the year commencing May 1, 1870, and ending April 30, 1871:—

EXPENDITURES.

Blacksmith shop, for stock, etc.	\$356 09
Plumbing shop, “ “	105 00
Stable	3,716 42
Taxes	266 86
Tools	2,940 78
Travelling expenses	457 50
Fountains	2,222 00
Laying main pipes, for stock, etc.	2,127 33
Postage and expresses	40 49
Reservoirs — Beacon Hill	650 63
“ East Boston	7,686 06
“ South Boston	236 50
“ Brookline	1,458 39
Aqueduct repairs	818 46
Printing (including Water Registrar's and Superintendent's)	1,681 67
Rent of Eastern Avenue wharf for tow-boats	2,000 00
<i>Amount carried forward,</i>	\$26,764 18

<i>Amount brought forward,</i>	\$26,764 18
Telegraph to the reservoirs, machine shop, and lakes	83 76
Stationery (including Water Registrar's and Superintendent's)	617 31
Salaries (including clerks in Water Regis- trar's department)	17,450 09
Main pipe	25,428 40
Service pipe	27,035 00
Off and on water	8,023 40
Inspectors	8,490 00
Wages, — laying main pipe	12,395 99
“ “ service pipe, etc.	13,610 72
“ blacksmith shop	1,317 50
“ plumbing shop	51 00
“ proving yard	6,180 49
Upper yard, finishing buildings, labor, etc.	2,965 88
Miscellaneous expenses	2,426 78
Meters	1,869 20
Maintaining meters	2,606 10
Repairing main pipe	5,567 32
“ service pipe	8,735 96
“ hydrants	3,195 98
“ streets	7,869 35
“ stopcocks	813 48
Stopcocks	10,767 17
Hydrants	1,915 73
Lake	9,288 58
Proving yard, stock, etc.	11,121 54
Raising pipes	531 48
Hydrant and stopcock boxes	2,438 58
Tolls and ferriage	70 50
Carting	393 50
<i>Amount carried forward,</i>	<u>\$220,024 97</u>

<i>Amount brought forward,</i>	. . . . .	\$220,024 97
Chestnut Hill reservoir	. . . . .	329,957 80
Wards 13, 14, 15	. . . . .	105,088 38
Amount drawn for the driveway around		
Chestnut Hill reservoir	. . . . .	24,751 02
Water to Deer Island	. . . . .	30,895 15
Ward 16	. . . . .	237,298 71
High service	. . . . .	9,006 22
Wages high service	. . . . .	2,347 75
Pumping works at lake	. . . . .	3,940 86
New main, East Boston	. . . . .	630 33
Damage	. . . . .	667 81
Advertising	. . . . .	444 19
		<hr/>
Total drawn for by the Board	. . . . .	<u>\$965,053 19</u>

And which is charged as follows:—

To Chestnut Hill reservoir	. . . . .	\$329,957 80	
“ Water Works	. . . . .	236,431 80	
“ Driveway	. . . . .	24,751 02	
“ Wards 13, 14, 15	. . . . .	105,088 38	
“ Water to Deer Island	. . . . .	30,895 15	
“ Ward 16	. . . . .	237,298 71	
“ New main, East Boston	. . . . .	630 33	
		<hr/>	
		\$965,053 19	
Amount charged Water Works	. . . . .		\$908,776 69

RECEIPTS.

Cash paid City Treasurer.

Received for grass and pasture	\$180 00	
“ “ fines for waste, etc.	828 00	
	<hr/>	
<i>Amount carried forward,</i>	\$1,008 00	\$908,776 69

<i>Amount brought forward,</i>	\$1,008 00	\$908,776 69
Received for off and on water,		
for repairs	2,476 25	
“ “ pipe laying, re- pairing, etc.	20,436 19	
“ “ stones sold	75 00	
“ “ land sold	487 82	
“ “ old iron, oxen, etc., sold on ac- count of C. H. reservoir	6,513 37	
“ “ hydrants and main- taining same for Fire Departm't	21,996 00	
	<hr/>	\$52,992 63
Net amount to Water Works		<hr/> <hr/> \$855,784 06

The above is credited to

Chestnut Hill reservoir	6,513 37
Water Works	46,479 26
	<hr/>
	\$52,992 63

Amount drawn for Water Works, not includ- ing Chestnut Hill reservoir, Wards 13, 14, 15, water to Deer Island, Ward 16, new main, East Boston, or Chestnut Hill drive- way	\$236,431 80
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EXTENSION OF THE WORKS.

Main pipe	\$25,428 40
Wages laying main pipe	12,395 99
Laying main pipe, stock, etc.	2,127 33
	<hr/>
	39,951 72

Amount of expenses from April 30, 1870, to May 1, 1871	\$196,480 08
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*Expenditures and Receipts on Account of the Water Works,
to May 1, 1871.*

Amount drawn by Commissioners	\$4,043,718 21
“ “ Water Board, in 1850	366,163 89
“ “ Cochituate Water Board, from January 1, 1851, to May 1, 1870	5,053,661 08
Amount drawn from April 30, 1870, to May 1, 1871, for Water Works	908,776 69
	<hr/>
	\$10,372,319 87

Amount paid the City Treas- urer by the Commissioners	\$47,648 38
Amount paid by Water Board, 1850	8,153 52
Amount paid by Cochituate Water Board, to May 1, 1870	210,531 92
Amount paid from April 30, 1870, to May 1, 1871	52,992 63
	<hr/>
	319,326 45
	<hr/>
Balance	<u>\$10,052,993 42</u>

Net amount drawn from the Treasurer, by the Commissioners and Water Boards, for the Water Works	<u>\$10,052,993 42</u>
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Gross payments (including interest, premium, etc.) for account of the Water Works	\$19,087,530 34
Gross receipts	9,867,633 70
	<hr/>
Net cost to the city, May 1, 1871	\$9,219,896 64

SAM'L N. DYER,
Clerk Cochituate Water Board.

COST OF THE WORKS TO MAY 1, 1871.

WESTERN DIVISION.

Amount paid William H. Knight for the lake	\$100,000	00
Amount paid William H. Knight for the factories, \$50,000; less amount on account of the sale of land and machinery, and insurance at the time of the fire	20,818	22
Expense of raising the lake two feet, including damages	28,002	18
Cost of roads, bridges and swamps	38,332	48
Gate-house at the lake	29,907	12
Dam at the outlet of the lake	8,458	20
Dudley pond, lower dam, and making connections with the lake	18,982	23
New dam, and improvements at the lake	19,610	90
	<hr/>	
Total cost of lake dep't, <i>not including land</i>	\$264,111	33
Land and land damages, less credit for land sold	\$225,523	15
Constructing the brick conduit	817,717	73
Brookline reservoir, land	\$58,418	92
Brookline reservoir, construction	108,301	92
Brookline reservoir, gate-house	33,356	37
	} 200,077 21	
Compensating reservoirs, less amount received when sold	66,859	80
Engineering expenses on the Western Division	69,900	31
Miscellaneous expenses on the Western Division	44,227	80
	<hr/>	
<i>Amounts carried forward,</i>	\$1,424,306	00
	\$264,111	33

<i>Amounts brought forward,</i>	\$1,424,306 00	\$264,111 33
Payment on account of the Chest- nut Hill reservoir	2,423,771 95	
	<hr/>	3,848,077 95
Total cost of Western Division		<hr/> <hr/> \$4,112,189 28

EASTERN DIVISION.

Main and service pipes	\$2,932,830 72	
Beacon Hill res- ervoir, land	\$145,107 10	
Beacon Hill reser- voir, construct'n,	368,426 11	513,533 21
South Boston res- ervoir, land	55,103 23	
South Boston reser- voir, construc'n,	35,804 87	90,908 10
East Boston res- ervoir, land	\$23,862 50	
East Boston reser- voir, construc'n,	46,328 59	70,191 09
Engineering expenses on the Eastern Division		31,403 02
Machine shop and pipe yards		69,887 96
Hydrants and stopcocks		93,392 61
Proving pipes		35,983 96
Meters		114,366 48
Miscellaneous expenses on the Eastern Division		353,656 65
Payment on account of Wards 13, 14, 15		686,266 78
Payment on acct. Ward 16		237,298 71
Total cost of Eastern Division		<hr/> <hr/> \$5,229,719 29

Total cost of Western Division	\$4,112,189 28
Total cost of Eastern Division	5,229,719 29
	<hr/>
Total Eastern and Western	\$9,341,908 57
Expenses of carrying on the works	\$1,119,801 40
Interest paid, after deducting to- tal income received	110,186 67
	<hr/>
Excess of expenses and interest over income	<u>\$1,229,988 07</u>
Total cost on May 1, 1870, over and above the income	\$10,571,896 64
Deduct amount transferred to the Water Works from Sinking Fund	\$1,352,000 00
	<hr/>
Net Cost	\$9,219,896 64

REPORT OF THE CITY ENGINEER.

CITY HALL, BOSTON, May 5, 1871.

OFFICE OF CITY ENGINEER.

CHAS. H. ALLEN, Esq.,

President of the Cochituate Water Board:

SIR: In compliance with the ordinance relating to the City Engineer's department, I have the honor to present the following report:—

EASTERN DIVISION.

On pages 58–59 will be found the usual tables of the average monthly and yearly heights of the water in the Brookline and City reservoirs, from 1861 to 1870 inclusive, said heights being expressed in feet and decimals of feet above "tide marsh level," or mean high water.

By reference to the Brookline table it will be seen that the average level for the entire year was $\frac{1}{10}$ of a foot higher than for the previous year; $\frac{28}{100}$ of a foot lower than the highest average (in 1862), and $\frac{38}{100}$ of a foot lower than the average for the whole ten years.

The average level of the water in the Beacon Hill reservoir the past year has been a trifle higher than the year previous; but it would, undoubtedly, have been considerably lower, had the reservoir been connected with the high-service distribution during the entire year; but, since the supply for this district has been furnished by the pumping engines, this reservoir has been disconnected from both the high and low service for the greater part of the time.

The average level of the water in the South Boston reser-

voir has been higher the past year than it has since 1866. The water in this reservoir, as in the Beacon Hill, is shut in for the greater part of the time. The completion of the new main and a separation of the high and low service districts will produce a marked difference in the level of the water in this reservoir; but the highest houses can be thoroughly served only by a supply from the pumping engines.

It will be seen by reference to the East Boston table that the average level during the past year was $5\frac{31}{100}$ feet higher than for the previous year, and $9\frac{57}{100}$ feet higher than the average for the nine years previous.

High-water mark in this reservoir is 107.60 feet above "tide marsh level." So that it will be seen the average level since the reservoir has been supplied from the Mystic works was $3\frac{23}{100}$ feet below high-water mark. During most of the year all the water used by East Boston has passed through the reservoir, and the average pressure has, therefore, been that due to a height of $104\frac{37}{100}$ feet above "tide marsh level;" but, when the reservoir is disconnected from East Boston and the supply is direct from the Mystic pipes, the pressure would be equivalent to a height of $132\frac{18}{100}$ feet above the same level.

ENLARGEMENT OF WATER PIPES IN EAST BOSTON.

For the details of the propositions relating to an enlargement of the pipes in certain streets in East Boston, I respectfully refer you to my annual report to the City Council (City Document, No. 15, 1871, p. 32), and to the several reports and estimates therein referred to.

Independently of the expediency or necessity of the enlargement of the water pipes in certain streets for the purpose of affording an adequate or a better fire supply, there are certain changes which should be made for the benefit of the fourth section and of Deer Island, and which would be

of some advantage in other districts. The sixteen-inch pipe in Brooks street should be extended to Chelsea street and connected with a twelve-inch pipe which should be extended south-westwardly to connect with the present twelve-inch pipe at Marion street, and also north-eastwardly to connect with the present twelve-inch pipe at Saratoga street, which supplies the north-easterly section of East Boston and Deer Island.

NEW MAIN WATER PIPE ACROSS CHELSEA CREEK FROM
CHELSEA TO EAST BOSTON.

The necessity for this work which is still uncompleted, and the action of the Water Committee of your Board and of the City Council in relation thereto, is given in full in City Document, No. 99, 1870, and is also incorporated in my annual report to the City Council (City Doc. No. 15, 1871, pp. 33-39).

The flexible jointed pipe, as stated in the aforesaid report, was all put together upon the East Boston flats and one of the adjacent wharves in January, ready to be launched as soon as the ice should clear away. The length of this section is about 650 feet. Before launching it, the water was drawn out at low tide and the ends plugged. A sufficient number of empty kerosene barrels were lashed to the top of the pipe, — being placed in couples along the entire length, — to float the pipe when not filled with water. The pipe was then filled with water, the ends plugged again, and the joints all tested by connecting the twenty-inch main, now in use, with the new pipe. Everything was found to be tight and secure, and the pipe was kept sunk for several days awaiting a seasonable tide and a calm day.

The first trial was not successful, owing to a slight opening of one of the joints, which permitted the tide water to partially fill the pipe and cause it to sink at the middle of the line and drag on the flats. The difficulty was subse-

quently remedied, and upon the next favorable opportunity, which occurred on Tuesday the 18th of April, the pipe was successfully launched and sunk in the trench which had been excavated for it. The work of extending the line at each end and of making the connections is still in progress, and until this is completed the new line cannot again be tested. The method devised by Mr. Norman, the contractor, of putting the pipe together in one entire line, and then floating it into position and sinking it by admitting the water to fill the pipe, is entirely novel, and, considering the various unforeseen contingencies which have arisen since the work was commenced, the result thus far has been quite a success.

DEER ISLAND WATER PIPE.

In my annual report to the City Council, I presented an abstract of the report which I had made to your Board, recommending the laying of a larger pipe, etc.; and I also stated the plan which your Board agreed upon as to the sizes of the pipes and the lengths of the several sizes, and the general terms of the contract made with Mr. Geo. H. Norman for furnishing the pipes and doing the work. You will find the aforesaid abstract and statement on pages 21, 22, 23, and 24, of City Document No. 15, 1871.

In addition to what is therein stated I beg leave to say that, since the date of that report, the work has been entirely completed except such further extensions upon the Island as the Board of Directors of Public Institutions may authorize.

The following is a statement of the work done by Mr. Norman, viz. :—

2,052 $\frac{1}{2}$	feet of 12-inch pipe.
9,310 $\frac{1}{2}$	“ 10 “ “
11,870	“ 8 “ “ in Winthrop.
3,173	“ 8 “ “ on Deer Island.

603 $\frac{3}{4}$ feet of 8-inch pipe across Shirley Gut.
 150 $\frac{1}{2}$ " 4 " " for Blow-offs.
 One 12-inch gate set.
 One 10 " " "
 Eight 8 " " "
 Six 4 " " "
 Three air-cocks.
 Seven post-hydrants.

The water has been let on, for the purpose of testing the pipes. Both lines of submerged pipe across the Gut were found perfectly tight; but on the main line in Winthrop and East Boston four leaks were found, which were subsequently repaired. Since then the water has been let on to the Island permanently, and the hydrants tested in the presence of your Board and the Board of Directors of Public Institutions, giving entire satisfaction.

SOUTH BOSTON HIGH SERVICE.

On pages 19, 20, and 21, of my Annual Report to the City Council (City Doc. No. 15, 1871), you will find a statement which embodies substantially the action of the Water Board, the City Council and myself upon this subject.

The plans then proposed and estimated upon, contemplated an independent line of 8-inch pipe, either from Tremont street through Dover to the high district, or from Upham's Corner, in Dorchester, through Boston and Dorchester streets to the same district. By using the present new line of 20-inch pipe, which is all laid from Upham's Corner to Telegraph Hill, and connecting the same by means of a 12-inch pipe with the proposed high-service pipe in Washington street, in Ward 16, an ample high-service supply for South Boston can be obtained at a moderate cost, and the high ground on Meeting House and Jones' Hills be supplied at the same time.

EXTENSION OF THE WORKS IN DORCHESTER, WARD 16.

For the action of my department, and a general statement of the whole matter relating to the extension of the works in Ward 16, I respectfully refer you to my annual report to the City Council (City Document No. 15, 1871, pp. 26, 27, 28, 29, 30, 31, 32). And the superintendent's report will furnish you all the details of the work accomplished.

Since the date of my annual report, above referred to, the surveys of the high-service districts in Dorchester have been continued as rapidly as possible by Mr. W. F. Learned, consistently with the discharge of the current duties appertaining to the present extensions of the works in that section. I hope before long to be able to lay before you a map, showing the location of the several high-service districts, their contours and areas; also the elevation of all the highest hills above our datum line of "tide marsh level."

HIGH-SERVICE PUMPING WORKS.

The pumping engines for the high-service supply, built by the Boston Machine Company, from designs by Mr. Charles Carr, the superintendent, were put in operation February 25, 1870, and have been in constant service since.

They have done their work to general satisfaction thus far; though some difficulty has been experienced in attaining the guaranteed maximum rate of speed of 35 revolutions per minute, owing, in part, to the rear pressure, which amounts to nearly 40 pounds per square inch, and in part to the small size of the supply pipe, which is 16 inches in diameter, and the velocity of the current through it, when the pumps are making 35 revolutions per minute, is at the rate of 156 feet per minute. The shock produced by the stoppage of this long column of water at the end of every stroke — 70 times a minute — when moving at so high a velocity, was not fully

appreciated in designing the arrangement of the supply pipes.

The engines are very simple in construction, substantially built, and of excellent finish; and a brief description of them may be of interest to many by whom this report will be read.

The engines, two in number, are non-condensing and direct-acting, working double-acting pumps, whose capacity is 47 gallons per revolution. The steam cylinders are 20 inches in diameter, and have a stroke of 36 inches. The pumps are of the same stroke, and 14 inches in diameter. The engines are furnished with heavy fly-wheels, 15 feet in diameter. The distance from the centre of the fly-wheel shaft to the centre of the steam cylinder is 13 feet $2\frac{1}{2}$ inches; from centre of steam cylinder to centre of pump, the distance is 8 feet 8 inches. One of the chief peculiarities of these engines is the arrangement of Mr. Carr's variable cut-off and valve-gear, which is readily adjusted to govern the height of the water in the stand-pipe, the height being always indicated by a mercurial gauge and miniature model of the stand-pipe placed in the engine-room.

Each engine is supplied with steam by a vertical tubular boiler, 7 feet in diameter, with tubes $2\frac{1}{2}$ inches in diameter by 10 feet long, all radiating from a common centre. One of the peculiarities of these boilers is a plate, dividing the water space between the fire-box and shell of the boiler, within 4 inches of the bottom, to cause continuous circulation. Another peculiarity is the introduction of air into the fire-box through perforated cast-iron pipes placed within and around said box, to insure a more perfect combustion. Thus far they have required no repairs, and have no appearance of needing any at present.

As before stated, the engines were first started February 25, to supply the Highland district. On the 4th of June the Beacon Hill high-service district was connected to test

the pipes, and play the fountain on the Common. On the 6th of June the supply was regularly commenced, and, except for occasional repairs, has continued to the present time. From the engine record I have compiled the following table, which exhibits the operations of the pumps from March to December, 1870, both inclusive :—

“Statement of Operations at the High-Service Pumping Works, from March to December, 1870.

	Total pumping time.		Daily average pump- ing time.		Daily average amount pumped.	Hourly average amt pumped.	Average maximum hourly draft.	Average minimum hourly draft.	Greatest hourly draft.	Least hourly draft.	Average No. of revo- lutions per minute.	Average amount coal used per day.	Percentage ashes and clinkers.	Quantity pumped per pound of coal.
	Days.	Hours	Hours	Min.										
March	51	21	1	40	46,694	913.88	18,900	14,288	47,282	14,288	9	1,000	22.9	47
April	47	18	1	34 ⁶ / ₁₀	47,000	940.00	18,900	14,288	47,282	14,288	10.67	895	18.7	52.5
May	71	45	2	23 ¹ / ₂	82,640	165.28	18,900	14,288	47,282	14,288	12.25	785	18.6	105.27
{ June 1st to 5th	25	19	3	41	128,479	256.96	18,900	14,288	47,282	14,288	12.37	823	18.2	156.
{ “ 6th to 30th			23	40	575,489	23,020	40,914	18,900	14,288	47,282	14,288	10.35	2,041	18.2
July	29	14	22	54 ¹ / ₂	694,200	138.84	18,900	14,288	47,282	14,288	9.82	1,986	20.5	319.
August	30	7	23	28 ¹ / ₂	651,842	130.37	18,900	14,288	47,282	14,288	9.85	2,080	18.8	312.
September	30	11	24	20	666,393	133.28	18,900	14,288	47,282	14,100	9.85	2,284	20.5	292.
October	31	13	24	38 ¹ / ₂	633,794	126.43	18,900	14,288	47,000	14,570	9.36	2,164	19.4	293.
November	29	13	23	38 ¹ / ₂	654,379	132.92	18,900	14,288	49,679	15,040	10.55	2,120	20.1	307.3
December	31	11	24	20	735,274	144.23	18,800	14,288	56,447	18,800	10.86	2,532	20.4	290.4

* The regular supply to Beacon Hill commenced on Monday, the 6th.*

This table presents some interesting and rather important facts relative to the amount of water pumped, either to supply waste or leakage. From June 6th to January 1st there has not been a single hour of the day or night (except when the water was shut off for repairs) that it has not been found necessary to keep the pumping engine working to maintain the proper level in the stand-pipe; and the least draught in any single hour during the aforesaid period of over six months was 11,066 gallons on the 13th of July, between the hours of 1 and 2 A. M., an amount equal to 40 per cent. of the hourly average for the entire month. But a fairer comparison would be, to take the average of the smallest hourly draughts in each month, and compare that with the hourly average for the whole term of nearly seven months. From this comparison it will appear that the average of the smallest hourly draughts in each month is 17,810 gallons, and the average hourly draught for the whole term is 27,280 gallons. In this case the percentage is increased from 40, as before stated, to $65\frac{1}{4}$. It is manifestly impossible that such an amount of water can be required for legitimate uses, and that it must be attributed to careless or wanton waste, or to leakage in the gates which separate the high and low service districts. I am of the opinion that both causes contribute to the unparalleled results of night consumption indicated by the foregoing figures; but that the leakage above referred to is the chief cause. If this be so, then we have not absolutely lost or used the water, but have pumped, probably, double the amount required to amply supply the entire high service.

The daily average amount of water pumped for the high service since June 6th, when the Beacon Hill district was connected, was 650,200 gallons to supply a population of not over 10,500 at a liberal estimate, and where the requirements are almost exclusively for domestic uses. Compare this rate of consumption with that of East Boston as deter-

mined by observations recorded in the following table, which I transcribe from my annual report to the Cochituate Water Board in May last (City Doc. No. 51), — bearing in mind that the East Boston observations were made in severely cold weather, when there would naturally be some waste to prevent freezing; and remembering also that the East Boston district requires a very considerable amount of water for manufacturing and shipping interests.

“Consumption of water in East Boston, from observations taken at East Boston reservoir, from 9 o'clock A. M., Dec. 24, 1869, to 9 o'clock A. M., Dec. 25, 1869.

Time.	Depth.	Consumption Galls. per hour	Total Con- sumption.
December 24.			
9 o'clock A.M.	ft. in. 20 11	. . . . .	. . . . .
10 “ “	20 8	68,233	68,233
11 “ “	20 5	67,642	135,875
12 “ M.	20 3	44,769	180,644
1 “ P.M.	20 1	44,509	225,158
2 “ “	19 11	44,250	269,403
3 “ “	18 9	43,989	313,392
4 “ “	19 7	43,731	357,123
5 “ “	19 6	21,769	378,892
6 “ “	19 3	64,921	443,813
7 “ “	19 2	21,512	465,325
8 “ “	19 1	21,448	486,773
9 “ “	18 11	42,704	529,477
10 “ “	18 9	42,448	571,925
11 “ “	18 8	21,129	593,054
12 “ M.	18 7	21,065	614,119
December 25.			
1 o'clock A.M.	18 5	41,940	656,059
2 “ “	18 4	20,875	676,934
3 “ “	18 4	. . . . .	676,934
4 “ “	18 4	. . . . .	676,934
5 “ “	18 2	41,561	718,495
6 “ “	18 0	41,307	759,802
7 “ “	17 9	61,489	821,291
8 “ “	17 7	40,679	861,970
9 “ “	17 6	20,245	882,215
Total		882,215	

“It appears, from the foregoing table, that the average hourly night draught from 9 o'clock P. M. the 24th, to 4 o'clock A. M., the 25th, was 15,000 gallons; that there were only two hours during the whole twenty-four when the

observation indicated no draught; that the average hourly draught during the seventeen hours, not reckoned above as night hours, was nearly 46,000 gallons, and the maximum hourly draught was from 9 to 11 A. M., and from 5 to 6 P. M., the 24th, and from 6 to 7 A. M. the 25th — the average of the four hours being 65,571 gallons.

“The total for the twenty-four hours was 882,215 gallons, and, calling the population 25,000, the consumption per head would be about 35 gallons.”

By reference to the preceding table of operations at the high-service pumping works, it will be seen that the daily average amount pumped in December was 735,274 gallons, an amount equivalent to 70 gallons per inhabitant, or just double the rate per head actually used in East Boston, as per the foregoing table.

Observations, continued for more than a year, of the amount of water actually used, as determined by meter measurement, in seven different families (members of the Water Board), show an average consumption of 25 gallons per head in 24 hours. In the estimates which I submitted to the Water Board in May last of the probable requirements of the Beacon Hill high service, I mapped out the proposed district, and procured from the Water Registrar a schedule of all the establishments within the district using the water, and the number of occupants in each dwelling-house, tenement house, hotel, etc. The population of the district as thus determined was called, in round numbers, 6,000, and I allowed 40 gallons per day to each inhabitant, making the daily requirements 240,000 gallons.

The district was subsequently enlarged, but to a very limited extent, and if I were to revise that estimate to conform to the enlargement, I should simply add to that amount (240,000 gallons) the amounts actually used by all the hotels, restaurants, club-houses, tenement-houses, and public buildings, using large quantities, as determined for the past year by meter measurement. This amount, as kindly furnished by the Water Registrar, amounts to 68,200 gal-

lons per day. The amount would then be 308,200 gallons per day. If to this we add the average amount actually pumped per day for the Highland high service, as shown by the records for May, before the Beacon Hill district was added, which was 82,640 gallons; the total requirements would then be, 390,840 gallons per day, by a most liberal estimate, and only 53 per cent. of the average daily amount actually pumped in the month of December. There are probably fifty gates in all, required to separate the high and low service, with a difference in pressure on the two faces of 40 pounds and upwards per square inch; and, unless all these gates are perfectly tight, it is evident that, with such a pressure, the leakage must be very large from the high to the low surface; and it is this, in my judgment, and not a wasteful use, that causes the enormous requirements of the high service.

The pumping records show that the hour of greatest draught generally falls between 8 and 9 o'clock A. M., and that the hour of least draught, between the hours of 2 and 3 o'clock A. M. Thinking it might be interesting to know the relative consumption on different days of the week, I have taken considerable pains to compile the following statement: —

Statement of the average daily number of gallons of water pumped for the high-service supply on each day of the week from June to December inclusive, arranged to illustrate the comparative draught on the several days of the week.

Month.	Monday.	Tuesday.	Wed'sday	Thursday	Friday.	Saturday.	Sunday.
June, . . .	745,479	687,234	706,661	678,977	654,786	726,683	543,731
July, . . .	692,948	661,949	624,600	644,927	662,916	640,528	603,872
August, . . .	697,554	650,037	657,276	661,554	677,322	700,084	593,043
September, . . .	703,837	676,603	667,870	668,592	650,756	687,680	608,007
October, . . .	674,927	630,176	643,465	625,271	630,166	660,488	582,132
November, . . .	733,435	647,908	668,926	656,801	647,378	683,296	598,915
December, . . .	791,826	729,510	732,213	711,101	725,097	765,788	692,345
Averages, . . .	720,001	669,600	671,573	663,932	664,060	694,935	603,149

From the foregoing statement it appears that the days of the week arranged in the order of the greatest average consumption stand as follows:—

No. 1.—Mondays, average	720,001	galls.
No. 2.—Saturdays, “	694,935	“
No. 3.—Wednesdays, “	671,573	“
No. 4.—Tuesdays, “	669,600	“
No. 5.—Fridays, “	664,060	“
No. 6.—Thursdays, “	663,932	“
No. 7.—Sundays, “	603,149	“

The average consumption on Mondays is $19\frac{4}{10}$ per cent. greater than on Sundays, and about 8 per cent. greater than the average of the Tuesdays, Wednesdays, Thursdays and Fridays, which do not vary much from each other.

Before the Beacon Hill high-service district was connected, the night consumption (from 12 o'clock midnight to 5 A. M.) was found to average 10 per cent. of the day consumption. Since the Beacon Hill district was connected, the

proportion of night to day consumption has increased to 20 per cent.

In January, owing to the low state of the water at the lake, and the consequent fears of a scarcity of water, it was decided to reduce the hours of pumping; therefore, from the 13th of January to the 1st of May the pumps have averaged only 18 hours per day, and the amount pumped has averaged 493,250 gallons per day, — equal to an average of 27,403 gallons per hour of pumping time. The daily average amount pumped in December was 735,274 gallons. It thus appears that the reduction of the pumping time one quarter has reduced the amount pumped from 735,274 gallons per day to 493,250, — a saving of 242,024 gallons, or $32\frac{9}{10}$ per cent.; or, more concisely, a reduction of 25 per cent. in the pumping time reduced the amount pumped 33 per cent. This result does not appear reasonable; for the reduction in the pumping time takes place during that portion of the night when the draught is lightest, and it would be naturally supposed that, if there were any difference between the percentage of the reduction of the amount pumped and the percentage of the reduction in the pumping time, it would be the other way, — that is, the amount pumped should be reduced by a smaller percentage than that of the reduction of the pumping time. But the fact is, without doubt, that a considerable portion of the percentage of reduction in the amount pumped is attributable to other causes independent of the mere reduction of the pumping time: such as a general economy in the use of the water caused by fears of a water famine, and the stoppage of the leak on the 30-inch gate in Tremont street, which finally broke on the 28th of January, and the supply to Beacon Hill was cut off for three days. That there must have been considerable leakage at this point is evident from the records of the amount pumped before the break was discovered, and the amount pumped immediately after the repairs were made. For instance, the pumping

time was reduced on the 13th of January, and the break was discovered on the 28th, during which interval the amount pumped per day averaged 511,000 gallons; while, for the eleven days immediately succeeding the repairs, the average amount pumped per day was only 461,000 gallons, a reduction of nearly 10 per cent., and, undoubtedly, attributable to the stoppage of a leak which may have existed for a long time.

WESTERN DIVISION.

The Superintendent's Report will furnish all information relative to the condition of the grounds and various structures on this division.

The work of marking the bounds of the city's property on this division still remains incomplete, and should be finished as soon as possible.

The annual examination of the interior of the conduit was made last month. The section from the Lake to the Waste Weir at Dedman's Brook was examined by J. Mains; from Dedman's Brook to West Pipe Chamber, in Needham, by J. A. Wiggin; from the East Pipe Chamber to Newton Centre Waste Weir, by Henry Manley; and the remainder to Brookline by Albert Stanwood, Superintendent of the Western Division.

The following is a transcript of the records made by the several examiners, from which it appears that the conduit is generally in a cleaner condition, and that no essential changes in its stability have occurred:—

Report of J. MAINS, from the Lake to Dedman's Brook Waste Weir.

Entered the conduit at 8.50 A. M.

Between the entrance and Station 1 is muddy.

“ 6 and 7 is a crack in top.

“ 8 and 9 muddy; thence to 47 all right.

Between 52 and 53 is a man-hole, at which is a bad leak.

“ 57 and 58 are three small fissures, which need to be pointed.

Between 66 and 67 needs repointing on the right.

“ 71 and 72 is muddy.

“ 97 and 98 is muddy.

“ 115 and 116 is muddy, then clean to 136.

Near 140 is a large willow root growing.

Crack about $\frac{1}{8}$ inch wide near last man-hole.

At 142 is considerable mud.

Between 152 and 153 is a small crack in top, extending to Dedman's Brook Waste Weir, which we reached at 11 A. M.

Report of J. A WIGGIN, from Dedman's Brook Waste Weir to Newton Lower Falls.

Entered the conduit at 9.45, April 14, 1871.

From 169 to 170 are several small cracks in top, some of which have been repointed, and have not started.

Between 178 and 181 are several cracks in top, some of them being nearly or quite $\frac{1}{4}$ inch wide, others quite fine.

From 182 to a little beyond 183 are several cracks, one of which has been repointed.

A little this side of 247, and extending about 50 feet, is a crack on top arch, left side, which in some places is nearly $\frac{1}{2}$ an inch wide.

Between 272 and 276 is a large crack, which has been repointed, which has not started any.

There is considerable sand along here.

What should be numbered 289 is numbered 282.

(From 12 to 14 are several large cracks, which have been repointed, but I think have started a little in places.)

Conduit quite muddy on bottom, from 16 to 18 $\frac{1}{2}$.

From 53 to a little beyond 54 are two cracks in top, in some places quite fine, and in others about $\frac{1}{4}$ inch wide.

Between 77 and 78 are three quite large cracks in top, but they look as if they had been in the condition they are now in for some time.

(From 107 to about 109½ is a crack in top, which has been repointed, but think it is opening some.)

With the exceptions of the mud and sand before mentioned, the conduit is very clean, being free from the roots and sediment which I saw on my last year's examination.

Arrived at Newton Lower Falls at 12.40 P. M.

BOSTON, April 15, 1871.

MR. A. STANWOOD, *Supt. Western Division B. W. W.:*

DEAR SIR, — The following is a transcript of my notes on the portion of the aqueduct examined by me yesterday.

Entered conduit at Eastern Pipe Chamber at 10.50 A. M.
April 14, 1871.

Stations 193 to 194, crack on right side of upper arch, about 3 feet long running diagonally to the courses.

195½ to 197, fine crack in top.

198 “ 199 “ “ “

217½ to 218½, bad crack in top arch, the same as reported last year, except that part of the way there are two cracks.

221 to 222, fine crack in top arch, part of the way there are two cracks.

224 to 225, two cracks in top arch, same as last year. This is the worst crack in the section.

227 to 228, fine crack in top arch.

232½ to 234, several cracks in top, some of the way fine but part of it from ¼ to ½ inch wide; this has not changed from last year.

242 to 244, several bad cracks on both sides of top arch, but no worse than they were described last year.

248, fine crack in top arch.

253½ to 254½, several fine cracks on top and right side of arch.

264, fine cracks in top and right side.

THIRD DIVISION.

Stations 1 to 2, fine crack in top.

Arrived at Newton Centre, Station 8½, at 2.08 P. M.

Yours truly,

(Signed) HENRY MANLEY.

CHESTNUT HILL RESERVOIR,

April 27, 1871.

N. HENRY CRAFTS, Esq., *City Engineer*:

DEAR SIR: The third division of the conduit was examined in company with the President — Chas. H. Allen, Esq., and Messrs. Haven, Noyes and Squires (of the Board), Niles, Brown and Taylor (of the Water Committee), and the Water Registrar.

April 14. Entered the conduit at the Newton Centre Waste Weir at 12.35. There was a decided improvement in the condition of this section from last year; but very little dirt was found, and the most of that was in the tunnel. No new defects were seen, and no change could be seen in the cracks, as before reported. Between 120 and 125 they should be repaired as soon as practicable. As the joints require to be cut out, so much time will be required to do the work it cannot be done until the city can be supplied from the "Bradlee Basin."

April 22. From the Intermediate gate-house to Brookline reservoir. This part of the conduit was examined today. Found no change in the appearance of the conduit from what it was in 1869, or from Mr. H. M. Wightman's report of last year, with this exception: about 20 feet

south of the Waste Wier at Webber's, and extending for 30 feet, is a bad crack that will require attention this season. While the water was off men were sent in and this part of the conduit cleaned.

Respectfully submitted,

A. STANWOOD,

Sup't W. D. B. W. W.

WATER AT THE LAKE.

On page 54 will be found the usual table exhibiting the average monthly and yearly heights of the water in the lake above the bottom of the conduit, from 1851 to 1870, both inclusive. It will be seen by inspection of this table that the average height of the surface of the water above the bottom of the conduit for the whole year was $10\frac{96}{100}$ feet, which varies but very little from the averages of 1860, '61, '64 and '65, being a trifle higher. The lowest monthly average, since the raising of the dam in 1859, was $5\frac{41}{100}$ feet in 1864. The lowest point reached since 1859 was in December, 1864.

The following statement exhibits the fact that the fears entertained in January of a short supply had no better foundation than those that were experienced in 1862-64; but the experience of those years and the last clearly demonstrated the importance of early action to either increase the storage capacity of the lake, or to seek an additional source of supply.

MONTH AND YEAR.	Average height of water in lake above the bottom of conduit.	Least height of water in lake above the bottom of conduit.	Average daily consumption in gallons.	Total rainfall for year in inches.
1862. January	6.09	5.00	17,000,000	46.69
1864. December	5.41	4.83	14,547,000	42.60
1870. December	6.39	5.87	14,094,000	55.89
1871. January 14th . . . . .	. .	5.00	.....	...

The table on page 57 shows the varying depths of the water let into the conduit at the lake. The average depth for the whole year was 5 feet 8½ inches, precisely the same as for the year 1869. The conduit has been run just full (6 feet 4 inches) 77 days in the year, mostly in the months of July, August, September and October; it has been run more than full (6 feet 6 inches) for 14 days, in the months of July, August and September. The water has been shut off from the conduit five days.

From the table on page 51 it appears that the rain-fall at the lake amounted to $55\frac{89}{100}$ inches, being $4\frac{3}{100}$ inches more than the average of the last 19 years. The amount of water drawn from the lake to the Chestnut Hill and Brookline reservoir was 5,477,810,000 gallons against 5,503,751,000 gallons in 1869. The amount of water wasted during the year was 4,818,971,000 gallons, equal to an average of 13,202,660 gallons per day, being nearly equal to the amount consumed. The average daily waste for the last 11 years was 5,000,600 gallons. The amount of rain-fall received into the lake available for use if it could have been stored was equal to a daily supply of 23,453,900 gallons, while the average for 17 years was 21,821,300 gallons. The net capacity of the Cochituate basin, deducting the amount wasted at the outlet dam, was for the last year only 10,-

251,240 gallons per day; that is to say, only 10,251,240 gallons per day of the actual rain-fall was actually available for the use of the city. This unusual fact was owing to a very large proportion of the rain collected, falling at a time when the lake was full.

CONSUMPTION OF WATER.

On pages 52-53 may be found the statement of the daily average amount of water consumed for each month and year since 1849. The average for the year was 15,007,700, being 62,700 gallons per day less than the previous year.

RAIN-FALL.

The usual tables of the rain-fall at Lake Cochituate, Boston, Cambridge, Lowell, Waltham and Providence will be found on page 56, and I desire to express my thanks to the several gentlemen to whose kindness I am indebted for the information therein presented.

An interesting table prepared by Wm. H. Bradley, Esq., Superintendent of Sewers, will be found on page 55. This table shows the days on which rain or snow fell during the year in Boston, and the amount.

CHESTNUT HILL RESERVOIR.

The report under this head, which is contained in my annual report to the City Council in January last, ought, I think, to have a place in this report, and I therefore take the liberty of inserting it here:—

“This great work, which has so largely exceeded in magnitude and cost the original designs and estimates, was so far completed on the 25th of October last as to be ready for the reception of water in the lower, or, as it is now called, the ‘Bradlee Basin.’ The engineering operations connected with this work, and extending over a period of seven years,

may, it seems to me, be appropriately recorded and described in this report, and be found of sufficient interest to warrant the occupation of the required space.

“Surveys for a suitable site for this reservoir were made in 1863, and in November of that year three plans were submitted to the Water Board. The first was a plan for a reservoir on the southerly side of the Woonsocket division of the Boston, Hartford and Erie railroad; the second was a plan of the site of the present Lawrence basin, and the third was a plan of the present Bradlee basin, but only included the portion on the northerly side of Beacon street, which then divided what is now the Bradlee basin. To this last plan was afterwards added the other portion of this basin, which was on the southerly side of Beacon street.

“By the first plan a water area of but 41 acres could be obtained, and that only by building a dam parallel to and adjoining the railroad, and this dam would, at the easterly end, have been 24 feet above the track, and the foundation for nearly the entire length of the dam was of the worst description, being of quicksand. By the second plan the water area was 44 acres, but the depth of water would have been but 12 feet, which is not sufficient to prevent the growth of subaqueous vegetation. An excavation of five feet in depth, over nearly the whole extent of this reservoir; was necessary, and this was considered and afterwards proved to be a very expensive work.

“By the third plan a water area of $52\frac{1}{2}$ acres could be obtained on the northerly side of Beacon street, and on the southerly side, an area of $41\frac{1}{2}$ acres, the two forming a basin 94 acres in extent; this third plan was the one adopted by the Water Board, upon my recommendation.

“During the following year but little was done by this department in connection with the reservoir, with the exception of some further rough surveys and approximate estimates of the cost of doing the work.

"In 1865, the City Council having made in 1864 an appropriation for the purchase of land for a site for the reservoir, and having procured an act of the Legislature authorizing the construction of the same, a party was detailed from this office, under the charge of Henry M. Wightman, who had made the previous preliminary surveys, to make an accurate survey of the whole territory and plans for the building of the reservoir. During the progress of these surveys, it was decided by the Water Board to connect the Lawrence basin with the site already adopted. The expense of draining this basin in a new direction, as its natural drainage would have been prevented by the construction of the reservoir upon the site selected; the difficulty of making the dam between the two perfectly tight so that no claim should arise for damages from its owner; the question of damages which would probably arise for diverting the natural drainage, and beyond all these considerations, the desire of the Board and myself to construct a reservoir which should be ample to meet the future wants of the city, were the reasons for the addition of this basin to the original plan.

"The area surveyed was about 300 acres in extent. The property lines were carefully determined, and a complete topographical survey made of the whole territory. The plans were made with great accuracy, and contour lines for every two feet in height were traced upon them. These plans were the basis for all the subsequent work upon the reservoir. The location of the banks was determined by means of profiles made at right angles to its proposed direction, upon which the most favorable position for the banks was fixed; these points were then transferred to the plans, and connected by straight lines and curves which formed the lines for the reservoir banks. These lines were of course subject to alterations should the material in cutting or the foundation in filling prove them to be not the most economical. All the

curves of this reservoir are regular, being either simple, compound or reversed, connected by straight lines.

"The accuracy of these surveys and plans may be judged by the fact that the lines of the banks, driveway, etc., as laid out from the base lines of the survey and by scale measurements from the plans, rarely varied a foot.

"These plans were not fully elaborated upon the commencement of the work upon the reservoir in the spring of 1866, as the party employed upon the work was small, and they were interrupted by the bad weather and the necessity of making plans and descriptions of the land bought, and by the sickness of the superintendent of the work, Mr. Knowlton, which rendered the presence of the Resident Engineer necessary at the site of the reservoir where arrangements were being made for constructing the necessary buildings, such as grading for the stables, and boarding-house for the men, draining, and clearing the land of trees.

"By working night and day upon the plans, they were completed so that no delay was occasioned in prosecuting the work on the reservoir. The plans for the location of the banks having been completed, the question of disposing of the surface-water drainage remained to be settled, there being considerable diversity of opinion upon the subject. Two plans were finally submitted, embodying the different views. By one of these plans it was proposed to divide the drainage at the Lawrence brook, and to convey one portion in a northerly direction in an open catch-water drain a distance of 2,100 feet, from which point a brick drain was to conduct it under the conduit a distance of 200 feet, and then an open catch-water drain a further distance of 1,235 feet to Chandler's ice pond.

"The other portion of the drainage was to be conveyed in an easterly direction and on the same route occupied by the present drain, but was to have been an open catch-water drain for a distance of 2,200 feet, and a brick drain for the

balance of the distance (about 3,800 feet) to the brook near the intersection of Beacon and Rockland streets.

“By the other plan submitted, the drain was to commence at the influent gate-house and continue entirely around the reservoir on the westerly, southerly and easterly sides, to the brook near the intersection of Beacon and Rockland streets, a distance of 7,754 feet. It was to be built of brick, underground the entire distance, and varying in size from two feet six inches in diameter to six feet four inches diameter, with suitable catch basins and inlets for the water. This latter plan, although much the more expensive, was after careful consideration of the subject adopted, and the work commenced on the 10th of May, and the entire drain was completed on the 27th of November, 1867.

“The building of a driveway around the reservoir having been agitated during the summer of 1866, and proving to be very popular with the citizens, several plans and estimates were submitted to the Water Board by the engineer. There was great diversity of opinion upon the subject in the Board, some of the members being opposed to the project, and others differing in their views as to the proper width to construct it. The engineer was finally directed to prepare a plan and estimate upon the best location that could be selected, and of a width not less than 80 feet. In preparing this plan the engineer ascertained that in some places the width of 80 feet would greatly add to the expense of the driveway, and having represented to the Board that a width of 60 feet in some places would greatly lessen the expense, a committee of the Board, consisting of Messrs. Norcross and Bradlee, were appointed to go over the proposed location, which had been staked out, and decide upon the width at these places.

“This committee having attended to their duty, a plan and estimate was made, and submitted to the Board, and by them recommended to the City Council, who, on the 9th of

October, 1866, passed the necessary orders for its construction.

"This driveway is constructed upon the plan of the Central Park roads, but differs from them in having a greater thickness of rough stone for the lower stratum, and a less thickness of crushed stone and gravel for a top dressing.

"Plans showing all the details of the gate-houses were made in this office, and the specifications for the cut granite and for building the gate-houses were made in 1867, and the intermediate gate-house was commenced. Before the work upon this gate-house began, it was necessary to remove 400 feet of the conduit, and convey the water around the gap thus formed, that there should be no interruption of the supply to the city.

"This object was accomplished by the construction of a wooden flume, the plans for which were made by the engineer, and so built as to be readily taken apart and put together again in any place where needed. Some difficulty was experienced in making its connection with the conduit perfectly tight, but by a liberal use of puddling clay, this object was accomplished, and the flume was in constant use for about two years, and was then taken apart and is now stored at the reservoir.

"Surveys and plans for the main pipes from this reservoir were made during the fall and winter of 1867 and spring of 1868. In order to select the most favorable route, and to show the various routes proposed, a tract of country was surveyed from Rockland street in Brighton, to Cypress street in Brookline, and between Boylston street, and Tappan street, and the Woonsocket Division of the Boston, Hartford & Erie R. R., and Beacon street, an area about one and one-half miles long by one-quarter of a mile wide, all of which was levelled over, and a topographical plan made, upon which was laid out no less than five distinct routes. Profiles and cross-sections of these were made and submitted to the

Water Board, and the route No. 5, on the general plan, showing the routes, was finally decided upon. Some additional surveys were made to show the feasibility of constructing a road over this route, and several propositions were made by the Water Board to the town authorities of Brookline; but the project was finally abandoned, and the land necessary for the pipe route was taken, under the act of the Legislature, giving the city authority to lay the pipe.

"In addition to these special surveys, the current work at the reservoir was continued without intermission. Lines and grades were given for every piece of embankment, for the drain, the main pipe, the gate-houses, driveway, etc., and a constant supervision exercised by the engineer over the work, that no unsuitable material should be used in the embankments or gate-houses, and that the construction should in all cases conform to the plans. Monthly estimates were made of the amount of slope wall built, the amount of clay delivered for puddling, and of coping stone for the slope wall. Estimates, involving a great amount of labor, were made at three different times, of the cost of completing the reservoir. Levels were taken over the bottom of both basins, and their capacity calculated for each inch in depth, and tables made containing the length of water line, area and capacity for each inch in depth, and the total capacity for each inch in depth.

"In addition to the work done at the reservoir, plans, specifications, and contracts were drawn in this office for building the gate-houses, for the main pipe and its connections, for the stables and other temporary buildings at the reservoir.

"The engineering force at this reservoir consisted for the larger portion of the time of the resident engineer, one assistant engineer, two rodmen, and one axeman, which was, I think, smaller than any force ever employed on a work of its size and importance.

“The resident engineer was twice obliged to change his assistant, once by the illness and subsequent death of his assistant, Samuel C. Horn, and the second time by a severe accident to his assistant, Wilbur F. Learned, who, while giving a line for the building of the effluent gate-house, fell from the wall, a distance of about twenty feet, causing such injuries that he was disabled for a period of six or seven months.

“The lower or Bradlee basin of this reservoir was completed and the water let into it on the 25th of October, 1870, and the branch office of this department at the reservoir, for five years under the charge of Henry M. Wightman, the resident engineer, was discontinued on the 10th of November.”

As before stated the water was let into the “Bradlee basin” on the 25th of October, and on November 26th there was a depth of 1 foot 9½ inches of water above the lower floor of the effluent gate-house. Owing to the low stage of the water at the lake the quantity admitted from the conduit was very small until after the danger of a scarcity at the lake was over. The depth, however, gradually increased from springs and rain-fall, and no signs of leakage have even yet appeared. On the 1st of January, the depth of water was 2 feet 8 inches; on the 1st of February, 3 feet 4½ inches; on the 1st of March, 4 feet 5¼ inches; on the 1st of April, 9 feet 10 inches, and on the 1st of May, 14 feet 2 inches.

Statement showing amount of Rainfall on Water-shed of Lake Cochituate, amount of Water consumed and wasted, available amount received into Lake, available percentage of Rainfall, etc., from 1852 to 1870, inclusive. Water-shed of Lake = 12,077 acres.

YEAR.	Rainfall.	Amount of Rainfall on Water-shed of Lake Cochituate.	Amount of Water consumed.	Amount of Water wasted from Lake.	Total amount consumed and wasted.	Rise of Lake during the year.	Fall of Lake during the year.	Total available amount of Rainfall received into Lake.	Available daily average amount of Rainfall received into Lake.	Available percentage of Rainfall received into Lake.
	Inches.	Gallons.	Gallons.	Gallons.	Gallons.	Gallons.	Gallons.	Gallons.	Gallons.	per cent.
1852*	47.93	15,750,297,000	2,947,042,800	4,020,566,885	6,994,609,685	.....	261,300,000	6,793,249,685	18,396,857	43 per cent.
1853	55.86	18,386,561,000	3,117,939,500	3,166,417,500	6,284,357,000	239,880,000	.....	6,523,937,000	17,873,800	85 per cent.
1854	43.15	14,187,562,000	3,614,230,000	4,187,733,020	7,801,963,020	.....	217,800,000	7,584,163,020	20,775,529	53 per cent.
1855	34.96	11,494,719,000	3,776,399,500	No acct kept.	.....	.....	326,700,000	.....	.....	.....
1856	40.80	13,414,892,000	4,409,787,600	No acct kept.	.....	598,950,000	.....	.....	.....	.....
1857	63.10	20,747,052,000	4,644,990,000	10,625,900,000	15,270,890,000	32,670,000	.....	15,308,560,000	41,957,562	74 per cent.
1858	48.66	15,999,232,000	4,689,155,000	1,984,500,000	6,673,655,000	.....	141,570,000	6,482,085,000	17,759,013	40 per cent.
1859†	49.02	16,117,602,000	4,808,875,000	7,569,000,000	12,377,875,000	283,140,000	.....	12,661,015,000	34,687,712	78 per cent.
1860	55.44	18,228,471,000	6,308,108,000	None.	6,309,108,000	174,240,000	.....	6,483,348,000	17,714,065	35 per cent.
1861	46.44	15,299,303,000	6,639,085,900	3,377,558,966	10,016,654,866	.....	1,459,260,000	8,557,394,866	23,444,917	56 per cent.
1862	49.69	16,337,890,000	6,059,000,000	33,200,000	6,092,200,000	1,366,800,000	.....	7,399,000,000	20,271,233	45 per cent.
1863	69.30	22,785,586,000	5,927,052,500	2,165,696,470	8,092,748,970	762,300,000	.....	8,855,048,970	24,260,408	39 per cent.
1864	42.60	14,006,726,000	6,105,306,700	1,368,746,000	7,474,052,700	.....	1,848,577,000	5,625,475,700	15,370,152	40 per cent.
1865	49.46	16,262,296,000	4,621,630,000	1,688,120,674	6,309,750,674	748,242,500	.....	7,052,973,174	19,823,270	43 per cent.
1866	62.32	20,490,455,000	4,463,585,000	None.	4,463,585,000	748,242,500	.....	5,206,827,500	14,295,280	25 per cent.
1867	56.25	18,494,795,000	4,951,225,000	2,482,041,000	7,433,266,000	.....	698,811,000	6,555,759,000	17,961,000	33 per cent.
1868	50.06	16,459,544,000	5,405,515,000	2,507,684,000	7,913,199,000	346,371,000	.....	8,259,570,000	22,567,160	50 per cent.
1869	64.34	21,069,808,000	5,603,751,000	1,635,570,000	7,139,321,000	480,882,000	.....	7,620,203,000	20,877,300	36 per cent.
1870	55.89	18,828,694,000	5,477,810,000	4,818,971,000	10,296,781,000	.....	1,736,085,000	8,560,696,000	23,453,300	47 per cent.

Average, . . . 51.86

Average daily waste for 17 years, . . . 8,312,900

" " " " for 6 years, '52-'59, . . . 14,378,900

" " " " " " " " last 11 " '60-'70, . . . 5,000,000

Average daily capacity of Lake as a source of supply for 17 years 21,821,300.

* Observations of Rainfall at Lake Cochituate commenced 1852, and these observations are assumed as correct for the whole district. † Lake raised two feet.

Consumption of Water. Daily Average Number of Wine Gallons drawn from the Brookline Reservoir.

MONTH.	1849.	1850.	1851.	1852.	1853.	1854.	1855.	1856.	1857.	1858.
January	1,700,000	5,181,700	7,233,700	8,280,900	8,050,500	10,035,200	9,702,700	12,669,000	15,089,000	12,160,000
February . . . . .	. . . . .	5,214,000	7,221,100	8,790,300	8,043,000	10,054,200	10,349,800	12,791,000	14,175,000	14,309,000
March	1,550,000	4,841,200	6,137,900	8,521,100	8,202,200	9,582,100	10,125,600	12,504,000	13,941,000	14,154,000
April . . . . .	. . . . .	4,931,000	5,365,200	8,043,700	7,903,600	8,738,500	8,540,000	10,800,000	12,454,000	13,465,000
May	3,600,000	5,346,100	6,238,400	8,350,000	8,123,400	9,085,200	9,103,800	10,378,000	12,414,000	11,423,000
June	4,300,000	6,906,500	7,925,000	8,033,100	8,945,900	11,745,200	9,984,400	11,223,000	12,504,000	10,867,000
July	4,800,000	8,514,200	7,180,200	9,608,000	8,800,200	10,613,800	11,056,600	13,167,000	13,551,000	13,621,000
August	4,100,000	8,004,600	7,233,000	9,709,300	8,461,900	10,028,100	11,120,800	12,664,000	13,077,000	13,141,000
September	4,800,000	6,585,500	7,230,600	7,920,000	8,640,700	9,712,400	11,710,800	11,522,000	12,030,000	12,745,000
October	4,550,000	4,504,300	6,716,000	6,930,000	8,371,100	8,769,800	10,771,200	11,891,000	10,804,000	12,969,000
November	3,800,000	4,960,500	6,473,500	6,637,900	8,624,700	8,030,200	10,383,200	11,691,000	11,372,000	12,143,000
December	3,600,000	5,037,000	7,063,400	7,195,800	9,228,400	10,597,600	11,307,200	13,284,000	11,241,000	13,075,000
Average for Year	3,680,000	5,837,900	6,883,800	8,125,800	8,942,300	9,902,000	10,346,300	12,048,600	12,726,000	12,847,000

REPORT OF THE WATER BOARD.

Consumption of Water. — Continued.

MONTH.	1859.	1860.	1861.	1862.	1863.	1864.	1865.	1866.	1867.	1868.	1869.	1870.
January	14,512,000	17,862,000	21,106,769	17,000,000	16,112,000	18,954,000	13,412,000	14,850,000	13,511,000	15,992,000	15,426,000	12,525,000
February	14,769,000	18,901,000	20,804,131	17,000,000	17,328,000	18,846,000	13,318,000	13,385,000	13,831,000	16,927,000	14,731,000	14,052,000
March	14,480,000	15,409,000	19,453,944	17,300,000	16,681,000	16,841,000	12,027,000	12,284,000	13,100,000	13,722,000	14,789,000	14,646,000
April	13,760,000	14,621,000	17,151,593	15,300,000	15,125,000	16,506,000	11,975,000	11,251,000	12,770,000	12,636,000	14,650,000	14,703,000
May	11,362,000	14,790,000	16,687,852	14,300,000	15,407,000	16,094,000	13,660,000	11,076,000	12,301,000	13,846,000	13,902,000	13,759,000
June	11,639,000	17,838,000	17,231,984	16,600,000	16,138,000	17,730,000	14,391,000	11,878,000	13,625,000	14,351,000	14,252,000	14,824,000
July	13,219,000	17,233,000	18,897,809	16,400,000	15,954,000	18,112,000	13,207,000	12,668,000	14,250,000	14,676,000	18,378,000	16,392,000
August	12,704,000	19,297,000	18,272,365	17,000,000	16,980,000	16,188,000	13,426,000	12,441,000	14,546,000	14,479,000	17,632,000	17,107,000
September	12,389,000	17,957,000	18,098,259	17,000,000	17,035,000	16,798,000	12,624,000	11,842,000	13,186,000	16,072,000	15,741,000	16,785,000
October	12,026,000	16,938,000	17,387,128	17,300,000	15,779,000	15,479,000	11,273,000	12,396,000	13,518,000	14,954,000	14,006,000	16,528,000
November	12,715,000	16,862,000	16,604,076	17,100,000	16,028,000	14,079,000	11,750,000	11,262,000	12,707,000	13,975,000	13,608,000	14,677,000
December	14,586,000	19,151,000	15,976,362	17,000,000	16,295,000	14,547,000	10,877,000	11,412,000	15,434,000	15,600,000	13,640,000	14,094,000
Average for year	13,175,000	17,238,000	18,189,394	16,600,000	16,238,500	16,681,000	12,662,000	12,229,000	13,565,000	14,769,167	15,070,400	15,007,700

Table of the average monthly and yearly heights of water in the Lake above the bottom of the Aqueduct.

MONTH.	1851.	1852.	1853.	1854.	1855.	1856.	1857.	1858.	1859.*	1860.	1861.	1862.	1863.	1864.	1865.	1866.	1867.	1868.	1869.	1870.
January .	9.50	10.63	9.51	10.54	10.16	8.06	9.63	10.75	10.80	10.83	11.93	6.09	11.33	13.88	7.41	8.37	12.14	10.29	12.27	13.25
February .	10.21	10.20	10.78	10.95	10.65	7.59	10.28	10.05	12.17	11.36	12.77	6.57	12.85	13.71	8.24	8.73	13.14	9.75	12.96	13.19
March . .	10.43	10.49	10.44	10.83	10.68	6.96	10.67	9.35	12.45	12.67	13.21	8.65	13.95	14.33	12.28	10.58	13.57	10.96	13.21	12.81
April . . .	11.17	11.23	10.68	10.66	11.57	10.24	12.30	9.36	12.06	12.72	14.14	12.40	14.59	14.32	14.00	11.96	13.50	13.29	13.40	13.33
May . . .	11.02	10.94	10.98	10.87	11.35	12.05	12.05	10.67	12.06	11.52	13.88	14.45	14.01	14.26	14.00	12.01	13.44	13.67	13.65	13.12
June . . .	10.40	10.28	10.62	10.33	10.69	11.78	12.14	11.72	11.96	10.83	12.99	14.43	13.29	13.51	13.41	12.72	13.20	13.37	13.23	13.02
July . . .	9.76	9.44	9.45	9.00	9.86	10.67	11.41	11.74	10.22	10.42	11.50	14.05	12.82	11.33	12.28	11.84	12.12	12.46	12.62	12.12
August . .	9.01	8.40	8.64	6.57	9.01	11.59	11.70	11.30	10.24	9.42	10.27	12.97	13.73	9.65	11.18	11.79	12.17	11.70	11.04	10.37
September .	8.00	5.68	7.78	6.64	7.52	10.82	11.72	10.40	9.84	9.42	8.71	11.33	13.43	7.91	10.09	11.59	12.00	11.61	9.73	8.07
October . .	7.55	6.55	7.34	5.90	6.42	10.10	11.10	8.72	10.15	10.35	7.79	10.30	12.94	6.46	9.02	11.72	11.10	11.83	10.58	8.10
November .	8.07	7.74	9.58	6.09	6.28	10.80	11.16	9.01	9.98	10.44	7.22	10.24	13.23	5.48	8.74	11.41	11.03	11.75	11.21	7.10
December .	9.67	8.49	10.57	8.38	7.29	10.97	11.62	9.85	10.54	11.17	6.88	11.70	14.06	5.41	8.48	11.68	10.51	12.33	11.77	6.40
Yearly av.	9.57	9.17	9.70	9.00	9.29	10.14	11.26	10.24	11.04	10.93	10.94	11.10	13.52	10.84	10.76	11.20	12.33	11.92	12.15	10.96

* High-water mark raised two feet.

Table showing the Rainfall in Boston for the year 1870, and the days on which it occurred, from observations by Wm. H. Bradley, Esq., Superintendent of Sewers.

Day of Month.	MONTHS.											
	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	INCHES.											
1 . . .	. . .	.84	. . .	. . .	. . .	. . .	1.44	. . .	. . .	1.36	. . .	. . .
2 . . .	3.05	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
3 . . .	. . .	.07	. . .	. . .	. . .	. . .	. . .	. . .	. . .	.73	.40	. . .
4 . . .	. . .	. . .	.04	2.36	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
5 . . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	.08	. . .
6 . . .	. . .	. . .	. . .	. . .	. . .	.79	. . .	. . .	. . .	.12	. . .	.04
7 . . .	.16	. . .	.24	.95	. . .	.30	. . .	. . .	. . .	. . .	. . .	. . .
8 . . .	.32	1.68	. . .	. . .	.32	. . .	1.61	. . .	.08	. . .	. . .	.76
9 . . .	. . .	. . .	. . .	. . .	.11	. . .	. . .	. . .	. . .	. . .	.35	. . .
10 . . .	.08	. . .	. . .	. . .	.64	.08	. . .	.04	. . .	. . .	. . .	. . .
11 . . .	. . .	. . .	. . .	1.42	.46	.24	. . .	.53	. . .	1.28	. . .	.08
12 . . .	.10	. . .	. . .	. . .	. . .	. . .	.08	. . .	. . .	.40	.08	1.37
13 . . .	.16	. . .	1.54	. . .	. . .	.44	.40	. . .	. . .	. . .	. . .	. . .
14 . . .	. . .	.88	. . .	. . .	. . .	.08	.11	. . .	. . .	. . .	. . .	. . .
15 . . .	.64	.72	. . .	. . .	. . .	. . .	. . .	.20	. . .	. . .	. . .	. . .
16 . . .	. . .	. . .	.88	. . .	. . .	. . .	. . .	. . .	.17	. . .	. . .	. . .
17 . . .	.20	. . .	. . .	. . .	. . .	. . .	.16	. . .	. . .	. . .	. . .	. . .
18 . . .	. . .	1.44	.28	. . .	. . .	. . .	. . .	. . .	. . .	. . .	.35	. . .
19 . . .	. . .	. . .	. . .	2.50	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
20 . . .	. . .	. . .	. . .	.32	. . .	3.84	. . .	. . .	. . .	1.84	. . .	.48
21 . . .	. . .	.60	.16	.31	. . .	.72	.04	.14	. . .	. . .	. . .	. . .
22 . . .	. . .	. . .	. . .	. . .	.16	. . .	. . .	. . .	. . .	. . .	. . .	. . .
23 . . .	.08	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	2.41	.15
24 . . .	. . .	. . .	. . .	. . .	.18	. . .	. . .	. . .	. . .	. . .	. . .	. . .
25 . . .	1.53	. . .	. . .	.20	. . .	. . .	. . .	.35	.42	. . .	. . .	. . .
26 . . .	. . .	. . .	. . .	. . .	. . .	.24	. . .	. . .	. . .	.19	.73	. . .
27 . . .	. . .	. . .	. . .	. . .	. . .	.36	. . .	. . .	. . .	. . .	. . .	. . .
28 . . .	. . .	.80	1.64	.36	.71	. . .	. . .	. . .	. . .	. . .	. . .	. . .
29 . . .	1.68	. . .	.10	. . .	. . .	.50	.17	.31	. . .	.08	. . .	.59
30 . . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
31 . . .	.16	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	.80	. . .	.15
Totals,	8.16	7.03	4.88	8.42	2.58	7.59	4.01	1.57	0.67	6.80	4.40	3.62

Total Rainfall, 59.73 inches.

Annual Amount of Rainfall, in Inches, at Lake Cochituate, Boston and vicinity, 1849 to 1870, inclusive.

YEAR.	PLACES AND OBSERVERS.						
	Lake Cochituate, by Supt. of Western Division, B. W. W.	Boston, by J. P. Hall, to 1865, by W. H. Bradley, since 1865.	Cambridge, by the Director of the Observatory.	Waltham, by E. Hobbs and J. R. Scott, Agt. Boston Manufacturing Co.	Lowell, by Merrimac Manufacturing Co.	Lowell, by Locks and Cables Co., J. B. Francis.	Providence, by A. Caswell.
1849 . . . . .	. .	40.30	40.97	40.74	51.09	. .	34.69
1850 . . . . .	. .	53.98	54.07	62.13	45.68	. .	51.48
1851 . . . . .	. .	44.31	41.97	41.00	41.00	. .	43.30
1852	*45.93	47.94	40.51	42.24	42.78	. .	38.58
1853	*55.86	48.86	53.83	45.04	43.92	. .	53.27
1854	43.15	45.71	45.17	41.29	42.08	. .	46.25
1855	34.96	44.19	47.59	40.63	44.89	48.41	39.05
1856	40.80	52.16	53.79	42.33	42.49	45.97	40.97
1857	63.10	56.87	57.92	44.04	49.38	52.02	44.74
1858	48.66	52.67	45.46	37.40	37.73	35.80	44.51
1859	49.02	56.70	. .	48.49	47.51	48.41	45.29
1860	55.44	51.46	46.95	. .	46.91	46.67	38.24
1861	46.44	50.07	50.14	. .	43.32	42.95	44.25
1862	49.69	61.06	57.21	. .	44.26	44.61	50.09
1863	69.30	67.72	56.42	53.66	52.37	57.81	54.17
1864	42.60	49.30	. .	36.56	38.11	40.64	36.83
1865	49.46	47.83	43.59	35.84	37.38	38.82	44.69
1866	62.32	50.70	. .	43.46	38.18	41.36	46.04
1867	56.25	55.64	41.71	41.40	45.54	45.87	47.04
1868	50.06	64.11	39.89	44.65	47.96	49.58	53.52
1869	64.34	66.28	47.98	47.30	47.30	48.96	47.70
1870	55.89	59.73	41.53	39.40	46.30	48.71	49.02

*By J. Vannevar.

CONDUIT AT THE LAKE.

The following table shows the varying depths of the water in the conduit at the gate-house, the number of days in each month that the water was running at those depths, and the average depth for each month.

Depths Ft. In.	Jan. Days.	Feb. Days.	Mar. Days.	April. Days.	May. Days.	June. Days.	July. Days.	Aug. Days.	Sept. Days.	Oct. Days.	Nov. Days.	Dec. Days.	Totl Dys.
0-11	1	...	...	...	...	...	...	...	...	1
1-0½	1	...	...	...	...	...	...	...	...	1
1-1	1	...	...	...	...	1
2-8	1	...	...	...	...	...	...	...	...	1
3-3½	1	...	1
4-9½	1	...	1
5-0	31	11	...	...	11	...	...	...	...	...	...	6	59
5-1	1	...	1
5-1½	1	1
5-3	9	1	...	...	...	...	1	...	11
5-4	1	2	3
5-4½	1	...	1
5-5½	1	1
5-6	...	14	...	...	4	13	...	...	...	...	9	14	54
5-6½	1	...	...	...	...	...	...	1
5-7	1	1	2
5-8	28	20	...	1	...	...	...	...	4	6	59
5-9½	1	...	...	...	...	...	...	1
5-10	1	...	...	...	...	...	3	...	4
6-0	3	6	13	18	...	8	12	5	...	65
6-1½	1	...	...	1	...	...	...	1	...	3
6-2½	...	1	...	...	...	...	...	...	...	...	...	...	1
6-3½	1	...	...	1
6-4	...	2	3	3	...	...	8	24	18	18	1	...	77
6-6	4	6	4	...	...	...	14

Average Monthly Depths.

Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Average for the year.
5-0	5-4½	5-8½	5-4½	5-4½	5-8½	6-1¾	6-2¼	6-3½	6-2½	5-6¾	5-5	5-8½

Average Monthly and Yearly Heights, in feet and decimals, of the Water in the Brookline, Beacon Hill, South and East Boston Reservoirs, above "tide marsh level," 1861-70.

MONTH.	BROOKLINE. Maximum high-water line, 19460.										BEACON HILL. Maximum high-water line, 12153.									
	1861.	1862.	1863.	1864.	1865.	1866.	1867.	1868.	1869.	1870.	1861.	1862.	1863.	1864.	1865.	1866.	1867.	1868.	1869.	1870.
January . . .	122.81	122.46	123.64	122.37	123.31	122.28	122.00	123.29	122.58	122.83	116.61	117.48	118.36	117.72	119.18	119.20	119.11	120.20	118.51	118.63
February . . .	122.68	122.85	123.23	122.61	122.82	122.47	123.12	122.79	122.64	122.60	118.93	119.46	118.18	117.54	118.91	119.65	118.59	120.11	118.72	117.78
March . . .	123.32	123.52	123.23	123.62	123.26	123.19	123.05	122.33	122.48	122.77	119.05	119.18	118.03	116.38	120.58	120.72	119.45	120.57	118.30	118.07
April . . .	124.01	124.18	123.85	123.82	123.38	123.45	123.00	123.04	122.60	122.56	118.91	117.91	117.27	117.21	121.28	120.70	119.86	120.57	118.92	118.34
May . . .	124.04	124.00	123.52	123.62	122.65	123.04	123.07	123.04	122.77	122.75	119.06	117.59	116.33	116.53	120.31	119.53	118.50	118.65	119.68	118.63
June . . .	123.68	123.25	123.17	122.66	123.23	123.29	122.34	122.77	121.85	122.64	117.32	116.39	115.40	115.31	120.56	118.53	118.34	118.45	117.13	118.03
July . . .	122.68	123.73	122.76	122.87	123.33	122.97	122.98	122.77	122.10	122.50	116.48	116.46	116.34	115.32	121.23	119.51	119.00	120.24	117.20	119.30
August . . .	123.71	123.70	123.11	122.64	123.39	122.80	122.23	122.75	122.19	122.23	114.18	116.22	116.05	115.19	119.83	119.17	117.70	117.11	117.63	119.59
September . . .	123.76	123.64	123.36	122.03	123.29	122.81	122.52	122.12	122.50	122.35	113.14	116.22	116.12	115.91	119.03	119.39	120.46	118.20	117.45	117.72
October . . .	123.79	123.85	122.26	123.19	123.29	123.03	122.65	122.31	122.58	122.64	115.91	. . .	115.87	118.17	118.43	119.50	120.46	118.61	118.36	117.80
November . . .	123.80	124.07	123.63	122.78	123.38	122.75	122.89	122.56	122.46	122.60	116.74	117.20	116.85	118.55	120.14	119.78	120.84	119.03	118.45	118.61
December . . .	124.00	123.46	122.53	122.29	123.24	122.64	122.37	122.00	122.92	122.50	117.45	115.23	118.30	117.35	120.50	119.37	120.02	117.78	118.30	119.38
Yearly Av'ge	123.52	123.56	123.19	122.87	123.21	122.89	122.69	122.65	122.48	122.58	116.98	117.21	116.92	116.77	120.00	119.59	119.36	119.11	118.13	118.49

REPORT OF THE WATER BOARD.

Average monthly and yearly heights, etc. — Continued.

MONTH.	SOUTH BOSTON. Maximum high-water line, 122.86.												EAST BOSTON. Maximum high-water line, 107.00.											
	1861.	1862.	1863.	1864.	1865.	1866.	1867.	1868.	1869.	1870.	1861.	1862.	1863.	1864.	1865.	1866.	1867.	1868.	1869.	1870.				
January	115.03	113.66	115.73	110.63	114.21	114.38	112.46	111.15	111.15	114.46	95.37	96.26	95.64	90.22	96.12	93.61	91.89	92.81	99.72	104.45				
February	115.07	114.08	115.54	110.94	113.42	114.44	111.36	111.15	111.34	114.80	93.05	94.94	93.86	92.98	97.00	96.61	92.06	92.10	100.56	104.20				
March	115.12	114.12	115.36	111.13	113.64	113.51	111.74	111.11	111.63	114.51	94.60	95.75	94.29	93.50	94.83	94.22	91.69	91.14	100.60	100.89				
April	115.32	114.93	114.73	112.07	114.82	114.99	111.88	111.55	111.96	113.57	98.07	96.71	95.65	96.16	96.52	96.47	90.91		100.00	104.93				
May	113.83	115.74	112.71	111.64	115.44	114.90	111.63	111.61	111.78	113.53	97.85	96.99	93.07	97.68	96.04	95.85	89.63		105.91					
June	112.58	114.22	111.39	109.06	114.91	114.32	111.19	112.15	111.51	113.36	96.22	95.99	91.10	94.22	93.91	93.71	91.82		106.00					
July	110.91	114.23	109.75	108.57	114.26	113.96	111.53	111.53	111.19	112.21	95.00	96.13	90.43	92.34	96.82	95.35	94.60		100.60	103.87				
August	112.92	114.03	109.80	109.53	113.80	114.07	111.90	111.53	110.65	110.78	97.34	93.96	91.23	92.84	95.78	93.85	94.16		95.08	104.25				
September	112.96	114.04	109.64	110.21	113.69	113.41	111.70	111.44	108.76	110.15	95.76	95.57	91.96	95.00	94.52		99.40		94.87	102.77				
October	114.68	114.24	109.90	112.49	112.89	112.74	111.29	111.44	113.15	110.01	95.56	91.80	95.02	97.55	93.38		96.85		96.97	105.20				
November	114.14	115.94	111.25	112.49	112.74	112.03	111.26	111.44	113.76	111.86	96.40	93.57	93.36	98.14	92.23		93.47		101.12	104.75				
December	113.79	116.35	109.90	113.89	113.78	112.62	111.08	111.11	113.88	112.61	97.37	95.77	89.79	97.27	94.34	92.29	92.57		102.06	105.18				
Yearly Average.	113.86	114.63	112.14	111.05	113.97	113.78	111.59	111.44	111.74	112.65	96.05	95.29	92.95	94.83	95.12	94.66	93.25	92.02	99.06	104.37				

Respectfully submitted,
 N. HENRY CRAFTS,
City Engineer.

WATER REGISTRAR'S REPORT.

WATER REGISTRAR'S OFFICE,
BOSTON, May 1, 1871.

CHARLES H. ALLEN, Esq.,

President of the Cochituate Water Board:

SIR: The undersigned Water Registrar, in conformity to the ordinance providing for the care and management of the Boston Water Works, has the honor of presenting to the Cochituate Water Board his annual report.

The total number of water-takers now entered for the year 1871 is 36,132, being an increase since January 1, 1870, of 4,632.

The total number of cases where the water has been turned off for non-payment of rates during the year is 740. Of this number 602 have been turned on, leaving a balance of 138 still remaining off.

The total amount of water-rates received from April 30, 1870, to May 1, 1871, is	\$773,722 92
Less amount paid to the City of Charlestown for Mystic water as per contract	38,932 18
	<hr/>
	\$734,790 74

Of this amount there was received for water used in previous years the sum of . . . \$50,876 64

<i>Amount carried forward,</i>	<hr/>
	\$734,790 74

<i>Amount brought forward,</i>	\$734,790 74
Leaving the receipts for water furnished during the financial year 1870 and 1871, the sum of	\$683,914 10
In addition to the above there has been received for turning on water in cases where it had been turned off for non-payment of rates, the sum of	1,340 00
	<u>736,130 74</u>

The increased amount of income for the financial year ending April 30, 1871, over the previous year, is	\$118,505 63
The total amount of assessments now made for the present year, is	543,454 49
The estimated amount of income from the sales of water during the year 1871, is	750,000 00
The expenditures of my office during the year 1870, have been	<u>17,543 78</u>

The items of this expenditure are as follows, viz. :—

Paid William F. Davis, registrar	\$2,500 00
Charles H. Little, clerk	2,000 00
Charles L. Bancroft, “	1,500 00
Stephen Badlam, “	1,500 00
Edwin Jennings, “	1,500 00
R. D. Child, inspector	936 00
J. Hayward, Jr., inspector	936 00
T. L. Kelley, “	936 00
C. M. Thompson, “	936 00
<i>Amount carried forward,</i>	<u>\$12,744 00</u>

<i>Amount brought forward,</i>	.	.	.	\$12,744	00
T. H. Badlam, inspector	.	.	.	936	00
J. G. McCawley, “	.	.	.	936	00
F. G. Coffin, “	East Boston			936	00
Charles Burcham, “	“	“	.	126	00
J. F. Mayo, services on meters	.	.		1,099	00
J. L. Fairbanks, for stationery	.	.		278	73
A. Mudge & Son, for printing	.	.		488	05
				<u>\$17,543</u>	<u>78</u>

METERS.

The total number of meters now applied to the premises of water-takers is 1,076. Of this number 808 are $\frac{3}{8}$ -inch, 234 1-inch, 30 2-inch, 2 3-inch, 2 4-inch size; they are attached to a variety of establishments, embracing hotels, railroads, manufactories, stables, confectionery, oyster saloons, and buildings occupied by several tenants.

The following table exhibits the yearly revenue received from the sale of Cochituate water since its introduction into the city, October 25th, 1848 : —

Received by Water Commissioners, as per

Auditor's Report, in 1848	.	.	.	\$972	81
From January 1, 1849, to January 1, 1850,	.			71,657	79
“ “ 1850, “ 1851,	.			99,025	45
“ “ 1851, “ 1852,	.			161,052	85
“ “ 1852, “ 1853,	.			179,567	39
“ “ 1853, “ 1854,	.			196,352	32
“ “ 1854, “ 1855,	.			217,007	51
“ “ 1855, “ 1856,	.			266,302	77
“ “ 1856, “ 1857,	.			282,651	84
“ “ 1857, “ 1858,	.			289,328	83
<i>Amount carried forward,</i>	.	.		<u>\$1,763,919</u>	<u>56</u>

<i>Amount brought forward,</i>	.	.	.	.	\$1,763,919	56
From January 1, 1858, to January 1, 1859,	.	.	.	.	302,409	73
“ “ 1859,	“	“	1860,	.	314,808	97
“ “ 1860,	“	“	1861,	.	334,544	86
“ “ 1861,	“	“	1862,	.	365,323	96
“ “ 1862,	“	“	1863,	.	373,922	33
“ “ 1863,	“	“	1864,	.	394,506	25
“ “ 1864,	“	“	1865,	.	430,710	76
“ “ 1865,	“	“	1866,	.	450,341	48
“ “ 1866,	“	“	1867,	.	486,538	25
“ “ 1867,	“	“	1868,	.	522,130	93
“ “ 1868,	“	“	1869,	.	553,744	88
“ “ 1869,	“	“	1870,	.	597,328	55
“ “ 1870,	“	“	1871,	.	708,783	68
“ “ 1871, to May 1,	“	“	1871,	.	584,879	31
Total	.	.	.	.	\$8,183,893	50

Statement showing the number of houses, stores, steam engines, etc., in the City of Boston, supplied with Cochituate water to the 1st of January, 1871, with the amount of water-rates paid for 1870:—

22,846	Dwelling-houses	.	.	.	.	\$342,270	66
11	Boarding-houses	.	.	.	.	521	00
371	Model-houses	.	.	.	.	10,601	95
4	Lodging-houses	.	.	.	.	116	00
10	Hotels	.	.	.	.	680	00
4,969	Stores and shops	.	.	.	.	50,267	50
258	Buildings	.	.	.	.	9,406	90
439	Offices	.	.	.	.	3,855	36
27	Printing-offices	.	.	.	.	382	00
25	Banks	.	.	.	.	344	92
29	Halls	.	.	.	.	421	17
1	Theatre	.	.	.	.	36	50
<i>Amount carried forward,</i>	.	.	.	.	.	\$418,903	96

<i>Amount brought forward,</i>	.	.	.	\$418,903 96
31 Private schools	.	.	.	409 41
16 Asylums	.	.	.	827 00
12 Greenhouses	.	.	.	137 17
82 Churches	.	.	.	1,129 96
4 Markets	.	.	.	851 50
124 Cellars	.	.	.	815 50
398 Restaurants and saloons	.	.	.	7,725 19
5 Club-houses	.	.	.	150 00
2 Bath-houses	.	.	.	67 42
38 Photographers	.	.	.	969 42
8 Packing-houses	.	.	.	265 00
1,262 Stables	.	.	.	9,455 71
24 Factories	.	.	.	772 62
9 Bleacheries	.	.	.	127 00
84 Bakeries	.	.	.	674 16
3 Ship-yards	.	.	.	62 00
3 Dry docks and engines	.	.	.	100 00
53 Shops and engines	.	.	.	2,673 44
21 Stores and engines	.	.	.	1,105 03
2 Foundries	"	.	.	103 00
6 Factories	"	.	.	414 80
5 Printing	"	.	.	314 35
1 Bakery,	"	.	.	33 00
2 Ship-yards	"	.	.	70 00
6 Buildings	"	.	.	650 66
1 Pottery	"	.	.	50 00
1 Mill	"	.	.	152 72
51 Stationary engines	.	.	.	1,634 10
7 Armories	.	.	.	104 00
2 Gymnasiums	.	.	.	48 50
827 Hand-hose	.	.	.	4,805 00
16 Fountains	.	.	.	126 00
2 Gasometers	.	.	.	22 00
<i>Amount carried forward,</i>	.	.	.	<u>\$455,749 62</u>

	<i>Amount brought forward,</i>	\$455,749 62
1	Laundry	11 25
	Custom-House	150 00
1	Ice Company (washing ice)	30 00
57	Steamboats	9,515 49
	Office (Harbor Master)	6 00
	“ (City Scales)	11 00
	Probate building	50 00
	House of Reception	10 00
28	Fire-engines, hose and hook and ladder houses	605 00
1,737	Fire-hydrants	31,266 00
96	Reservoirs	1,728 00
343	Public schools	2,666 00
	City stables	234 75
	Offal station	175 00
	Steamer “Henry Morrison”	200 00
	Faneuil Hall	40 00
	Public Library	50 00
	Suffolk county Court House	300 00
	Paving department	167 00
	Common Sewer department	225 00
	Deer Park	10 00
	Public urinals	145 00
	Street sprinkling	500 00
	Public Garden	25 00
	Public fountains	450 00
	Drinking fountains	300 00
1	Hospital	75 00
	Steam-shovel	212 50
	Mount Warren Water Co.	192 39
	Building purposes	3,644 69
	Contractors for supplying shipping	1,606 57
	Metered water (9 months)	150,576 58
		<hr/>
		\$660,927 84

Statement showing the number and kind of Water Fixtures contained within the premises of Water-takers in the City of Boston, to January 1, 1871, as compared with previous years.

1868.	1869.	1870.	REMARKS.
5,129	5,321	5,893	Taps. These have no connection with any drain or sewer.
44,939	47,476	53,010	Sinks.
20,555	23,113	23,961	Wash-hand basins.
6,506	7,256	8,013	Bathing-tubs.
8,702	9,971	11,319	Pan water-closets.
9,319	10,686	12,235	Hopper water-closets.
233	220	250	“ “ “ pull.
292	263	216	“ “ “ self-acting.
381	406	433	“ “ “ waste.
554	580	607	“ “ “ door.
2,128	2,336	2,447	Urinals.
7,686	8,750	9,615	Wash-tubs. These are permanently attached to the building.
782	736	879	Shower-baths.
17	17	13	Hydraulic rams.
703	608	547	Private hydrants.
391	468	723	Slop-hoppers.
46	65	73	Foot-baths.
108,363	118,272	130,234	

Respectfully submitted,

WM. F. DAVIS,
Water Registrar.

REPORT OF THE SUPERINTENDENT OF THE
EASTERN DIVISION.

BOSTON, May 1, 1871.

CHAS. H. ALLEN, ESQ.,

President of the Cochituate Water Board:

SIR,—I respectfully submit the following report.

The labor of extending the pipe in the newly adopted territories has been pushed as rapidly as circumstances admitted; the tables below show but a small amount compared to what might be expected from so favorable a season for work.

The delay in getting the appropriation, in the delivery of pipes by the contractors, added to the rocky nature of the soil, the irregularity in which the gas pipes are laid, the numbers of large culverts, and other similar obstructions, all have kept my operations to the limit of this report. I cannot but think, had inordinate hindrances been removed, that both the Roxbury and Dorchester districts would to-day be well supplied with water.

The tables below show that there has been laid, of main pipe of all sizes, in length 129,040 feet, equal to 24 and nearly $\frac{1}{2}$ miles, and of service pipes 70,318 feet, equal to $13\frac{1}{3}$ miles.

Included in the length of main pipe given, is 27,488 feet laid by contract, to Deer Island.

Since the commencement of this season, however (which is the closing of our year's work), we have been more successful; having laid in the space of a little over 7 weeks, 33,413 feet, equal to about $6\frac{1}{3}$ miles, a portion of which was 20 and 24-inch pipes.

These large sizes are all now laid, 12-inch pipes being the largest required for the present year.

The 20-inch main from Upham's Corner, in Dorchester, to the South Boston reservoir, is laid to the point of connection on Telegraph Hill; this connection will be made in a few days.

A 16-inch main has been laid through a portion of Charles street, connecting with the 40-inch main at the foot of the Common, and to connect with the 12-inch main on Cambridge street. This will give a more direct communication with the low service in that locality, and a better supply. A 30-inch gate has been established on Hancock street, near Derne street, for the same purpose. A line of 12-inch pipes has been laid on the Common, from the 40-inch main to the Frog pond, to supply the fountain from the low service.

The plan suggested last season of supplying the high part of Beacon Hill by the pumping engines of Roxbury, I am pleased to say, has succeeded admirably. The water was let on to the fountain on the Common on the 4th of June, in presence of the Board, the City Government, and numerous spectators, and forced a jet in height beyond all expectations. The increased pressure on the pipes, however (the gates that give the opening to that section being shut), opened what was evidently an old crack in the 30-inch main, on Joy street; consequently the high service was not in use until Monday the 6th inst. The pipes of this district, and of the line to the engines, old as they are, made and laid with no expectation of their being used for other than the first pressure, have stood remarkably well. Two large gates of the original pattern burst during the season, and a few minor leaks have occurred; with these exceptions, the water has flowed to the tops of the highest dwellings, and, as far as I have learned, has given general satisfaction.

For particulars of the working of the pumping engines I refer you to the City Engineer's report.

Twenty street drinking fountains of the Nash pattern have been established; 12 of them in the city proper, 3 in East Boston, 3 in South Boston, and 2 in Roxbury. From these fountains the water runs continually, wasting it in large quantities. It is also badly constructed, having but one bowl for horses, and that much too small. I think the best one we have is located in Eliot Square; was formerly in Haymarket Square. It has a circular trough, and will supply 4 horses and more if needed, consuming no more water than the smaller ones. There are 2 long troughs on the Mill Dam, and well adapted for a locality like that where herds of cattle frequent. I have nearly ready to be set up one of Woods' Philadelphia pattern, having 4 basins, and a self-closing delivery, which I shall set in the rear of the Old State House, in a few days. This fountain promises well, both for economy in water and convenience in use.

On account of the excavations on the Fort Hill territory, the pipes have been taken up, and a few have been relaid. The Suffolk street district will no doubt have to be repiped this season.

A full account of the leak in the submerged pipes across the Chelsea Creek appeared in the City Engineer's annual report to the City Government, and no doubt will appear in his report to you. The laying of the new line by Mr. Norman is nearly completed.

The water was let into the line of pipes to Deer Island on the 29th day of April of the present year, in presence of the Board and a portion of the City Government, giving a fair supply, which will no doubt be increased when the 16-inch main on Brooks and the 12-inch main on Chelsea street are continued to their proper connections.

The East Boston reservoir has been tested by filling it to its utmost capacity during the year, and continues tight. When the new line across the creek is completed the reservoir can be kept full as a reserve for the supply of the East

Boston section, in case of accident to any of the lines leading thereto. By closing the gates leading to the reservoir, the section will have the whole pressure of the Mystic water, and consequently a greater supply in case of fire.

The Brooks street end, and the White street side of the embankment has been graded to conform to the altered grades of those streets, and a new and substantial iron fence erected. This fence has stood well the frost test; no perceptible change to be seen. The slope banks were sowed well with grass seed, but the hot season spoiled the most of our labors; this spring, however, it looks well, and I hope it will soon be in a satisfactory condition. The surroundings of the stand-pipe have been sodded, and a portion sowed, but, like the grass at the East Boston reservoir, the season was too hot for it to do well. A retaining wall has been built on Fort Avenue and the driveway gravelled and rolled.

Relaid.

526 feet 6-inch pipe in Chatham street.
150 " 4 " " " Pearl place.

Raised.

524 feet 12-inch pipe in Dorchester street, between 8th and O. C. & N. R. R. bridge.
600 feet 6-inch pipe in Canton street, between Newland and Tremont streets.
420 feet 4-inch pipe in Fabian street, between Newland and Ivanhoe streets.
260 feet 4-inch pipe in Trumbull street, between Newland and Ivanhoe streets.

Taken Up.

579 feet 6-inch pipe in Tremont street, between Phillips and Weston streets.
526 feet 6-inch pipe in Chatham street.

240 feet 6-inch pipe in Lehigh street, at B. & A. R. R.
Round House.

324 feet 6-inch pipe at Fort Hill.

393 feet 4-inch pipe at Fort Hill.

57 feet 4-inch pipe in Tremont street, between Philips and
Weston street.

64 feet 4-inch pipe in Central Court.

779 feet $1\frac{1}{2}$ inch iron.

214 " 1 " lead.

187 " $\frac{3}{4}$ " "

1,365 " $\frac{5}{8}$ " "

Extended.

1-inch pipe, 68 feet.

$\frac{3}{4}$ " " 81 "

$\frac{5}{8}$ " " 1,887 feet.

Statement of Location, Size, and Number of Feet of Pipe laid in 1870.

In what Street.	Between what Streets.	Diameter of Iron Pipe in Inches.	Feet of Pipe.
BOSTON PROPER.			
Charles	Beacon and Pinckney	16	980
	Total, 16-inch		980
Berkeley	Cortes and Boston and Albany R. R. . . .	12	92
Albany	Malden and Dover	"	1,660
Boston Common	40-in. Main and Frog Pond	"	610
	Total, 12-inch		2,362
Chandler	Berkeley and Columbus Avenue	6	600
East Chester Park . . .	Albany and Harrison Avenue	"	637
West " "	Columbus Ave. and Boston and Prov. R. R.	"	60
Dartmouth	Marlboro' and Commonwealth Avenue . .	"	120
"	" " Beacon	"	184
"	" " Newbury	"	494
"	Commonwealth Ave. and B. and A. R. R. .	"	1,082
"	Columbus Avenue and B. and A. R. R. . .	"	472
Sawyer	Shawmut Avenue and Lenox	"	164
Piedmont	Pleasant and Church	"	60
Shawmut	" " "	"	60
Tennyson	" " "	"	90
Tremont	" " Warrenton	"	25
Fairfield	Beacon and Marlboro'	"	297
Newton	Columbus Ave. and Boston and Prov. R. R.	"	138
Holyoke	" " "	"	50
Canton	" " "	"	200
Clarendon	" " Chandler	"	100
Warren Avenue	Berkeley and Clarendon	"	432
Washington	At Boston and Albany R. R. bridge	"	65
Stoughton	Harrison Avenue and Albany	"	417
	<i>Carried forward</i>		5,697

Statement of Location, Size, etc. — Continued.

In what Street.	Between what Street.	Diameter of Iron Pipe in Inches.	Feet of Pipe.
	<i>Brought forward</i>		5,697
Hamilton	Batterymarch and Wendall	6	122
Sturgis Place	Pearl and Oliver	"	80
Camden	Tremont and Boston and Providence R. R.	"	266
Berwick Park	Columbus Ave. & Boston & Providence R. R.	"	220
Marlboro'	Fairfield and Gloucester	"	367
Commonwealth Avenue	Clarendon and Dartmouth	"	1,418
Albany	Dover and Troy	"	460
Malden	Albany and Wareham	"	31
Union Park Street . .	" " Harrison Avenue	"	29
Troy	" " " "	"	27
Bristol	" " " "	"	635
Chestnut	Brimmer and the water	"	50
Village	Dover and Chapman	"	352
Worcester	Tremont and Columbus Avenue	"	300
	Total, 6-inch		10,054
Hancock	Cambridge and Derne	4	30
Avon	Washington and Chauncey	"	190
Arnold	Shawmut Avenue and Washington	"	64
Greenwich Park . . .	Columbus Ave. and Boston & Prov. R. R. .	"	36
Gray	Berkeley and Clarendon	"	210
Ivanhoe	Trumbull and Canton	"	113
Albany	To main Sea Wall	"	92
Harrison Avenue . . .	Perry and Bristol	"	45
No name	West Newton and Berwick Park	"	181
	Total, 4-inch		961

Statement of Location, Size, etc. — Continued.

In what Street,	Between what Streets.	Diameter of Iron Pipe in Inches	Feet of Pipe.
SOUTH BOSTON.			
Thomas	Atlantic and Old Harbor	20	387
Telegraph	Dorchester and Old Harbor	“	864
Dorchester	Telegraph and Dorchester Line	“	3,629
	Total, 20-inch		4,880
Emerson	Broadway and I	6	170
Woodward	Glover and Dorchester	“	223
Pacific	Fourth and Thomas	“	320
Thomas	London and Pacific	“	196
Second	O and P	“	294
Third	N “ O	“	250
Fifth	N “ P	“	290
Sixth	B “ Dorchester Avenue	“	167
Seventh	M “ N	“	158
Eighth	C “ D	“	72
I	Fifth and Seventh	“	400
L	Second and Third	“	155
M	Fifth and Sixth	“	96
	Total, 6-inch		2,791
Frederick	Ninth and O. C and N. R. R.	4	236
Vinton	Dorchester and Preble	“	300
Dorchester Avenue . .	Foundry Street and B. H. & E. R. R. Bridge	“	26
Gates	Eighth and Telegraph	“	155
Bowen	D and E	“	440
Colony	Swan and Sixth	“	172
Emmet	Second and Third	“	318
Tudor	C and D	“	400
“	E “ Dorchester	“	317
Chestnut Place	B street and B. H. and E. R. R.	“	207
Place from D Street . .	Eighth and Ninth	“	170
	Total, 4-inch		2,741

Statement of Location, Size, etc. — Continued.

In what Street.	Between what Streets.	Diameter of Iron Pipe in Inches.	Feet of Pipe.
EAST BOSTON.			
Saratoga	Chelsea and Byron	12	2,776
“	Moore and Culvert, bet. E. B. & Breed’s Is’d	“	2,052
	Total, 12-inch		4,828
Saratoga	End of 12-inch above Beach St., on Winthrop	10	9,311
	Total, 10-inch		9,311
Shirley	Beach and Shirley Gut	8	11,870
“	Across “ “	“	603
	On Deer Island	“	3,173
	Total, 8-inch		15,646
Princeton	Prescott and Eagle	6	33
White	Brooks “ Eutaw	“	236
“	Putnam “ Trenton	“	258
Trenton	Eagle “ White	“	686
White	Trenton “ Putnam	“	100
	On Deer Island	“	329
	Total, 6-inch		1,642
Union Place	From Princeton	4	121
In Winthrop	Between Shirley Gut and E. B.	“	150
	Total, 4-inch		271

Statement of Location, Size, etc. — Continued.

In what Street.	Between what Streets.	Diameter of Iron Pipe in Inches.	Feet of Pipe.
BOSTON HIGHLANDS.			
Dudley	Hampden and Dorchester line	24	1,322
Tremont	Providence Railroad Crossing	"	75
	Total, 24-inch		1,397
Thornton	Ellis and Shawmut Avenue	16	676
Ellis	Thornton and Hawthorne	"	47
Hawthorne	Ellis and Highland	"	145
Townsend	Shawmut Ave. and Walnut Ave.	"	1,149
Highland	Hawthorne and Fort Avenue	"	104
Highland Park	Tubular Reservoir and Beech Glen Ave.	"	97
Beech Glen Avenue	Highland and Fort Avenue	"	600
	Total, 16-inch		2,818
Parker	Conant and Longwood Ave.	12	247
Washington	Gardner and Tremont	"	605
Longwood Avenue	Parker and Binney	"	1,622
Tremont	Parker and Bumstead Lane	"	766
"	Cabot and Providence Railroad Crossing	"	3,496
Pyncheon	Cedar and Centre	"	25
Warren	Warren and Blue Hill Avenue	"	4,100
Shawmut Avenue	Townsend and Cobden	"	858
Ruggles	Auburn and Parker	"	541
Munroe	Warren and Walnut Avenue	"	2,237
	Total, 12-inch		14,497

Statement of Location, Size, etc. — Continued.

In what Street.	Between what Streets.	Diameter of Iron Pipe in Inches.	Feet of Pipe.
George	Hampden and Langdon	6	1,345
Norfolk Avenue	“ “ Magazine	“	1,308
Cabot	Tremont and Weston	“	204
Thornton	Ellis and Shawmut Avenue	“	676
Yeoman	Albany and Hampden	“	945
Ellis	Thornton and Hawthorne	“	73
Hawthorne	Ellis and Highland	“	159
Highland	Marcella and Fort Avenue	“	1,050
Townsend	Shawmut Avenue and Walnut Avenue	“	673
Beech Glen Avenue	Highland and Fort Avenue	“	63
Factory	Tremont and Hampshire	“	239
Culvert	“ “	“	46
Palmer	Warren and Winslow	“	165
Winslow	Palmer and Zeigler	“	98
Bower	Laurel and Walnut Avenue	“	223
New Heath	Centre and Parker	“	882
Waverly	Perrin and Blue Hill Avenue	“	651
Centre	New Heath and Cedar	“	556
Ball	Washington and Shawmut Avenue	“	471
Trask Avenue	From Yeoman	“	274
Hammond Park	Tremont and Shawmut Avenue	“	748
Marcella	Highland and “	“	1,169
Eustis	Hampden and Harrison Avenue	“	1,295
New	From New Heath	“	406
Copeland	Moreland and Warren	“	1,139
Maywood	Blue Hill Avenue and Warren	“	476
Shawmut Avenue	Ruggles and Washington	“	934
Philip	Tremont and Smith	“	137
Dennis	Stafford and Blue Hill Avenue	“	217
Linwood	Highland and Centre	“	698
Woodville Square	Dennis and Blue Hill Avenue	“	194
Parker	New Heath and Billings Place	“	61
Wabon	From Warren	“	469
Mindoro	Station and Prentiss	“	506
	Total, 6-inch		18,550

Statement of Location, Size, etc. — Continued.

In what Street.	Between what Streets.	Diameter of Iron Pipe in Inches.	Feet of Pipe.
Kearsarge Avenue . .	Warren and Winthrop	4	365
Parker Place	From Parker	"	369
Webber	Albany and Harrison Avenue	"	659
Stafford	Dennis and Blue Hill Avenue	"	328
Taber	Winslow and Washington	"	575
Beech Glen Avenue . .	Highland " Fort Avenue	"	495
Walnut Park	Shawmut Avenue and Walnut Avenue . .	"	980
Alaska	Perrin and Blue Hill Avenue	"	40
Adams Place	Washington and Williams	"	539
Elmwood Court	From Elmwood	"	238
Cliff	Glenwood and Shawmut Avenue	"	340
Montrose Avenue . . .	From Warren	"	427
Myrtle Place	" Glenwood	"	115
Orchard	Adams and Eustis	"	557
Glenwood	Cliff and Warren	"	262
Delle Avenue	From Parker	"	166
Nawn	Washington and Harrison Avenue	"	169
Cottage Place	From Tremont	"	270
Forest Avenue	" Warren	"	400
Rockingham Place . . .	Cabot and Lindall Park	"	286
Codman Park	From Shawmut Avenue	"	616
Putnam	Washington and Dudley	"	150
Lansing	Warren and Sherman	"	293
	Total, 4-inch		8,639

Statement of Location, Size, etc. — Continued.

In what Street.	Between what Streets.	Diameter of Pipe in Inches.	Feet of Pipe.
DORCHESTER.			
Stoughton	Roxbury Line and Boston Street	24	3,299
	Total, 24-inch		3,299
Boston	Stoughton and Dorchester line	20	3,698
	Total, 20-inch		3,698
Hancock	Stoughton and Columbia	16	456
	Total, 16-inch		456
Stoughton	Roxbury Line and Pleasant Street	12	4,855
Pleasant	Stoughton and Savin Hill Avenue	"	826
Savin Hill Avenue . .	Pleasant " Dorchester Avenue	"	453
Boston	Stoughton " Boston line	"	2,731
Dorchester Avenue . .	Savin Hill Avenue and Adams	"	4,172
Hancock	Columbia and Commercial	"	1,810
Adams	Dorchester Avenue and Park	"	299
	Total, 12-inch		15,146
Brook Avenue	Stoughton and West Cottage	6	901
North "	" " Brook Avenue	"	466
Hudson	" " Clifton	"	513
W. Cottage	" " Brook Avenue	"	544
Mount Vernon	Boston and Dorchester "	"	1,022
Sumner	Stoughton and Allbright Court	"	591
	Total, 6-inch		4,037
Dorchester Avenue . .	Savin Hill Avenue and Adams	4	36
	Total, 4-inch		36

RECAPITULATION.

SECTION.	1870.	DIAMETER IN INCHES.										Total.
		30.	24.	20.	16.	12.	10.	8.	6.	4.		
Boston Proper	Total number of feet laid	1	1	1	3	2	2,362	980	2,362	10,054	961	
South Boston	Stopcocks in same			4,880	1	3	2			23	16	
	Total number of feet laid									2,791	2,741	
	Stopcocks in same			1						8	7	
East Boston	Total number of feet laid						4,828		9,311	15,646	271	
	Stopcocks in same						5		1	8	2	
Boston Highlands	Total number of feet laid		1,397		2,818	14,497				15,550	8,039	
	Stopcocks in same	1	2		3	21				41	24	
Dorchester	Total number of feet laid		3,290	3,098	456	15,146				4,037	36	
	Stopcocks in same		3	1	1	20				9	6	
	Sums of Pipes		4,606	8,578	4,254	36,853	9,311	15,646	37,074	12,648	129,040	220
	Sums of Stopcocks	2	5	3	7	48	1	8	91	55		

Statement of the Length of different Sizes of Pipes laid, and the Number of Stopcocks put in, to May 1, 1871.

DIAMETER OF PIPES IN INCHES.														Aggregate.
48.	40.	36.	30.	24.	20.	16.	12.	10.	8.	6.	4.	3.		
Feet of Pipe laid in Brookline, Boston Highlands, and Boston Proper	7,283	23,166	20,070	26,770	5,773	7,076	67,283	2,020	275,233	88,287				
Number of Stopcocks in same	5	5	8	11	10	24	128	5	595	318				
Feet of Pipe laid in Boston Highlands					7,618	7,141	50,438			77,247	17,717	238		
Number of Stopcocks in same					7	16	68	1	155	77	2			
Feet of Pipe laid in South Boston					13,035		19,243	2,871	109,751	31,573				
Number of Stopcocks in same					5		31	2	153	80				
Feet of Pipe laid in East Boston					15,972	1,523	20,978	9,311	15,646	74,058	5,364			
Number of Stopcocks in same					6	3	28	1	8	106	32			
Feet of Pipe laid in Dorchester					3,290	456	15,146			4,037	36			
Number of Stopcocks in same					3	1	20			9	6			
Feet of Pipe laid in Newton and Needham			1,074	2,140			1,359			360				
Number of Stopcocks in same							2			2				
Totals — Length of Pipe laid	7,283	23,166	21,144	28,910	16,690	16,196	174,447	9,311	20,537	533,686	142,977	238		1,027,290, equal to 194 miles 2,970 feet.
Number of Stopcocks put in	5	5	8	12	20	14	277	1	16	1,020	513	2		1,037

Statement of Service Pipe laid in 1870.

Diameter in Inches.	BOSTON.		SOUTH BOSTON.		EAST BOSTON.		BOSTON HIGHLANDS.		DORCHESTER.		TOTALS.	
	Number of Pipes.	Length in Feet.	Number of Pipes.	Length in Feet.	Number of Pipes.	Length in Feet.	Number of Pipes.	Length in Feet.	Number of Pipes.	Length in Feet.	Number of Pipes.	Length in Feet.
1½	1	28	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	1	28
1¼ . . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	1	133	. . . . .	. . . . .	1	133
1	13	401	. . . . .	297	. . . . .	61	7	627	. . . . .	. . . . .	25	1,386
¾	3	129	. . . . .	454	. . . . .	. . . . .	12	950	. . . . .	. . . . .	22	1,533
½	404	14,650	. . . . .	436	11,552	3,784	724	23,311	. . . . .	1,836	1,746	55,133
¼	58	1,787	. . . . .	117	3,271	2,059	183	4,911	. . . . .	77	429	12,105
Aggregate											2,224	70,318
Making the total number up to May 1st, 1871											32,665	

Repairs of Pipes during the Year 1870.

WHERE.	DIAMETER OF PIPES IN INCHES.													Total.			
	40	36	30	24	20	12	6	4	3	2	1½	1¼	1		¾	½	
Boston	2	4	6	.	.	12	30	64	3	13	90	1	9	7	487	21	749
South Boston . . . . .	.	.	.	.	4	1	5	1	.	.	.	.	.	.	41	5	57
East Boston . . . . .	.	.	4	.	2	2	4	.	.	.	.	.	1	.	40	2	55
Boston Highlands . . . . .	.	3	.	1	.	5	2	4	.	.	.	.	.	.	47	2	64
Dorchester . . . . .	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1
Totals	2	7	10	1	6	20	41	69	3	13	90	1	10	7	616	30	926

Of the leaks that have occurred in pipes of four inches and upwards, joints, 90; settling of earth, 18; settling of boxing, 2; defective pipe, 11; defective gates, 2; defective packing, 3; frost, 10; parties building, 2; cap blown off, 1; struck by pick, 2. Total, 141.

Stoppages by frost, 16. Total, 16.

Of three inches and on service pipes, joints, 1; by settling of earth, 151; by settling of boxing, 6; by settling of drain, 1; by defective pipe, 37; by defective packing, 13; by defective coupling, 16; by defective faucet, 3; by frost, 27; by faucet broken at main, 15; by faucet loose at main, 8; by stiff connections, 90; struck by pick, 12; gnawed by rats, 10; by blasting, 2; by pipes not in use, 5; by nail-hole, 2; twisted off, 1. Total, 400.

Stoppages in service pipes, by frost, 209; by rust, 97; by fish, 46; by gasket, 10; by dirt, 5; by paper, 2. Total, 369.

Statement of Number of Leaks, 1850-70.

YEAR.	DIAMETER OF		TOTAL.
	Four Inches and upwards.	Less than four inches.	
1850	32	72	104
1851	64	173	237
1852	82	241	323
1853	85	260	345
1854	74	280	354
1855	75	219	294
1856	75	232	307
1857	85	278	363
1858	77	324	401
1859	82	449	531
1860	134	458	592
1861	109	399	508
1862	117	373	490
1863	97	397	494
1864	95	394	489
1865	111	496	607
1866	139	536	675
1867	122	487	609
1868	82	449	531
1869	82	407	489
1870	157	769	926

HYDRANTS.

During the year 207 new hydrants have been established, as follows : —

In Boston proper — Wilmarth 24, Lowell, 3, Lowry, 1	28
“ South Boston, “ 7, “ 2,	9
<i>Carried forward,</i>	<u>37</u>

<i>Brought forward,</i>	. . . . .	37
In East Boston — Wilmarth 5, Lowry 1		6
“ Boston Highlands, Lowell 6, Lowry, 103		109
“ Dorchester, Lowry 48		48
Deer Island, Port Hydrants, 7		7
Total,		<u>207</u>

Total number of hydrants established up to May 1, 1871 :—

Boston proper	1,106
South Boston	362
East “	210
Boston Highlands	419
Dorchester	48
Brookline	3
Charlestown	11
Chelsea	8
Deer Island	7
Total,	<u>2,174</u>

11 hydrants have been discontinued in Boston Highlands ; 6 on Fort Hill territory. These are deducted from the total number.

18 hydrants have been taken out and replaced by new or repaired ones, and 119 boxes have been taken out and replaced by new ones.

The hydrants have had the usual attention paid them.

STOPCOCKS.

220 new stopcocks have been established this year.

3 have been discontinued and are deducted from the total number. 49 boxes have been taken out and replaced by new ones.

All the stopcocks have had the attention of former years paid them.

*Statement of Pipes and other Stock on hand, exclusive of Tools,
May 1, 1871.*

NUMBER OF	DIAMETER IN INCHES.														
	48.	40.	36.	30.	24.	20.	18.	16.	12.	8.	6.	4.	3.	2.	1½.
Pipes	12	10	64	19	18	3	83	1677	3	4906	784	34			
Blow-off Branches			3	4				9							
Y Branches				1							2				
4 Way-Branches	2	1	2	6	7		5	29	7	10	1				
Flange Pipe	2	2	3	3			2	3		8	1				
Sleeves	2	2	6	5	5	7		27	50		40	54	9	22	
Clamp Sleeves			9	14½				12½	1		14	12	2		
Caps	2	1	4	3		1		24	5	34	40				
Reducers		3	2		7	4		2	9		18	10			
Bevel Hubs											5	2			
Curve Pipes	1	3	22	5			7	16		16	20				
Quarter Turns		2	10	2	5		3	19	3	50	48	8	6		
Double Hubs						3		9			32				60
Offset Pipes											39	38			
Yoke Pipes								8		2	5				
Manhole Pipes	2		2												
One-Eighth Turns				4			2		2	23	45	1			
3 Way-Branches	7	4	7	9	15		5	59	3	158	48	1	9		
Pieces of Pipes	4	6	21	2	13		3	8		17	14				
Stopcocks	1	2	3		3		1	3	1	73	11	7			
Blow-off and Man- holes	1		2												
Plugs										18	37				
Thawing Clamps										20	14				

Hydrants.—51 Lowry, 9 Lowry bases, 8 Lowry extensions, 3 Lowry chucks, 2 Lowry frames and covers, 39 Wilmarth, 11 Lowell, 2 Wilmarth, and 8 Lowell, old.

For Hydrants.—16 bends, 38 lengtheners, 133 covers, 8

old bends, 52 wastes, 5 nipples, 45 socket nuts, 6 wharf hydrants, 68 washers, 25 rods, 2 wharf hydrant cocks, 10 heavy frames, 1 heavy cover, 1,550 lbs. iron castings, 2,003 lbs. bolts, nuts and washers, 314 lbs. composition castings, 10 lbs. Babbitt metal, 74 pairs straps, unfinished.

For Stopcocks.— 2 36-inch screws, 1 30-inch ditto, 2 24-inch ditto, 1 16-inch ditto, 1 4-inch ditto for waste wiew, 1 ditto for Brookline reservoir (old), 20 composition screws for 6 and 4 inch gates, 1 6-inch valve, 6 6-inch rings, 6 6-inch stuffing boxes, 2,995 lbs. iron castings for 6 and 4 inch gates, 1 2-inch globe valve, 243 frames, 256 covers.

Meters in Shop.— 3 3-inch, 5 2-inch, 9 1-inch, 15 $\frac{5}{8}$ -inch.

Stock for Meters.— 10 2-inch nipples, 74 1-inch ditto, 77 $\frac{5}{8}$ -inch ditto, 5 2-inch connection pieces, 7 1-inch ditto, 24 $\frac{5}{8}$ -inch ditto, 92 1-inch cocks, 21 $\frac{5}{8}$ -inch ditto, 2 3-inch clocks, 2 2-inch ditto, 100 $\frac{5}{8}$ -inch ditto, 6 brass spindles, 160 rubber nipples, 75 glasses, 9 fish-boxes, 6 covers.

For Service Pipe.— 5 2 $\frac{1}{2}$ -inch union cocks, 97 1-inch ditto, 52 $\frac{3}{4}$ -inch ditto, 469 $\frac{5}{8}$ -inch ditto, 404 ditto unfinished, 56 $\frac{1}{2}$ -inch union cocks, 151 $\frac{1}{4}$ -inch T cocks, 50 1-inch ditto, 14 $\frac{5}{8}$ -inch ditto, 9 $\frac{5}{8}$ -inch Y ditto, 43 $\frac{5}{8}$ -inch thawing ditto, 37 2-inch couplings, 58 1 $\frac{1}{4}$ -inch ditto, 46 1 $\frac{1}{2}$ -inch tubes, 47 1-inch male couplings, 29 1-inch female ditto, 26 $\frac{3}{4}$ -inch male ditto, 86 $\frac{3}{4}$ -inch tubes, 126 $\frac{5}{8}$ -inch couplings, 580 $\frac{5}{8}$ -inch female ditto, 400 $\frac{5}{8}$ -inch tubes, 96 $\frac{1}{2}$ -inch couplings, 169 1-inch tubes, 1,042 boxes, 66 T ditto, 14 Y ditto, 43 extension tubes, 2,410 tubes, 1,650 caps, 765 lbs. unfinished castings (composition), 85 lbs. old composition, 9 4 x 2 composition flange reducers, 13 3 x 2 ditto, 37 2 x $\frac{5}{8}$ -inch ditto, 2 4 x 2 Y ditto, 3 4-inch tunnel pipe.

Lead Pipe.— 800 pounds 2-inch lead pipe, 340 pounds 1 $\frac{1}{2}$ -inch ditto, 1,340 pounds 1 $\frac{1}{4}$ -inch ditto, 960 pounds 1-inch ditto, 5,499 pounds $\frac{3}{4}$ -inch ditto, 17,400 pounds $\frac{5}{8}$ -inch ditto, 7,800 pounds $\frac{1}{2}$ -inch ditto, 80 pounds 1-inch tin-lined ditto, 65 pounds $\frac{3}{4}$ -inch ditto, 2,014 pounds $\frac{5}{8}$ -inch ditto, 420

pounds $\frac{1}{2}$ -inch ditto, 80 pounds $\frac{3}{8}$ -inch block-tin pipe, 98 pounds $1\frac{1}{2}$ -inch waste pipe, 60 pounds $\frac{1}{2}$ -inch block-tin pipe, 716 pounds old pieces, 30 pounds solder.

Blacksmith Shop. — 1,305 pounds round iron, 852 pounds flat ditto, 225 pounds square ditto, 1,640 pounds working pieces, 682 pounds cast steel, 1 case pick-handles, 14 dozen pick-blanks.

Carpenter's Shop. — 131 Lowry hydrant boxes, 94 stop-cock boxes, 8 ditto unfinished, 35 hydrant boxes, 95 ditto unfinished, 3 meter boxes, 33 ditto unfinished, 125 feet 3-inch hard-wood plank, 900 pounds spikes and nails, 200 feet bottom boards.

Tools. — 1 steam engine, 1 large hoisting crane, 3 boom-derricks, 5 hand geared ditto, 4 sets shears and rigging for same, 5 tool-houses, 3 tool-boxes, 2 platform scales, 1 portable blacksmith shop, 1 portable covering for Brewer fountain, 1 hand roller, 1 horse ditto, tools for laying and repairing main and service pipes, 2 engine lathes, 1 foot ditto, 1 hand ditto, 1 Pratt & Whitney's taper ditto, 1 upright drilling machine, 3 grindstones, the necessary tools for carrying on the machine, blacksmith, carpenter, and plumbing shops, 1 circular saw, 1 40-inch proving press, 1 36-inch ditto, 1 small ditto, 6 wheelbarrows, 300 feet new hose, 200 feet old ditto; also, office furniture, and a large lot of patterns at the foundries where we obtain castings.

Stable. — 9 horses, 8 wagons, 2 buggies, 3 pungs, 1 sled, 1 cart, 9 sets of harness, 10 blankets, 2 sleighs, 2 tons English hay, 25 bushels grain.

Beacon Hill Reservoir. — 1 large composition cylinder 16-inch jet, 1 6-inch composition jet, 3 composition plates, 9 cast-iron plates, 2 4-inch composition jets, 5 swivel pipe patterns, 1 2-inch copper straight jet, 6 composition jets for small fountains, 6 large composition cylinders.

Miscellaneous. — 1 Wood's Philadelphia four-basin foun-

tain, 55 tons pig lead, 3 gallons linseed, 2 barrels kerosene oil, 160 tons furnace coal, 1 freight gravel, 4,092 pounds gasket, 1 keg old bolts, lot paving stones, 52 reservoir covers, 20 cords wood, 6 manholes, 5 plates, lot of lumber; also, old machinery from Marlboro.

Respectfully submitted,

E. R. JONES,

Supt. Eastern Division.

REPORT OF THE SUPERINTENDENT OF THE
WESTERN DIVISION.

CHESTNUT HILL RESERVOIR,
BRIGHTON, May 1, 1871.

CHARLES H. ALLEN, Esq.,

President of the Cochituate Water Board:

SIR: In compliance with the rules and regulations of the Water Board, I submit the following report:—

LAKE COCHITUATE.

The low state of the water at the lake the past season has given an opportunity to make the repairs that were needed; new timbers have been put in at the lower dam, and the stone work repointed; at the upper dam, the outlet gate has been repaired, and a new composition screw substituted for the iron one, and the stone work repointed. 780 feet of wall have been laid to protect the banks from washing away, as they were exposed to the west and north-west winds; as soon as the stone can be obtained, it will be necessary to protect the banks by the side of the Saxonville Branch Railroad, as the water is washing it away quite fast. The house and outbuildings are in very good condition, the ice-house has been repaired, and filled with ice. An engine-house has been built, and connected to the north side of the gate-house to be used in case of resorting to pumping.

FENCES.

During the year 3,536 feet of fence has been built; it will require nearly as much more to be made this season. Posts

are already on the ground, and work will be commenced on it at an early day.

DUG POND.

The stop plank were removed so as to let the water into the lake from this pond September 16, 1870; they were put in again, March 2, 1871; all the water that was available was drawn from this pond.

DUDLEY POND.

The stop plank were taken out September 17, 1870, and the water drawn down to the lowest point as rapidly as possible, in order to repair the gate-chamber. The ice had moved the stone so much that the stop plank could not be put in or taken out; it was found necessary to take the stone work all down and rebuild it again. The stop plank were put in December 2, 1870.

PEGAN BROOK.

Early in the fall, work was commenced on the new dam at Pegan Brook; the mud was removed and a good foundation put in, and a good substantial dam built; 597 cubic yards of stone were used. The mud in front of the dam was removed, also that between the two dams, and the brook cleaned out. This will allow the water to settle and pass into the lake in a purer state than before.

CULVERTS.

Work was commenced to remove the obstructions in the culverts as soon as the water was low enough for the men to go through them, in order to get rid of the complaints that had been made by the Selectmen of Natick. It was found that the most of the trouble was at the Willow-bridge culvert; that not being enlarged at the time the additional 2 feet was given to the lake, its original capacity was not large enough, and that has decreased from year to year, by the

growth of the willow roots that had formed in it, until it was obstructed so much as to dam the water back into the lower section of the lake. The old culvert was taken out, and an open passage or sluice-way made 18 feet wide, with a space of 18 inches from the high-water mark, to the floor timbers of the bridge built by the consent of the Selectmen of Natick, and was done to the satisfaction of the Chairman of the Board.

CONDUIT.

The water has been shut off from the conduit three times the past year for the following purposes: August 25, to repair a leak in the conduit at Wellesley, water was off for 24 hours. Nov. 17, to change the screens at the lake, the water was not drawn entirely out of the conduit. April 14, 1871, for the annual examination between the lake and Chestnut Hill reservoir. The condition of the conduit does not change materially; notes were taken of the different sections, and will be given by the City Engineer in his report.

WASTE WEIRS AND PIPE CHAMBERS.

The waste weirs are all in good condition; new stop plank have been put in at Grantville, and the gate repaired; the west pipe chamber at the Lower Falls is in good condition, but the east chamber requires attention as soon as the conduit can be spared long enough to make a change in its location.

CHESTNUT HILL RESERVOIR.

The Bradlee basin was completed, and the water was let in October 25, 1870. On November 1, all of the shanties, stables, and old materials were sold at auction, and were at once removed. A lot was laid out, 500 feet front on Beacon street, with a depth of 144 feet, running back to the line of the railroad, to be used as a repair yard for the Western division. Work was at once commenced, to grade and fence

it; some of the old buildings were removed on to it, to be used until more suitable ones could be erected; suitable sheds have been built for the storage of the water carts, rollers, etc. The embankments have been dressed this spring, and the ground where the stables and the office stood graded and seeded down; the sidewalk, on Beacon street, is nearly completed, and a part of the fence built. Work will be continued in clearing up and putting the grounds surrounding the reservoir in order as soon as possible. The water was let into the Bradlæe basin every day from 2 P. M., to 7 P. M., from October 25 until November 2; the low state of the water at the lake at that time would not allow any more to be run in. All that the basin gained from that date until March was from the rain and snow. On the 14th of March, the water was again let in, and has been continued to this date (May 1), all that could be spared over and above the supply required for the city.

BROOKLINE RESERVOIR.

The walls surrounding this reservoir have been repointed, the gate-house painted inside, the trees pruned and thinned out, and the usual care taken of the grounds. Nothing more can be done until the water is drawn off, and the basin cleaned out, which will be done without doubt this season.

Height of Water at the Bradlee Basin above the lower floor at the Effluent Gate-House.

DATE.	Height of Water.		DATE.	Height of Water.		DATE.	Height of Water.	
1870.	<i>Ft.</i>	<i>In.</i>	1870-71.	<i>Ft.</i>	<i>In.</i>	, 1871.	<i>Ft.</i>	<i>In.</i>
November 26 . . .	1	9½	December 28 . . .	2	6¾	January 29 . . .	3	3¾
“ 27 . . .	1	9½	“ 29 . . .	2	7	“ 30 . . .	3	3½
“ 28 . . .	1	9¾	“ 30 . . .	2	7	“ 31 . . .	3	4
“ 29 . . .	1	9¾	“ 31 . . .	2	8	February 1 . . .	3	4½
“ 30 . . .	1	9¾	January 1 . . .	2	8	“ 2 . . .	3	5½
December 1 . . .	1	10	“ 2 . . .	2	8¼	“ 3 . . .	3	6
“ 2 . . .	1	10¼	“ 3 . . .	2	8¼	“ 4 . . .	3	6
“ 3 . . .	1	10¼	“ 4 . . .	2	8½	“ 5 . . .	3	6
“ 4 . . .	1	10¼	“ 5 . . .	2	8½	“ 6 . . .	3	6¼
“ 5 . . .	1	10½	“ 6 . . .	2	8¾	“ 7 . . .	3	6¼
“ 6 . . .	1	10½	“ 7 . . .	2	10	“ 8 . . .	3	6¼
“ 7 . . .	1	10¾	“ 8 . . .	2	10	“ 9 . . .	3	7
“ 8 . . .	1	11	“ 9 . . .	2	10	“ 10 . . .	3	7
“ 9 . . .	2	0½	“ 10 . . .	2	10	“ 11 . . .	3	7
“ 10 . . .	2	0¾	“ 11 . . .	2	10	“ 12 . . .	3	7¼
“ 11 . . .	2	1	“ 12 . . .	2	10	“ 13 . . .	3	7½
“ 12 . . .	2	1¼	“ 13 . . .	2	10¼	“ 14 . . .	3	8
“ 13 . . .	2	5	“ 14 . . .	2	10½	“ 15 . . .	3	8½
“ 14 . . .	2	5¼	“ 15 . . .	2	11	“ 16 . . .	3	9
“ 15 . . .	2	6	“ 16 . . .	3	00	“ 17 . . .	3	9¼
“ 16 . . .	2	6	“ 17 . . .	3	1	“ 18 . . .	3	9½
“ 17 . . .	2	5¾	“ 18 . . .	3	1½	“ 19 . . .	4	1
“ 18 . . .	2	5½	“ 19 . . .	3	2	“ 20 . . .	4	1½
“ 19 . . .	2	5½	“ 20 . . .	3	2	“ 21 . . .	4	1¾
“ 20 . . .	2	6	“ 21 . . .	3	2¼	“ 22 . . .	4	2
“ 21 . . .	2	6¼	“ 22 . . .	3	2¼	“ 23 . . .	4	2
“ 22 . . .	2	6½	“ 23 . . .	3	2¼	“ 24 . . .	4	2¼
“ 23 . . .	2	6½	“ 24 . . .	3	2½	“ 25 . . .	4	3½
“ 24 . . .	2	6¾	“ 25 . . .	3	2½	“ 26 . . .	4	4¼
“ 25 . . .	2	6¾	“ 26 . . .	3	2½	“ 27 . . .	4	4¾
“ 26 . . .	2	6¾	“ 27 . . .	3	2¾	“ 28 . . .	4	5
“ 27 . . .	2	6¾	“ 28	3	3¼	March 1 . . .	4	5¼

Height of Water at Bradlee Basin. — Continued.

DATE.	Height of Water.	DATE.	Height of Water.	DATE.	Height of Water.
1871.	<i>Ft. In.</i>	1871.	<i>Ft. In.</i>	1871.	<i>Ft. In.</i>
March 2	4 5½	March 22	7 1	April 11	10 11¼
“ 3	4 6	“ 23	7 5½	“ 12	10 11¼
“ 4	4 6½	“ 24	7 10	“ 13	11
“ 5	4 6¾	“ 25	8 1½	“ 14	11 5¼
“ 6	4 7¼	“ 26	8 5	“ 15	11 5½
“ 7	4 7½	“ 27	8 9	“ 16	11 5½
“ 8	4 7¾	“ 28	9 1	“ 17	11 5½
“ 9	4 8	“ 29	9 4	“ 18	11 5½
“ 10	4 8¼	“ 30	9 6¼	“ 19	11 5¾
“ 11	4 8¾	“ 31	9 8	“ 20	11 6¼
“ 12	4 9½	April 1	9 10	“ 21	11 7½
“ 13	4 10¼	“ 2	9 10½	“ 22	11 10
“ 14	4 10½	“ 3	10 0½	“ 23	12 ½
“ 15	5 3½	“ 4	10 2½	“ 24	12 2¼
“ 16	5 4½	“ 5	10 5	“ 25	12 5¼
“ 17	5 7½	“ 6	10 6¾	“ 26	12 9
“ 18	5 11½	“ 7	10 8½	“ 27	13
“ 19	6 3	“ 8	10 10¼	“ 28	13 4
“ 20	6 4½	“ 9	10 11½	“ 29	13 7½
“ 21	6 5¾	“ 10	10 11½	“ 30	13 11

Schedule of Property at Chestnut Hill Reservoir.

- 1 two-horse express wagon.
- 1 single “ “ “ (poor).
- 1 water cart, with shafts.
- 2 two-horse water carts.
- 4 “ “ iron rollers.
- 25 new castings, for rollers.
- 3 ox carts.

- 1 single horse pung.
- 1 two “ “
- 2 horse trucks.
- 1 horse power.
- 1 hay wagon.
- 2 hand carts.
- 1 two-wheel ox dray.
- 1 ox truck.
- 1 ox sling.
- 1 pair large wheels.
- 3 clay mills and shafting.
- 1 large water cistern.
- 4 new stone drags.
- 6 screens.
- 50 ox tie chains.
- 2 7-inch rotary pumps.
- 2 4 “ “ “
- 3 Joyce force “
- 1 house “ “
- 1 steam engine.
- 1 stone-crushing machine and castings.
- 2 blacksmiths' forges and tools.
- 1 portable forge.
- 1 derrick and rigging.
- 4 clay knives.
- 2 manheads.
- 36 grub axes.
- 157 picks.
- 189 shovels.
- 12 spades.
- 11 new shovels.
- 3 hoes.
- 46 iron bars.
- 9 stone hammers.
- 13 striking hammers.

- 15 iron rakes.
- 6 new iron rakes.
- 5 scuffling hoes.
- 4 border knives.
- 1 root-puller.
- 1 pair grass shears.
- 5 scythes and snaiths.
- 2 lawn-mowers.
- 1 garden engine.
- 3 hay forks.
- 4 manure forks.
- 14 lanterns.
- 8 peat knives.
- 13 tin dippers.
- 23 tin candlesticks.
- 4 reflector lanterns.
- 2 bags grass seed.
- 1 barrel cement.
- 15 short drills.
- 2 long “
- 7 birch brooms.
- 3 rattan brushes.
- 9 wooden rammers.
- 45 new hammer handles.
- 54 “ pick “
- 36 grub axes.
- 2 grindstones.
- 4 jack screws.
- 1 iron pump.
- 88 feet 4-inch iron flange pipe.
- 38 “ 8 “ “ “ “
- 1 12-inch quarter turn.
- 12 feet 18-inch Scotch pipe.
- 42 feet 15 “ “ “
- 15 “ 30 “ cement pipe.

- 5 feet 9-inch cement pipe.
- 4 pieces rubber hose.
- 2 " belting.
- 2 whitewash brushes (old).
- 5 new whitewash brushes.
- 10 new paint brushes.
- 1 window brush.
- 3 telegraph batteries.
- 2 horses.
- 1 Concord wagon.
- 1 covered " "
- 1 iron safe.
- 3 stoves.
- 12 pair rubber boots.

OFFICE AND STABLE FURNITURE.

Property at Lake Cochituate.

- 1 extension table.
- 1 parlor table.
- 18 dining-room chairs.
- 1 mirror.
- 1 wash-bowl.
- 1 map.
- 1 oil-cloth carpet.
- 1 straw carpet.
- 1 cooking range.
- 1 telegraph battery.
- 1 horse.
- 1 single harness.
- 1 beach wagon.
- 1 cart.
- 1 cart harness.
- 1 express wagon.
- 1 sleigh.

- 1 buffalo robe.
- 1 pair steelyards.
- 1 rain gauge.
- 2 boats.
- 1 haycutter.
- 12 picks.
- 6 shovels.
- 2 long-handle shovels.
- 2 spades.
- 2 iron rakes.
- 6 iron bars.
- 1 hand saw.
- 1 axe.
- 2 hatchets.
- 1 spirit level.
- 1 grindstone.
- 2 hoes.
- 6 fang hoes.
- 1 manure fork.
- 2 hay forks.
- 2 hay rakes.
- 2 scythes.
- 1 hedge shears.
- 2 grass hooks.
- 6 wheelbarrows.
- 1 gravel screen.
- 2 stop-plank hooks.
- 2 ice tongs.
- 2 stone hammers.
- 3 whitewash brushes.
- 4 ox chains.
- 1 twenty-horse power engine.
- 2 12-inch pumps.

At Brookline Reservoir.

- 3 settees.
- 1 desk.
- 3 pails.
- 2 picks.
- 3 scuffle hoes.
- 2 hay rakes.
- 2 iron rakes.
- 1 iron bar.
- 1 broom.
- 2 towels.
- 1 scythe.
- 5 shovels.
- 1 wheelbarrow.
- 2 ladders.
- 1 brush.
- 1 large stove.

Respectfully submitted,

ALBERT STANWOOD,

Sup't Western Division.

CIVIL ORGANIZATION OF THE WATER WORKS, FROM
THEIR COMMENCEMENT, TO MAY 1, 1870.

Water Commissioners.

NATHAN HALE, JAMES F. BALDWIN, THOMAS B. CURTIS.
From May 4, 1846, to January 4, 1850.

Engineers for the Construction.

JOHN B. JERVIS, of New York, Consulting Engineer.
From May, 1846, to November, 1848.

E. S. CHESBROUGH, Chief Engineer of the Western Division.
From May, 1846, to January 4, 1850.

WILLIAM S. WHITWELL, Chief Engineer of the Eastern Division.
From May, 1846, to January 4, 1850.

City Engineers having charge of the Works.

E. S. CHESBROUGH, Engineer. From November 18,
1850, to October 1, 1855.

GEORGE H. BAILEY, Assistant Engineer. From January
27, 1851, to July 19, 1852.

H. S. MCKEAN, Assistant Engineer. From July 19,
1852, to October 1, 1855.

JAMES SLADE, Engineer. From October 1, 1855, to
April 1, 1863.

N. HENRY CRAFTS, Assistant Engineer. From October
1, 1855, to April 1, 1863.

N. HENRY CRAFTS, City Engineer. From April 1, 1863, to the present time.

THOMAS W. DAVIS, Assistant Engineer. From April 1, 1863, to December 8, 1866.

HENRY M. WIGHTMAN, Resident Engineer at C. H. Reservoir. From February 14, 1866, to the present time.

After January 4, 1850, Messrs. E. S. CHESBROUGH, W. S. WHITWELL, and J. AVERY RICHARDS, were elected a Water Board, subject to the direction of a Joint Standing Committee of the City Council, by an ordinance passed December 31, 1849, which was limited to keep in force one year; and in 1851 the Cochituate Water Board was established.

COCHITUATE WATER BOARD.

Presidents of the Board.

THOMAS WETMORE, elected in 1851, and resigned April 7, 1856 * * Five years.
 JOHN W. WILKINS, elected in 1856, and resigned June 5, 1860 * * Four years.
 EBENEZER JOHNSON, elected in 1860, term expired April 3, 1865 Five years.
 OTIS NORCROSS, elected in 1865, and resigned January 15, 1867 One year and nine months.
 JOHN H. THORNDIKE, elected in 1867, term expired April 6, 1868 One year and three months.
 NATHANIEL J. BRADLEE, elected April 6, 1868, and resigned Jan. 4, 1871 Two years and nine months.
 CHARLES H. ALLEN, elected from January 4, 1871, to present time

Members of the Board.

THOMAS WETMORE, 1851, 52, 53, 54 and 55 * *	Five years.
JOHN H. WILKINS, 1851, 52, 53, *56, 57, 58, and 59 * *	Eight years.
HENRY B. ROGERS, 1851, 52, 53, *54 and 55	Five years.
JONATHAN PRESTON, 1851, 52, 53 and 56	Four years.
JAMES W. SEVER, 1851	One year.
SAMUEL A. ELIOT, 1851 * *	
JOHN T. HEARD, 1851	One year.
ADAM W. THAXTER, Jr., 1852, 53, 54 and 55 * *	Four years.
SAMPSON REED, 1852 and 1853	Two years.
EZRA LINCOLN, 1852 * *	One year.
THOMAS SPRAGUE, 1853, 54 and 55	Three years.
SAMUEL HATCH, 1854, 55, 56, 57, 58 and 61	Six years.
CHARLES STODDARD,* 1854, 55, 56 and 57	Four years.
WILLIAM WASHBURN, 1854 and 55	Two years.
TISDALE DRAKE, 1856, 57, 58 and 59 * *	Four years.
THOMAS P. RICH, 1856, 57 and 58	Three years.
JOHN T. DINGLEY, 1856 and 59	Two years.
JOSEPH SMITH, 1856	Two months.
EBENEZER JOHNSON, 1857, 58, 59, 60, 61, 62, 63 and 64	Eight years.
SAMUEL HALL, 1857, 58, 59, 60 and 61 * *	Five years.
GEORGE P. FRENCH, 1859, 60, 61, 62 and 63	Five years.
EBENEZER ATKINS, 1859 * *	One year.
GEORGE DENNEY, 1860, 61, 62, 63, 64 and 65	Six years.
CLEMENT WILLIS, 1860	One year.
G. E. PIERCE, 1860	One year.
JABEZ FREDERICK, 1861, 62 and 63 * *	Three years.
GEORGE HINMAN, 1862 and 63	Two years.
JOHN F. PRAY, 1862	One year.
J. C. J. BROWN, 1862	One year.

JONAS FITCH, 1864, 65 and 66	Three years.
OTIS NORCROSS,* 1855 and 66	Two years.
L. MILES STANDISH, 1860, 61, 63, 64, 65, 66 and 67	Seven years.
JOHN H. THORNDIKE, 1864, 65, 66 and 67	Four years.
CHARLES R. McLEAN, 1867	One year.
BENJAMIN F. STEVENS, 1866, 67 and 68	Three years.
WILLIAM S. HILLS, 1867	One year.
CHARLES R. TRAIN, 1868	One year.
ALEXANDER WADSWORTH, 1864, 65, 66, 67, 68 and 69	Six years.
JOSEPH M. WIGHTMAN, 1868 and 69	Two years.
BENJAMIN JAMES,* 1858, 68 and 69	Three years.
FRANCIS A. OSBORN, 1869	One year.
WALTER E. HAWES, 1870	One year.
JOHN O. POOR, 1870	One year.
HOLLIS R. GRAY, 1870	One year.
NATHANIEL J. BRADLEE, 1863, 64, 65, 66, 67, 68, 69, 70-71	} <i>Present Board.</i>
GEORGE LEWIS, 1868, 69, 70-71	
CHARLES H. ALLEN, 1869, 70-71	
JOHN A. HAVEN, 1870-71	
LEONARD R. CUTTER, 1871	
SIDNEY SQUIRES, 1871	
AMOS L. NOYES, 1871	

* Mr. John H. Wilkins resigned Nov. 15, 1854, and Charles Stoddard was elected to fill the vacancy. Mr. Henry B. Rogers resigned Oct. 22, 1865. Mr. Wilkins was re-elected February, 1856, and chosen President of the Board, which office he held until his resignation on June 5, 1860, when Mr. Ebenezer Johnson was elected President; and on July 2d, Mr. Miles Standish was elected to fill the vacancy occasioned by the resignation of Mr. Wilkins. Otis Norcross resigned Jan. 15, 1867, having been elected Mayor of the City. Benjamin James served one year, in 1858, and was re-elected in 1863.

** Deceased.

COCHITUATE WATER BOARD, 1871.

CHARLES H. ALLEN, President.

LEONARD R. CUTTER, of the Board of Aldermen.

SIDNEY SQUIRES, }
 AMOS L. NOYES, } Of the Common Council.

AT LARGE.

For Two Years.

NATHANIEL J. BRADLEE,
 CHARLES H. ALLEN.

For One Year.

GEORGE LEWIS,
 JOHN A. HAVEN:

Clerk,

JOSEPH A. WIGGIN.

Assistant Clerk and Clerk of Committees,

SAMUEL N. DYER.

Superintendent of the Eastern Division,

EZEKIEL R. JONES.

Superintendent of the Western Division,

ALBERT STANWOOD.

Water Registrar,

WILLIAM F. DAVIS.

City Engineer,

N. HENRY CRAFTS.

STANDING COMMITTEES OF THE BOARD.

Eastern Division.

GEORGE LEWIS, Chairman.

JOHN A. HAVEN,

SIDNEY SQUIRES.

Western Division.

CHAS. H. ALLEN, Chairman.

LEONARD R. CUTTER,

AMOS L. NOYES.

Water Registrar's Department.

JOHN A. HAVEN, Chairman.

SIDNEY SQUIRES,

CHAS. H. ALLEN.

On Construction of Chestnut Hill Reservoir.

NATHANIEL J. BRADLEE, Chairman.

GEORGE LEWIS,

CHARLES H. ALLEN.



BOSTON PUBLIC LIBRARY.

CENTRAL LIBRARY.

ABBREVIATED REGULATIONS.

One volume can be had at a time, in home use, from the Lower Hall, and one from the Bates Hall, and this volume must always be returned with the applicant's library card, within such hours as the rules prescribe. No book can be taken from the Lower Hall of this Library, while the applicant has one from any Branch.

Books can be kept out 14 days, but may be renewed *within* that time, by presenting a new slip with the card; after 14 days a fine of *two* cents for *each* day is incurred, and after 21 days the book will be sent for at the borrower's cost, who cannot take another book until all charges are paid.

No book is to be lent out of the household of the borrower; nor is it to be kept by transfers in one household more than one month, and it must remain in the Library one week before it can be again drawn in the same household.

The Library hours for the delivery and return of books are from 9 o'clock, A. M., to 8 o'clock, P. M., in the *Lower Hall*; and from 9 o'clock, A. M., until 6 o'clock, P. M., from October to March, and until 7 o'clock, from April to September, in the *Bates Hall*.

Borrowers finding this book mutilated or unwarrantably defaced, are expected to report it; and also any undue delay in the delivery of books.

* * * No claim can be established because of the failure of any Library notice to reach, through the mail, the person addressed.

[50,000, Nov., 1870.]

