Boston Water and Sewer Commission

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Boston, Massachusetts 02109
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NOTICE OF PUBLIC HEARING TO BE HELD BY THE BOSTON WATER AND SEWER COMMISSION CONCERNING ITS PROPOSED CAPITAL IMPROVEMENT PROGRAM.

Pursuant to Chapter 436 of the Acts of 1977 of the Massachusetts General Court, the Boston Water and Sewer Commission will hold a public hearing commencing at 2:00 P.M. on Thursday, November 29, 1979 at the Dorothy Quincy Suite of the John Hancock Building, 180 Berkeley Street, Boston, Massachusetts for the purpose of giving interested persons an opportunity to present data, views or argument relative to the proposed capital improvement program.

Copies of the foregoing capital improvement program will be available for inspection on or after November 8, 1979 at the office of the Boston Water and Sewer Commission, 8th Floor, 10 Post Office Square, Boston, Massachusetts.

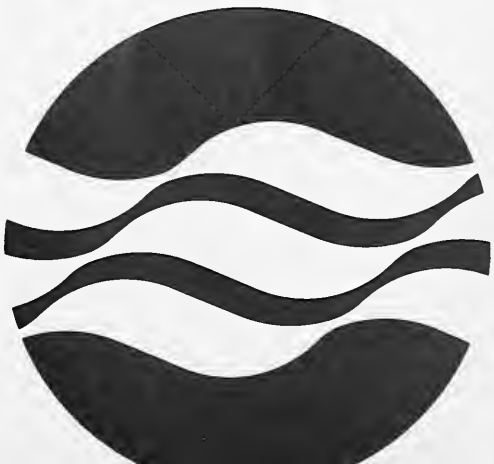
Any individual, partnership, trust, corporation, association, organized group or governmental entity which may be affected by the foregoing capital improvement program may appear before the Commission, at such hearing, for the purpose of presenting data, views or argument relevant thereto. Data, views or argument may be presented orally at the hearing, or in the form of a memorandum which shall be filed with the Secretary of the Commission on or before November 21, 1979 at the office of the Boston Water and Sewer Commission, 8th Floor, 10 Post Office Square, Boston, Massachusetts.

The hearing and all continuances thereof shall be conducted in accordance with the Boston Water and Sewer Commission Rules of Procedure which may be examined at the Commission's office.

John S. Howe, Chairman

Boston Water and Sewer Commission

Proposed
Capital Improvement Program
1980 – 1982



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INTRODUCTION

This document outlines Staff recommendations for a three-year Capital Improvement Program for the Boston Water and Sewer Commission. The Commission operates as a retailer of water and sewer services for nearly 90,000 customers in the City of Boston. Its largest capital asset is a distribution and recovery system to provide these services.

In developing its proposed three-year Capital Improvement Program, the Commission Staff has dealt with improvements and changes, mainly to the underground distribution and recovery systems. Due to maintenance considerations, many of the proposed programs represent system renewal and rehabilitation efforts.

The Commission Staff has designed its proposed Capital Improvement Program as a dynamic program. Thus more detail is supplied for programs which take place in 1980 rather than for those occurring in 1981 or 1982. The Staff feels that by using its dynamic approach to capital budgeting, it will be able to constantly review and update its Capital Improvement Program based on engineering needs and financial resources available to the Commission.

The Staff envisions monitoring the effectiveness of these programs, using this information in conjunction with information from additional engineering investigations, to review the allocations of funds for capital improvements in subsequent years.

This document contains a chapter outlining the proposed Capital Improvement Program for the Water Distribution System, a chapter outlining the proposed Capital Improvement Program for the Wastewater Collection System, and a final chapter summarizing the proposed programs, and discussion of financing for these projects and their impact on water and sewer rates.

CHAPTER II

Proposed Capital Improvement Program for the Water Distribution System

1980-1982

This chapter provides an analysis of the various projects recommended by Staff for a proposed three-year (1980-1982) Capital Improvement Program for the Water Distribution System. A brief history and description of the Boston water system is presented along with a brief assessment of the current system, and a statement of the objectives of the Capital Improvement Program. An item by item description of the components of the Capital Improvement Program for the Water Distribution System is presented; included with each program description is a summary of costs, and information of benefits to be realized.

II. 1.a History of Boston Water Distribution System

The Boston water system is composed of four major distribution networks: the Southern Low Service, the Northern Low Service, the Southern High Service, and the Southern Extra High Service. The aerial extent of the service levels, in general, is determined by ground elevation. Approximately 90 percent of the water consumed in Boston is distributed through the Southern Low and Southern High Services.

The Commission purchases its water supply from the Metropolitan District Commission through twenty-eight metered connections located at various delivery points throughout the system. The distribution network consists of approximately 1,080 miles of pipe, 87,100 water accounts, and 13,300 fire hydrants. The system supplies water through mains ranging in size from four to forty-eight inches in diameter.

Historically, the first major underground Boston public water supply was put in service in 1848. Rapid expansion of the system occurred for approximately the next 60 years and by 1910 the Boston distribution system was considered second to none. By 1924 it was recognized that additional supplies of water were needed, and a comprehensive organization for the planning and delivery of water in the Boston Metropolitan area was necessary. A solution to these problems culminated in the creation of a forerunner to the Metropolitan District Commission in 1926. This organization was charged with delivery of water and recovery of effluents in the Boston Metropolitan Area. Thus by 1927 the Boston Water and Sewer Works had evolved into a retail distribution and recovery operation. Currently, although under a different form of management, the general operations remain the same, a retail water distribution and sewerage recovery operation.

II. 1.b Current State of Distribution System

Most of the distribution network was installed many years ago, and there has been some deterioration in the ability of the system to convey water. Due to the high resistivity of the Boston soil, the external corrosion of the distribution system is currently not considered a major problem. However, lack of capacity due to age of pipe and caustic water, leakage due to age of pipes, and revenue loss due to age of meters are considered major problems of the water distribution system. It is estimated that over 20 percent of the current distribution network was built prior to 1900. Moreover, due to an inadequate meter replacement program, many of the system meters are old and subject to underregistration.

In both the 1979 and 1980 BWSC Capital Improvement Programs, the Commission has instituted a comprehensive metering program and water-main relaying/relining program in order to deal with these problems.

II. 1.c System Losses

Table II - 1 gives an indication of the magnitude of unaccounted-for water for the last five years in the City of Boston distribution system, i.e. the difference between water purchased from the MDC and water metered to BWSC customers.

TABLE II-1

Calendar Year	MDC Purchases (MGD)	Metered Water* (MGD)	Metered Water as a % of * MDC Purchases
1974	145.0	72.7	50.1
1975	147.1	75.3	51.2
1976	150.8	75.0	49.7
1977	146.1	76.1	52.1
1978	143.0	76.0	53.1

* (Does not include City of Boston usage, currently estimated at 4.36 MGD or 3% of 1978 MDC Water Purchases)

A breakdown of system losses is useful in formulating a program for increasing the ratio of metered water to MDC purchases. One approximization is available and shown in Table II-2.

TABLE II-2

System Losses (MGD)

	Coopers & Lybrand(1)
Undermetering	31.1
Leaks and Breaks	25.0
Blowoffs, Flushings, etc.	1.2
Firefighting	1.9
Unmetered Public Usage	4.2
Other	1.2

These figures do not include water system losses (i.e. water purchased from the M.D.C. but not billed to Commission customers) of approximately 10% to 15%. These losses are inherent in any system of this nature and age and are impracticable or impossible to eliminate.(2)

(1) BWSC 1978 Rate Hearing

(2) Water and Sewer Facility and Financial Analysis, Camp, Dresser & McKee, Inc., 1979.

Factors to be considered in revenue losses from undermetering are:

- unmetered consumers tend to use more water.
- per capita consumption historically has been on the rise.
- estimating usage from past records assumes that water needs of these consumers at these locations do not change. (i.e., use of automatic dishwashers, washing machines, etc.)

Unmetered public usage was estimated to be 4.2 MGD by Coopers & Lybrand. Other system losses include illegal use of hydrants, which by its nature is difficult to estimate as well as control. The categories of system losses which are for the most part uncontrollable by the BWSC are blowoffs and flushings, and firefighting.

II. 2 Objectives of the Water Capital Improvement Program

The primary objectives of outlaying capital expenditures disbursements for the Water Capital Improvement Program are: 1) the ensurance of adequate, high quality water at proper pressures for BWSC customers and 2) the reduction of long-term operation and maintenance costs.

For the present time the formulation of the BWSC CIP is based on the experience gained in the first two years of operation, and is somewhat constrained by limited historical information. However, based on previous experience of similar distribution networks, and general engineering criteria, Staff feels that its program selections are economically feasible to meet the set objectives. The BWSC Staff has formulated a three-year capital improvement program in order to reduce long-term O & M costs. The proposed water distribution system CIP includes two major areas of activity:

1) a comprehensive metering program,
2) a relaying/relining program.

The programs for the water distribution system will be presented and explained in seven separate program components:

- residential metering
- industrial metering
- public metering
- main relaying/relining
- programs coordinated with other agencies.
- new MDC meter connection
- flow and pressure monitoring

Each program component will be subdivided further into three sections:

- program description
- program costs
- program benefits

II. 3a. Residential Metering: Program Description

The number of residential customers served through the BWSC distribution system numbers approximately 75,000. The residential metering program supplied principally through 5/8" meters is intended to solve the following problems:

- broken or non-registering meters
- meter under registration
- meter inaccessability

To solve the meter inaccessability problem, the BWSC is installing meters with outside reading devices (ORDs). In order to determine the number of 5/8" meters with ORDs to be installed on a yearly basis, the optimum life of these meters must be calculated. Cost considerations include the following:

- meter costs
- installation costs
- operation & maintenance costs (O & M includes annual revenue losses resulting from meter inaccuracies)
- salvage value

Revenue losses occasioned by meters depend on the chemical properties of water and quantity flow as well as the water/sewer rate. Therefore, revenue losses will vary among regions which precludes the use of outside data. Because of the absense of meter-testing data on the ORD meters presently being installed by the BWSC, it will be some time before meter accuracy losses are determined.

Staff recommends that the ten-year meter replacement cycle initiated in 1979 be continued in the residential metering program. This will involve the installation of 7,500 meters annually.

However, because of the large number of broken meters, unmetered residences, or under-registering meters, Staff proposes the installation of 10,000 meters with ORDS for 1980 and 1981. Therefore, the 7,500 meter annual replacement cycle will begin in 1982.

II. 3b. Residential Metering: Program Costs

	Number of Meters	Meter Costs	Installation Costs	Average Costs	Total Costs
1980	10,000	$33.50	$34.50	$68.00	$680,000
1981	10,000	36.20	37.30	73.50	735,000
1982	7,500	38.40	39.50	77.90	584,250
Total 3 Year CIP					$1,999,250

Note:

- Installation and meter costs are based on the 1979 bid price.
- An inflation factor of 8% is assumed for 1980 and 1981, 6% for 1982.

II. 3c. Residential Metering: Program Benefits

As discussed earlier, the installation of residential 5/8" meters should be based on a replacement policy with consideration of annual discounted costs of investment and operation and maintenance which includes revenue losses and testing and repair costs. The expected benefit of a residential metering program is, therefore, the minimization of total long-term costs.

There is the additional benifit of the residential metering program of ensuring consumer confidence that water and sewer bills are correct. Estimated bills from improperly functioning or inaccessible meters cause customer service related problems. The residential metering program of which the installation of ORDs is a highlight is perceived to substantially reduce this problem.

II. 4a. Industrial/Large User Metering: Program Description

As stated in the 1979 BWSC CIP report losses resulting from industrial meter inaccuracies can range from 10 to 50 percent(1). Therefore, with a yearly testing program, it is the intent of the BWSC to check these meters at frequent intervals. The BWSC is completing the first year of a field maintenance and testing program of the 100 largest meters. Initially most of the program work involves certain meter installation changes such as: the installation of turbine meters with removable parts; the installation of meter by-passes; and the installation of pitometer cocks; After these meter changes are made, the yearly field testing of industrial meters can proceed on a routine basis.

The industrial/large user metering program will be examined in terms of average costs and revenues over a ten year period, the expected life of the initial instatllations. Determination of how many meters to include in the analysis will include net present value revenue analysis of the first 250 meters.

(1) "Field Maintenance of Industrial Meters," Charles Alden. Journal of AWWA, March 1976.

II. 4.b Industrial/Large User Metering: Program Costs

Below is a summary of costs to be considered in computing the present value of net revenue of the first 250 meters.

1980

Installation of Metering Equipment	100 meters @ $4,000 =	$400,000
Meter Testing Costs	200 meters @ $ 150 =	30,000
Meter Maintenance Costs	40 meters @ $ 400 =	16,000
		$446,000

1981

Installation of Metering Equipment	50 meters @ $4,320 =	$216,000
Meter Testing Costs	250 meters @ $ 162 =	40,500
Meter Maintenance Costs	50 meters @ $ 432 =	21,600
		$278,100

1982

Meter Testing costs	250 meters @ $ 172 =	$ 43,000
Meter Maintenance Costs	50 meters @ $ 458 =	22,900
		$ 65,900

Notes:

- Installation of metering equipment costs supplied by C. E. Maguire, Inc. in 1979 BWSC CIP report.

- Initial meter testing costs supplied by Pitometer Associates.

- Meter maintenance costs are based on initial repair costs experienced in 1979.

- The number of meters in need of repair per year is unknown at this time. The number used is based on experience of the City of Hagerstown, MD where 20% of its largest user meters require repair.*

- After 1981 routine meter testing and maintenance costs will be financed through the operating budget.

* Law, Norman D. "Revenue Benefits Through Large - Meter Maintenance" Journal of American Water Works Association, August 1978.

II. 4.c Industrial/Large User Metering: Program Benefits

This section includes a calculation of expected net benefits from implementation of the Large User Program.

Below is a presentation of the 1978 water usage and expected 1979 revenue by user class of the largest 250 meters along with the revenue gain of the program(1) using a conservative estimate of a 5 percent accuracy increase.(2)

User Class	1978 Gallonage (billions)	Percent Of Total Water Billed	1979 Expected Revenue (millions)	5% Expected Gain In Revenue (000's)
1 - 100	7.8	26	$11.620	$ ~~581~~ 450
100 - 150	1.1	4	$ 5.215	$ ~~261~~ 82
150 - 200	.8	3	$ 3.725	$ ~~186~~ 60
200 - 250	.1	.3	$ .445	$ ~~22~~ 44.5
TOTAL	9.8	33.3	$21.005	$~~1,050~~ 636.5

The calculation of present discounted benefits is helpful in determining the usefulness of the program. The analysis will involve separately including in the program the first 100 largest meters, the second 100 largest meters and the next 50 largest users, respectively.

For simplicity, constant water and sewer rates will be assumed;* meter testing and repair costs will escalate by an 8 percent inflation adjustmentfor 1980 and 1981; 6% for subsequent years. A 10 percent discount rate will be used to express net revenue in present day terms. A one year lag in revenue gain will be assumed after meters are tested and repaired.

(1) based on present rates of $1.01/1000 gallons water and $0.49/1000 gallons sewer.

(2) in 1979, 32 meters were tested and 13 were found to be underregistering by an average of 20%.

NET PRESENT VALUE ANALYSIS (FIRST 100 METERS)

	Revenue	Cost	Net Present Value
1979	0	$ 391,400	$- 391,400
1980	~~581,000~~	23,000	507,270
1981	581,000	24,840	459,635
1982	581,000	26,330	417,045
1983	581,000	- 27,910	378,830
1984	581,000	29,585	342,495
1985	581,000	31,360	310,530
1986	581,000	33,240	280,900
1987	581,000	35,235	255,030
1988	581,000	37,350	230,360
1989	581,000	39,590	209,040
TOTAL NET PRESENT VALUE (FIRST 100 METERS)			$2,999,735

NET PRESENT VALUE ANALYSIS
(Second 100 Meters)

	Revenue	Cost	Net Present Value
1980	0	$ 423,000	$ - 423,000
1981	447,000 142,200	59,700	352,090
1982	447,000	63,285	317,120
1983	447,000	67,080	285,655
1984	447,000	71,105	257,465
1985	447,000	75,370	230,830
1986	447,000	79,895	207,405
1987	447,000	84,690	185,800
1988	447,000	89,770	166,930
1989	447,000	95,155	149,085
1990	447,000	100,865	133,645
TOTAL NET PRESENT VALUE (Second 100 Meters)			$ ~~1,863,025~~ $ 257.71

NET PRESENT VALUE ANALYSIS
(additional 50 meters)

	Revenue	Cost	Net Present Value
1981	0	$ 228,960	$ - 228,960
1982	22,000 44,500	13,180	8,020
1983	22,000	13,170	6,635
1984	22,000	14,810	5,405
1985	22,000	15,700	4,315
1986	22,000	16,640	3,330
1987	22,000	17,640	2,465
1988	22,000	18,695	1,695
1989	22,000	19,820	1,020
1990	22,000	21,005	420
1991	22,000	22,265	- 100
TOTAL NET PRESENT VALUE (additional 50 meters)			- 195,755

- 56,778

Same consideration

Analysis of the data indicates that inclusion of the first 200 meters in the large user metering program is cost effective yielding the BWSC a net present value revenue gain of ~~$4,862,760~~ 2,475,140 from 1979 to 1990; incorporating the additional 50 meters results in a present value loss of ~~$195,755~~ 36,778. Therefore, Staff recommends funds be allocated for only the first two hundred meters. The program costs will total $446,000 in 1980, ~~$84,540~~ 49,640 in 1981, and ~~$89,615~~ 53,540 in 1982. Only program costs allocated in 1980 will be included in the capital budget; meter testing and maintenance costs in 1981 and 1982 will be financed through the operating budget.

It should be emphasized that the analysis is based on current water/sewer rates, interest rates, inflation factors, and cost information. As a result, budget considerations may change as these variables are subject to variations.

II. 5a. Public Metering: Program Description

Prior to the formation of the BWSC, the City of Boston was not charged for water and sewer use. Legislation which created the BWSC mandates that the City be included in the customer billing base. This mandate, therefore, requires the metering of City of Boston property.

It is estimated that the City of Boston uses approximately 4.36 million gallons daily, about 5 percent of total water billed in the BWSC system, representing approximately $2.4 million annually based on current rates.

In order to accurately bill the City of Boston, the BWSC is undertaking a program of public building metering.

BWSC staff is presently carrying out the program based on information from the City of Boston Assessor's Department. So far in 1979, 65% of the schools, 71% of the police stations, and 76% of the fire stations have had meters either installed or examined.

Facility lists from individual departments are also forthcoming. The School, Fire, Police, Parks and Playground, and Health and Hospitals Departments have already responded to BWSC requests and have provided or agreed to cooperate with BWSC Staff in the Public Metering Program.

Information is also being requested from county, state, and federal agencies on locations of respective facilities.

Getting accurate lists are only one facet of the problem. Some City property such as City Hospital contain many buildings with numbers and locations of service connections not on record. Certain structural connections remain unmetered and will be completed in 1980.

With the information obtained thus far, BWSC Staff estimates that 300 service connections remain unmetered and will be completed in 1980.

II. 5b. Public Building Metering Program: Program Costs

Due to the diverse sizes and problems of the facilities to be metered, the cost of this program is very difficult to calculate. The cost of meter installation varies from $4000 per installation (1) for a large user to $68.00 per installation (2) for a small user. Based on the 1978 Public Metering Program, it is estimated that the average cost per installation of a public meter is approximately $220. This figure includes materials, supplies, and meter costs.

Installation of 300 meters @ $220 =	$66,000
Necessary distribution system changes (3)	$10,000
TOTAL	$76,000

(1) C. E. Maguire cost estimate of installation for large user including engineering, design and supervision costs.

(2) Staff cost estimate of installation for 5/8" meter:

Purchase	$33.50
Installation	$34.50
TOTAL	$68.00

(3) As some public buildings currently have many water inlets, it will be necessary to redesign parts of the distribution system to reduce the number of water inlets entering certain buildings.

II. 5.c Public Metering: Program Benefits

At the present time, the City is being billed on the basis of an estimated consumption of 4.36 million gallons/day. Staff feels that the City of Boston should be billed on a metered basis, and this program is designed to accomplish this goal. The detailed breakdown of consumption should permit the City to engage in programs of water conservation where it is appropriate.

II. 6.a Relaying/Relining: Program Description & Benefits

The primary purpose of the relaying and relining program is to ensure a continued adequate supply of high quality water, at adequate pressure, for customer use and for fire protection. Specifically, the program is expected to:

- Reduce the occurence of main breaks and the resulting inconvenience and cost. Although no precise data for the Commission's system is available, in New York City, where such pipes constitute 14 percent of the system, approximately 31 percent of the water main breaks occur in pipes over 100 years old.
- Decrease current and potential water leakage, thereby reducing the amount of water which must be purchased from the MDC to meet the needs of the Commission's customers. The exact effect on water purchases could not be estimated.
- Increase the carrying capacity of rehabilitated mains, thereby increasing potential flow rates and reducing problems of localized low pressures.
- Reduce "red water" conditions associated with mains suffering from encrustation.
- Reduce long-run maintenance costs.

Much of the distribution system piping transferred to the Commission from the City is old, unlined cast-iron piping: an estimated 20 percent (212 miles) of the distribution system was built prior to 1900. Because of the problems associated with this piping the Commission has established a goal for the year 2000 of having no water mains which have been left unrehabilitated (not relined of replaced) for over 100 years.

To meet this goal, the Commission has projected that some 53,500 feet of pipe (approximately one percent of the total system) must be relayed or relined (cleaned and cement lined) each year. To date for 1979, the Commission currently has approved plans for some 41,000 linear feet of relaying relining work.

In order to conduct this program efficiently, the Commission has developed a list of system priorities based on: maintenance records, age records, loss-of-head tests, fire flow tests, incidents of breaks and leaks, and the construction work of other agencies. Commission policy is, to the extent possible, to tie the relaying/relining of water mains to other work requiring street construction: urban development, housing development, subway, and roadway construction. Coordination of projects with other agencies helps to minimize costs and reduce traffic flow disruption and general public nuisance. An initial priority list for 1980 has been developed and will be revised as new problems occur or additional construction information from other agencies become available.

II. 6b Relaying/Relining: Program Costs

COST PER LINEAR FOOT

	1980	1981	1982
Relaying (including paving charge)	$100	$110	$120
Relaying (excluding paving charge)	$ 70	$ 77	$ 85
Cleaning and Cement Reling	$ 50	$ 55	$ 60

PROPOSED LINFAR FEET OF PIPE

Relaying	51,191	51,311	51,310
Cleaning & Cement Relining	14,870	17,655	17,655
	66,061	68,966	68,965

TOTAL ESTIMATED COST OF CONSTRUCTION & PAVING

Relaying	$3,737,400	$4,617,965	$5,131,000
Cleaning & Cement Lining	$ 743,500	$ 971,025	$1,059,300
	$4,480,900	$5,588,990	$6,190,300

Engineering, Design, and Research
(Relaying @ 5.5%, relining @ 2.75%
of Construction and Paving Costs)

	1980	1981	1982
Relaying	$205,557	$253,988	$282,205
Cleaning and Cement Lining	20,446	26,703	29,131
	$226,003	$280,691	$311,336

TOTAL ESTIMATED COSTS

	1980	1981	1982
Relaying	$3,942,957	$4,871,953	$5,413,205
Cleaning and Cement Lining	763,946	997,728	1,088,431
	$4,706,903	$5,869,681	$6,501,636

II. 6c. Relaying/Relining: Program Detail

1980

(i) CLEANING AND CEMENT RELINING

Beachview Rd.	East Boston	Drumlin to Orient Ave.	1350 ft
Crestway St.	East Boston	Faywood to Waldemar Ave.	500 ft
Drumlin Rd.	East Boston	Orient Ave. to Beachview Rd.	330 ft
Faywood Ave.	East Boston	Montmorenci Ave. to Orient Ave.	3600 ft
Montmorenci Ave.	East Boston	Faywood Ave. to Drumlin Rd.	980 ft
Orient Ave.	East Boston	Faywood Ave. to Walley St.	3000 ft
SeaView Ave.	East Boston	Drumlin Rd. to Orient Ave	730 ft
Selma St.	East Boston	Galdstone St. to Orient Ave.	350 ft
Vallar Rd.	East Boston	Faywood Ave. to END	1130 ft
Waldemar Ave.	East Boston	Wally St. to END	2900 ft
		TOTAL	14870 ft

II 6c. Relaying/Relining Program: Program Detail

1980

(ii) RELAYING

Adams St.	Dorchester	Dorchester Ave. to Richmond St.	2150 ft
Albion Pl.	Charlestown	Main St. to END	280 ft
Allen St.	Hyde Park	Hyde Park Ave. to Winter St.	200 ft
Armory St.	Charlestown	Main St. to END	310 ft
Baldwin Pl.	Brighton	Washington St. to END	226 ft
Baldwin St.	Charlestown	Main St. to Bunker Hill St.	640 ft
Bayswater St.	East Boston	Barnes St. to Shawsheen St.	963 ft
Beech Glen St.	Roxbury	Fort Ave. to Highland St.	1142 ft
Beechland St.	West Roxbur	Washington St. to Beram St.	100 ft
Buswell St.	Roxbury	Park Drive to St. Mary's St.	940 ft
Canal St.	City Proper	Causeway St. to Market St.	390 ft
Cedar St.	Roxbury	Washington St. to Centre St.	2270 ft
Cedar Lane Way	City Proper	Chestnut St. to Pinkney St.	660 ft
Chestnut St.	Charlestown	Monument Sq. to Lowney Way	415 ft
Common St.	Charlestown	Winthrop St. to Adams St.	180 ft
Commonwealth Ave.	Brighton	Brighton Ave. to Boulevard Terr.	1035 ft
Concord St.	Charlestown	Monument Sq. to Bunker Hill St.	430 ft
Cooper St.	City Proper	N. Washington St. to Salem St.	670 ft

Dracut St.	Dorchester	Dorchester Ave. to Bruce St.	1220 ft
Dudley St.	Roxbury	Warren St. to Mt. Pleasant St.	2650 ft
Ellwood St.	Charlestown	Putnam St. to END	270 ft
Esmond St.	Dorchester	Blue Hill Ave. to Harvard St.	1370 ft
Euclid St.	Dorchester	Withington St. to Washington St.	460 ft
Fairfax St.	Dorchester	Beaumont St. to Westmoreland Ct.	240 ft
Fenwood Rd.	Roxbury	Huntington Ave. to Brookline Ave.	1500 ft
Fiske Terr.	Brighton	Brainerd Rd. to Brookline Line	180 ft
Fort Ave.	Roxbury	Highland St. to Centre St.	1100 ft
Fort Ave. Terr.	Roxbury	Fort Ave. to Glenn St.	240 ft
Gates St.	South Boston	East 8th St. to Dorchester St.	1060 ft
Gold St.	South Boston	Dorchester St. to F. St.	530 ft
Gustin St.	South Boston	Old Colony Ave. to END	150 ft
Harrison Ave.	Roxbury	Eustis St. to Crosstown St.	600 ft
Hemman St.	Roxbury	Highfield St. to Kittredge	650 ft
Homestead St.	Roxbury	Humbolt Ave. to Walnut Ave.	1290 ft
Hutchings St.	Roxbury	Humbolt Ave. to Harold St.	290 ft
Intervale St.	Roxbury	Warren Ave. to Blue Hill Ave.	650 ft
Kelley Ct.	Brighton	Western Ave., Southerly	280 ft
Knowlton St.	South Boston	Telegraph St. to East 8th St.	350 ft

RELAYING (Cont.)

Lawrence St.	Charlestown	Austin to Union	320 ft
LaFayette St.	City Proper	Endicott St. to Prince St.	150 ft
Lynn St.	City Proper	Cooper to Thatcher	320 ft
Lyon St.	Dorchester	Dorchester Ave. toAdams St.	700 ft
Marcella St.	Roxbury	Washington St. to Centre St.	2350 ft
Monument Ct.	Charlestown	Winthrop St. to Dead End	120 ft
Mt. Vernon Ave.	Charlestown	Chestnut St. to Mt. Vernon St.,	150 ft
Mt. Vernon St.	Charlestown	Adams St. to END	660 ft
New Dudley St.	Roxbury	Washington St. to Roxbury St.	1600 ft
Northampton St.	Roxbury	Tremont to Washington	1420 ft
North Margin St.	City Proper	Wiget to Thatcher	800 ft
Oak St.	Charlestown	Main St. to Russell St.	450 ft
Old Harbor St.	South Boston	Columbia Rd. to Dorchester St.	520 ft
Park St.	Charlestown	Henley St. to City Square	380 ft
Parker St.	Roxbury	Tremont St. to Huntington Ave.	3300 ft
Pilgrim Rd.	Roxbury	Longwood Ave. to Francis St.	280 ft
Prescott St.	Charlestown	Devens St. to Washington St.	400 ft
Putnam St.	Charlestown	Common St. to Henley St.	270 ft
Reedsdale St.	Brighton	Brighton Ave. to Linden St.	490 ft

Rockledge St.	Roxbury	Lambert Ave. to Thornton St.	430 ft
St. Botolph St.	Roxbury	Harcourt St. to Garrison St.	300 ft
St. Andrew Rd.	East Boston	Bayswater St. to Shawsheen St.	780 ft
Seminary St.	Charlestown	Lawrence St. to Austing St.	160 ft
State St.	City Proper	Commercial St. to Atlantic Ave.	560 ft
Stillman St.	City Proper	North Washington to Salem	500 ft
Thatcher St.	City Proper	N. Washington St. to Prince	620 ft
Torrey St.	Dorchester	Washington St. to Wentworth St.	1060 ft
Warren St.	Charlestown	Thompson Sq. to Henley St.	1160 ft
Wales St.	Dorchester	Harvary St. to Talbot Ave.	300 ft
Waverley St.	Roxbury	Warren Ave. to Blue Hill Ave.	750 ft
Weldon St.	Roxbury	Holborn St. to Quincy St.	370 ft
West 6th St.	South Boston	Dorchester Ave. to Dorchester St.	730 ft
White St.	East Boston	Meridian St. to Trentor St.	210 ft
Wiget St.	City Proper	N. Margin St. to Salem St.	280 ft
Winslow St.	Roxbury	Dudley St. to Ziegler St.	220 ft
			51191 ft

II 7a. Other Programs: Program Description

Frequently, major construction activities undertaken by other agencies provide the Commission with an opportunity to undertake minor capital projects at significantly reduced costs. These economies arise through the reduction of overhead items such as paving costs, design costs and inspection costs.

II 7b. Other Programs: Program Costs

1980 - $500,000.

1981 - $540,000

1982 - $583,200

II 7c. Other Programs: Program Benefits

As previously mentioned, Staff feels that with these funds the BWSC will be able to take advantage of other agencies' grants and projects to significantly reduce costs.

II 8a. New M.D.C. Metered Connection: Program Description

The Engineering Department proposes the construction of a new MDC meter connection at the intersection of Washington St. and Old Morton St. in Dorchester. The installation of this 30-inch meter will increase the flexibility of the southern high service system by decreasing the dependency of the existing system on the MDC's twin 36-inch distribution lines at Morton St.

II 8b. New M.D.C. Metered Connection: Program Costs

1980 - $63,300
1981 - 0
1982 - 0

Note: Includes Engineering, Design, and Supervision Costs of 5.5% or $3,300.

II 8c. New M.D.C. Metered Connection: Program Benefits

As noted above, the connection will increase the flexibility of the Southern High Service and reduce our dependency on the existing MDC twin distribution lines at Morton Street.

II 9a. Pressure and Flow Monitoring: Program Description

The MDC will be undertaking a major rehabilitation of their metering system including the remote monitoring through telemetry of the 28 meters supplying water to the City of Boston. The Engineering Department recommends that the Commission set aside funds to allow the interconnector with the MDC's central monitoring board to monitor the pressures and flows through the Boston Meters.

II 9b. Pressure and Flow Monitoring: Program Costs

1980 - $40,000
1981 - 0
1982 - 0

II 9c. Pressure and Flow Monitoring: Program Benefits

The establishment of a monitoring system will enable the BWSC to collect pressure and flow data and to immediately evaluate same during emergency conditions, such as main breaks or major fires.

PROPOSED WATER CAPITAL IMPROVEMENT PROGRAM

	1980	1981	1982	3 Year Total
METERING				
Residential	$ 680,000	$ 735,000	$ 584,250	$ 1,999,250
Industrial	446,000	-	-	446,000
Public	76,000	-	-	76,000
Sub Total	$1,202,000	$ 735,000	$ 584,250	$ 2,521,250
DISTRIBUTION SYSTEM				
Relaying	$3,737,400	$4,617,965	$5,131,000	$13,486,365
Relining	743,500	971,025	1,059,300	2,773,825
Engineering, Design and Supervision	226,003	280,691	311,336	818,030
Sub Total	$4,706,903	$5,869,681	$6,501,636	$17,078,220
MISCELLANEOUS				
New MDC Meter Connection	$ 63,300	-	-	$ 63,300
Pressure and Flow Monitoring	40,000	-	-	40,000
Other Programs	500,000	540,000	583,200	1,623,200
Sub Total	$ 603,300	$ 540,000	$ 583,200	$1,726,500
TOTAL	$6,512,203	$7,144,681	$7,669,086	$21,325,970

NOTE: Engineering, Design and Supervision Costs have been removed from relaying and relining programs and exhibited as a separate line item.

	1980	1981	1982
Relaying @5.5%	205,557	253,988	282,205
Relining @2.75%	20,446	26,703	29,131
	$226,003	$280,691	$311,336

CHAPTER III

Proposed Capital Improvement Program for the Wastewater Collection System

1980-1982

The Capital Improvement Program for the Wastewater Collection System, presented here, defines the projects required to fulfill Staff's Proposed Capital Improvement Program for the system for 1980, 1981, and 1982.

A brief history and current assessment of the Boston sewerage system is provided along with an outline of program objectives.

Detailed program descriptions, costs, and benefits for each item in the proposed sewer capital improvement program follows along with a summary of costs for all programs.

III. 1.a History of the Boston Sewerage System

The City of Boston, from 1877 to 1884, constructed what is known as the Boston Main Drainage System, the principal component of the Boston Sewerage System. The system was designed to provide adequate capacity to carry the estimated dry weather flow of sanitary sewerage and a small allowance for storm water. Subsequent improvements to the system included the construction of several new intercepting sewers, sewer conduits and channels, and a pumping station at Union Park Street.

Today, the Boston Main Drainage System (BMDS) services approximately 10,800 acres (during dry weather) of the 20,500 acres representing the total sewered area of Boston. The major components of the BMDS are the Boston Main Interceptor, five branch interceptors, and outlet works. Together, these components transmit Boston's sanitary sewage and industrial wastes to the Metropolitan District Commission (MDC) Sewerage System for treatment. The total length of sewers and storm drains in the City of Boston is approximately 1,400 miles, including some 24 miles of intercepting sewer and approximately 7 miles of trunk sanitary sewers directly connected to the MDC Sewerage System.

III. 1.b Current Status of Collection System:

A substantial portion of the BMDS utilizes combined systems which carry both sanitary sewage and storm water through common sewers. The combined systems (which are prevalent in the older areas of the system network) are generally the sections requiring some degree of relief or

rehabilitation due to insufficient system capacity or the high degree of system deterioration. Staff feels that structural deterioration has accelerated due to the continued deferral of required system maintenance.

III. 2 - Wastewater Collection System: Program Objectives

The U.S. Environmental Protection Agency, through its National Pollutant Discharge Elimination System Permit program, exerts a major influence on the wastewater collection system CIP. Compliance with the EPA mandated planning efforts, improvements, and implementation schedules defined in the BWSC's Permit dated May 31, 1979 must be given top priority in planning system improvements. These EPA mandated projects represent an ambitious program which must be partially funded in the three-year CIP. In addition to the EPA mandated improvements, the three-year wastewater system CIP includes funds for other EPA funded additional projects which the Commission considers necessary to improve or maintain the collection system. This system improvements program includes contingency replacements, separation of combined sewers, reconstruction and rehabilitation, and increased system capacity projects.

The primary objectives of the proposed capital improvements program for the wastewater collection system are:

- To provide for the continued integrity of the system against major collapses and minor breaks and malfunctions.

- To minimize structural deterioration of the wastewater collection and drainage systems and provide relief capacity, whereever necessary.

- To coordinate required projects with anticipated local, state or federal capital improvement projects (e.g. EPA, Massachusetts Division of Water Pollution Control, Boston Redevelopment Authority, City of Boston Public Works Department, Massachusetts Department of Public Works, Office of State Planning and Development).

- To minimize long-term maintenance costs.

- To ensure the provision of sufficient system capacity for at a minimum, the design year 2020.

The programs and projects which comprise the wastewater system CIP are described below, along with their projected costs and benefits.

III. 3a. EPA Mandated Programs: Program Description

BWSC's NPDES Permit mandates several specific capital improvement construction projects and establishes an implementation schedule for each project. In addition the Permit requires submittal of Construction Grants Program applications for completion of a facilities plan and infiltration/inflow analysis for the entire service area. The permit also addresses the interaction of the BWSC and the MDC Combined Sewer Overflow Facilities Plan (MDC-CSO) study now being conducted.

EPA mandated construction projects include: (1) the construction of the MT. Vernon Street Sewer; (2) the replacement of the existing Boston Main Interceptor and East Side Interceptor, South Branch; (3) the replacement of the East Side Interceptor, North Branch, and (4) the construction of the Union Park Street Pump Station Overflow Treatment Project. A description of each of these projects follows.

- Mt. Vernon Street Sewer - This will be a major branch sewer which will receive sanitary and institutional flows now discharged to a portion of the existing Boston Main Interceptor in Mt. Vernon Street. The Mt. Vernon Street Sewer will extend westward from near Monticello Avenue in the Columbia Point Section about 3,140 feet to a connection with the MDC Columbus Park Connection at Kosciuszko Circle. The sewer will have diameters of 36 inches up-stream and 42 inches downstream.

- Boston Main Interceptor and East Side Interceptor, South Branch, Replacement. These two replacement projects are planned for construction under one contract. The Boston Main Interceptor Replacement will replace a large portion of the original Boston Main Interceptor. The 96-inch diameter interceptor replacement will extend 6,600 feet southeastward from its junction with the proposed North and South Branches of the East Side Interceptor Replacement, east of the John F. Fitzgerald Expressway, to a junction with the MDC Columbus Park Connection at the Columbus Park Headworks.

  The South Branch Replacement will replace the portion of the existing East Side Interceptor in Albany Street. This 72-inch and 84-inch replacement will extend northeastward from Massachusetts Avenue about 3,600 feet to a junction with the Boston Main Interceptor Replacement. The replacement project would include conduit connections from combined trunk sewers now connected to the existing East Side Interceptor, with regulators at each such connection and outlet conduits to the Roxbury Canal Conduit.

- East Side Interceptor Replacement, North Branch. This project will replace the northern portion of the existing East Side Interceptor. The northern portion of the replacement will be sized to accept stormwater overflows from the connected combined collection system. The capacity of this portion, when detention and appurtenant facilities are constructed in the future, will be adequate for run-off from the 1 - year design storm. (This is in accordance with EPA Region I directive issued in a letter to City of Boston Commissioner of Public Works dated September 22, 1976).

  At the downstream end of this combined conduit, a regional combined sewer regulator will be contructed. This regulator will connect to the suggested future detention facilities mentioned above and will outlet to Fort Point Channel or to a possible South Bay-Fort Point Channel Drainage Conduit. (Neither the detention facilities nor the drainage conduit are included as part of this replacement project).

- From the upstream combined conduit, the North Branch Replacement dry-weather flow connecting conduit will extend to the junction of the proposed Boston Main Interceptor and East-Side Interceptor, South Branch Replacements.

  The overall North Branch Replacement will extend about 8,500 feet from near High Street to the junction with the Boston Main Interceptor. Some 4,600 feet of this conduit will be located in the Fort Point Channel. The replacement project will include conduit connections from combined truck sewers now connected to the existing East Side Interceptor, with regulators at such connection and outlet connections to the Harbor, Fort Point Channel, or the Roxbury Canal Conduit.

- Union Park Street Pump Station Overflow Treatment Project. This project involves the construction of treatment facilities at the Union Park Street Pump Station put into operation in 1977. Included will be fine mesh screening, skimming, sampling, detention and chlorine contact tanks, and sludge collection and disposal to the East Side Interceptor Replacement, South Branch. The implementation of Phase II of the Union Park Street Project is of major importance because it will: provide the required chlorine contact time for bacteria destruction; separate and remove solids and organics from the effluent flowing to Boston Harbor; and handle inflows of floodwater from the sewers in the South End.

In addition to funds required for capital construction projects, consideration has been given to the funds needed to meet EPA mandated planning efforts including: (1) a Facilities Plan and infiltration/ inflow study for the entire service area, and (2) projects resultig from the MDC Combined Sewer Overflow Facilities Plan currently in progress. These planning projects are discussed below.

- Facilities Plan and Infiltration/Inflow (I/I) Study. The BWSC's NPDES permit requires the BWSC's to submit "a complete plan of study for facilities planning for the entire City (BWSC service area) needed to coordinate ongoing activities, update previous studies, and layout an orderly program for capital expenditures. The facilities plan shall include but not be limited to investigation of infiltration/inflow, as applicable for the entire sanitary/sanitary-stormwater drainage system." This service areawide Facilities Plan and I/I study is included in the wastewater system CIP in 1980 and 1981.

  In addition, federal and state agencies have required that an I/I analysis be conducted for the areas which are tributary to the interceptor replacements described above. Step II (design) grant applications are now being made for these facilities and the applicable I/I study is included in the application to be donewith the Step II design. This program will extend to early 1981.

- Coordination with the MDC Combined Sewer Overflow (MDC-CSO) Facilities Planning Study. The Commission's NPDES permit includes a suggestd schedule for review of and comment on the current MDC-CSO study. The impact of the MDC-CSO facilities plan on possible future capital improvements projects and the BWSC's CIP cannot be determined until completion of that report. The lead consultant for the CSO study Camp, Dresser and McKee reports that it is too early in the project to make any projections regarding the final recommended plan of study. The recommendations from the CSO study, when available, will be reviewed as part of the BWSC's facilities planning effort. The wastewater system CIP does not include funds for any projects which may be required as the result of the MDC-CSO study.

III. 3b. EPA Mandated Programs: Program Costs

Tables I through VII summarizes the projected costs for the EPA mandated projects and when these costs are expected to be incurred to meet the implementation schedule contained in the BWSC's NPDES permit. These tables show both the total project cost and the BWSC's estimated share of the total cost after taking into account expected federal and state funding. Projects included in the three-year CIP are: design (Step II) and construction (Step III) of the Mt. Vernon Street Sewer; design and initial phases of construction of the interceptor replacements; construction of the Union Park Street Pump Station Overflow Treatment Project, and the EPA mandated Facilities Planning and I/I analysis (Step I) efforts. Proposed funding of the interceptor replacements will extend past the end of the three-year CIP and will be completed in 1984. No costs for projects which may result from the MDC-CSO study are included.

The estimated project costs for the interceptor replacements and the Mt. Vernon Street Sewer have been developed from the costs report by CDM in its 1976 report to the City of Boston. The construction costs of each project, including an allowance for engineering, contingencies, and land taking, have been updated based on the projected Engineering News Record (ENR) Construction Cost Index at the anticipated midpoint of the funding period. An additional allowance equal to approximately five percent of the cost of consulting services (engineering, design, and construction inspection has been included to cover any expenses the BWSC may incur in providing support services on these projects. (It is anticipated that these costs will be participated in by the state and federal government.

The EPA mandated programs should be eligible for the 75 percent federal funding provided under the EPA construction grants program. This funding, which is paid as costs are incurred, was, therefore deducted in determining the BWSC's share of the total cost of these projects.

The total costs of the EPA mandated projects are also expected to be eligible for 15 percent state funding. The schedule for state reimbursement, however, does not coincide with when costs are incurred and cannot be deducted directly. The state will provide 25 percent of all eligible costs for Step II design of these projects making the combined federal and state fundings of Step II costs equal to 100 percent. However, the total state funding effort will be adjusted during payments made for Step III so that the total amount of state funds for each project will not exceed 15 percent of the total project cost. Therefore, the BWSC's share of Step II costs is shown as zero and the 15 percent state reimbursement of Step III costs has been reduced by an amount equal to 10 percent of Step II costs.

The state also provides 15 percent funding of Step I project costs. This reimbursement, however, is not paid until the facilities recommended in the Step I facilities plan are constructed. Therefore, no state funding is included in determining the BWSC's share of the facilities plan and I/I analysis. State reimbursement for 15 percent of these costs can, however, be expected when Step III is completed as noted above.

In conclusion, the three-year CIP and five-year CIP for EPA dated projects include a schedule of the capital funds needed by the BWSC to support these projects. The estimated cost of each project is based on the best information available. As more definite capital cost estimates are made available and the impact of MDC-CSO study becomes known, the CIP will be reviewed to evaluate the effect on the projected water and sewer rates.

TABLE I
EPA Mandated Programs
Mt. Vernon Street Sewer*

YEAR	PERCENT OF TOTAL FUNDING	Step II (Design) TOTAL	Step II (Design) BWSC	Step III (Construction) TOTAL	Step III (Construction) BWSC	Step II, Step III Total TOTAL	Step II, Step III Total BWSC
1980	2%	$ 67,000	-	$ 7,000	$ 1,000	$ 74,000	$1,000
1981	90%	-	-	4,389,000	449,000	4,389,000	449,000
1982	8%	-	-	398,000	41,000	398,000	41,000
Total 3-Year CIP	100%	$ 67,000	-	$4,794,000	$491,000	$4,861,000	$491,000

Note:

* BWSC share does not include any state reimbursement for Step I costs.

Table II
EPA Mandated Programs
Main Interceptor & East Side
Interceptor, South Branch, Replacement*

YEAR	PERCENT OF TOTAL FUNDING	Step II (Design) TOTAL	Step II (Design) BWSC	Step III (Construction) TOTAL	Step III (Construction) BWSC	Step II, Step III Total TOTAL	Step II, Step III Total BWSC
1980	1%	$ 299,000	-	-	-	$ 299,000	-
1981	4%	149,000	-	825,000	84,000	974,000	84,000
1982	35%	-	-	9,150,000	937,000	9,150,000	937,000
Total 3-Year CIP	40%	$ 448,000	-	$9,975,000	$1,021,000	$10,423,000	$1,021,000
1983	36%	-	-	9,150,000	937,000	9,150,000	937,000
1984	24%	-	-	6,100,000	624,000	6,100,000	624,000
GRAND TOTAL	100%	$ 448,000	-	$25,225,000	$2,582,000	$25,673,000	$2,582,000

Note:

* BWSC share does not include any state reimbursemrnt for Step I costs.

Table III
EPA Mandated Programs
East Side Interceptor
North Branch Replacement*

YEAR	PERCENT OF TOTAL FUNDING	Step II (Design) TOTAL	Step II (Design) BWSC	Step III (Construction) TOTAL	Step III (Construction) BWSC	Step II, Step III Total TOTAL	Step II, Step III Total BWSC
1980	1%	$623,000	-	-	-	$623,000	-
1981	4%	312,000	-	1,599,000	164,000	1,911,000	164,000
1982	35%	-	-	19,067,000	1,952,000	19,067,000	1,952,000
Total 3-Year CIP	40%	$935,000	-	$20,666,000	$2,116,000	$21,601,000	$2,116,000
1983	36%	-	-	19,066,000	1,952,000	19,066,000	1,952,000
1984	24%	-	-	12,711,000	1,301,000	12,711,000	1,301,000
GRAND TOTAL	100%	$935,000	-	$52,443,000	$5,369,000	$53,378,000	$5,369,000

Note:

* BWSC share does not include any state reimbursement for Step I funding.

Table IV
I/I Analysis for EPA
Mandated Projects*

YEAR	PERCENT OF TOTAL FUNDING	Step II (Design) TOTAL	BWSC
1980	92%	$433,000	$108,000
1981	8%	39,000	10,000
1982	-	-	-
Total 3-Year	100%	$472,000	$118,000

Note:

* Does not allow for 15 percent state funding in determining BWSC share. This funding is expected to be included in Step III funding at the time of construction.

Table V
EPA Mandated Programs
Facility, Plan & I/I Analysis
for Entire Service Area*

YEAR	PERCENT OF TOTAL FUNDING	Step I (Planning) TOTAL	BWSC
1980	35%	$1,838,000	$ 460,000
1981	65%	3,413,000	853,000
1982	-	-	-
Total 3-Year CIP	100%	$ 5,251,000	$1,313,000

Note:

* Does not allow for 15 percent state funding in determining BWSC share. This funding is expected to be included in Step III funding at the time of construction.

Table VI
EPA Mandated Programs
Union Park Street Pump
Station Overflow Treatment Project*

YEAR	PERCENT OF TOTAL FUNDING	Step III (Construction) TOTAL	BWSC
1980	45%	$3,066,000	$320,000
1981	45%	3,066,000	320,000
1982	10%	766,000	80,000
Total 3-Year CIP	100%	$6,898,000	$720,000

Note:

* Total program costs shown exclude any costs which the BWSC may incur as result of the current MDC-CSO Study.

Table VII
SUMMARY ALL EPA MANDATED PROGRAMS
PROGRAMS
(Values in $1000)

YEAR	Step I TOTAL	Step I BWSC	Step II TOTAL	Step II BWSC	Step III TOTAL	Step III BWSC	Total TOTAL	Total BWSC
1980	$4,271	$ 568	$ 989	0	$ 3,073	$ 321	$ 6,333	$ 889
1981	3,452	863	461	0	9,879	1,017	13,792	1,880
1982	0	0	0	0	29,381	3,010	29,381	3,010
Total 3-Year CIP	$5,723	$1,431	$1,450	0	$42,333	$4,348	$49,506	$5,779
1983	0	0	0	0	28,216	2,889	28,216	2,889
1984	0	0	0	0	18,811	1,925	18,811	1,925
Total 5-Year CIP	$5,723	$1,431	$1,450	0	$89,360	$9,162	$96,533	$10,593

III. 3c. EPA Mandated Programs: Program Benefits

The major impact of the EPA mandated capital improvements program will occur within the Boston Main Drainage District. Two of the existing major interceptors, the East Side and Boston Main Interceptors, are scheduled to be replaced by the end of fiscal year 1984. These replacements will provide new, structurally reliable conduits designed to handle estimated peak dry-weather flows through the year 2020. These replacements will allow the existing interceptors, which are known to be in poor structural condition, to be either abandoned or rehabilitated for some other use, as discussed previously. New regulator and tidegate structures will also be constructed as part of these projects. The structures will replace the existing structures and should ensure more dependable service.

An additional future benefit of the East Side Interceptor, North Branch Replacement will be the interception of a portion of the combined sewer overflow volumes now legally, by permit, discharged, untreated, to the Inner Harbor and Fort Point Channel. The intercepted combined wastewater overflow volumes up to the 1 year, 6 hour storm would be carried to the tentatively proposed treatment and disposal facilities by the large interceptor. (These treatment and disposal facilities are not included as part of the interceptor replacement project).

The construction of the Mt. Vernon Street Sewer will provide a separate sanitary sewer to intercept the existing local separate sanitary sewers from the existing Columbia Point Housing Development, the University of Massachusetts, the Kennedy Library, and the State Archives Building, as well as other future planned development along Mt. Vernon Street at Columbia Point. This will eliminate the unfavorable condition of reverse flow at an adverse slope which now exists at

that location. Sanitary sewage will be conducted directly to the MDC Columbus Park Connection and could no longer accumulate and become septic in the lower section of the Boston Main Interceptor in Mt. Vernon Street below Kosciuszko Circle. Currently, under storm flow conditions, these accumulated sanitary wastes are pumped at the Calf Pasture Pumping Station ahead of mixed storm and wastewater discharges to the harbor at Moon Island.

After the completion of a Mt. Vernon Street sewer, separate stormwater runoff would continue to be discharged to the lower portion of the BMI and require pumping at the Calf Pasture Pumping Station following rainstorms. Future planned construction by the BRA would relieve this condition by providing a separate storm drain in Mt. Vernon Street to complete the separation of sewerage works in the Columbia Point area. The continued use of the Calf Pasture Pumping Station would then be predicated only on the need for it as part of a stormwater overflow system.

The construction of the Union Park Street Pump Station Overflow Treatment Project will complete another part of the BRA South End Project. The treatment facility to be constructed will provide detention and partial treatment of the combined wastewater flows discharged to Fort Point Channel. This construction is part of the overall BRA renewal project now under way in the South End.

The facilities plan and infiltration/inflow analysis of the entire City (BWSC Service Area) will define a coordinated plan for the BWSC wastewater collection system and establish the I/I parameters to be used in design. The planning effort would also help integrate the 208 areawide

planning efforts of the MAPC, the MDC Eastern Massachusetts Metropolitan Area plan of study, the ongoing MDC facilities planning within the City of Boston, and the planning of other City and State agencies with the planning of the Commission.

The infiltration/inflow analysis of the limited areas to be served by the interceptor replacements and the MT. Vernon Street Sewer is also mandated by the EPA. This study will provide information on the level of infiltration/inflow in sewers to be connected to the new sewer and interceptor replacements. It is expected that the results of the study will be included in the I/I analysis for the entire service area and reduce the scope of that project.

III. 4a. Other EPA Funded Projects: Program Description

The BRA as part of its urban renewal program is carrying out a program of separation of combined systems in the South End for 1980 and 1981. The original combined systems were designed to accomodate storage during storms at high tide, with subsequent direct discharges to adjacent waters.

Extensive expenditures have been made already to provide local separation of the old combined systems in this very low area of the City. Most of these new sanitary sewers and storm drains still flow to elements of the old combined systems and during moderately heavy storms, contribute overflow to tidewater. Unless the intended program is continued, the work completed to date will have little impact in abating pollution.

All of these separation projects are being carried out in conjunction with the Boston Redevelopment Authority.

III. 4b. Other EPA Funded Projects: Program Costs

Below is a summary of BWSC project costs by contract category. The totals represent both the ten percent local share of eligible EPA project costs and ineligible project costs.

Contract Number	1980	1981	1982	Total 3-Year CIP
SD1,SD3*	$ 888,000	$ 370,000		$1,258,000
SD6	$ 437,040	$ 437,040	0	$ 874,080
SD-7	$ 320,700	$ 320,700	0	$ 641,400
SD-10	$ 509,100	$ 509,100	0	$1,018,200
SD-11	$ 417,600	$ 417,600	0	$ 835,200
TOTAL	$2,572,440	$2,054,440	0	$4,626,880

* This includes an additional $205,000 above the level of funding approved by the Commission in 1979.

III 4c. Other EPA Funded Projects: Program Benefits

The benefits of the separation of combined systems under the BRA urban renewal projects as stated under program description is pollution abatement during high tide and storm conditions. Also mentioned, was that benefits of pollution abatement projects already completed in the South End are contingent on completion of proposed work in the area for 1980, 1981, and 1982.

III 4d. Other EPA Funded Projects (Separation of Combined Systems): Program Detail

SD-1			
Clarendon St.	Roxbury	Chandler St. to Tremont St.	
Shawmut Ave.	Roxbury	Waltham St. to E. Berkeley St.	870 ft., S.S., 1000 ft S.S.
SD-3			
E. Berkeley	Roxbury	Albany St. to Tremont St.	3,390 ft. S.S., 2,780 ft. S.D.
SD-6			
Shawmut Ave.	Roxbury	West Concord St. to Union Park St.	
Rutland St.	Roxbury	Washington St. to Tremont St.	
W. Newton St.	Roxbury	Washington St. to Tremont St	
Pembroke St.	Roxbury	Shawmut Ave. to Tremont St.	3,260 ft., S.S., 4,460 ft. S.D.
SD-7			
Bristol St.	Roxbury	Harrison Ave. to Albany St.	
E. Brookline St.	Roxbury	James St. to Roxbury Canal Conduit	1,790 ft., S.S., 1,830 ft. S.D.
SD-10			
E. Newton St.	Roxbury	Washington St. to Harrison Ave.	
Msgr. Reynolds Way	Roxbury	Washington St. to Harrison Ave.	
E. Concord St.	Roxbury	Washington St. to Harrison Ave.	
James St.	Roxbury	E. Concord St. to E. Brookline St.	
Alley 710	Roxbury	E. Brookline St. to E. Newton St.	
Washington St.	Roxbury	E. Concord St. to Msgr. Reynolds Way	5,200 ft., S.S., 4,250 ft. S.D.
SD-11			
Worcester Sq.	Roxbury	Harrison Ave. to Washington St.	
Alley 719	Roxbury	Harrison Ave. to Alley 718	
E. Springfield	Roxbury	Harrison Ave. to Washington St.	
Alley 716	Roxbury	Harrison Ave. to Alley 715	
Washington St.	Roxbury	Mass. Ave. to E. Concord St.	2,580 ft. S.S., 3,460 ft. S.D.

$417,600

III. 5a. System Improvements: Program Description

The system improvements program represents a large portion of the overall CIP for the wastewater system. Included in this program are the following elements:

- Contingency Replacement: Replacement in-kind of existing sewer system components exhibiting an immediate maintenance problem, usually following breakdown and emergency repairs.
- Separation of Combined Systems: Construction of new sewer lines so that sanitary sewage and stormwater will be carried through separate sewers. The various construction locations will be primarily dictated by the current year City and State street reconstruction programs.
- Reconstruction and Rehabilitation: Replacement in-kind of existing sewer system components (exclusive of separation of combined systems) that have maintenance problems and whose correction, for whatever reason, has been deferred.
- Increased System Capacity: Replacement or addition of sewer system components to provide additional capacity in areas where current system is not adequate to meet existing or projected demands.
- Other Programs: Similar to category under Water CIP where major construction activities undertaken by other agencies provides the BWSC with an opportunity to undertake minor capital projects at reduced costs.

Expenditure levels for each program element for the three-year CIP were established by the BWSC based on a survey of existing system needs. Each year, the BWSC develops a priority listing of projects for which system improvements funds should be used. These priority lists will be developed taking into consideration: the facilities needs established in the upcoming service area-wide facilities plan; funding requests and construction projects of other agencies; and known system maintenance problems.

III 5b. System Improvements: Program Costs

The estimated costs of each element of the system improvements program for 1980, 1981, and 1982 are shown on Table VIII below:

Table VIII

SYSTEM IMPROVEMENTS PROGRAM

(Values in $1000)

Program Element	1980	1981	1982	Total 3-Year CIP
Contingency Replacement	$ 780	$1,040	$1,300	$3,120
Separation of Combined Systems	1,561	2,080	2,600	6,241
Reconstruction & Rehabilitation	300	400	500	1,200
Increased System Capacity	360	480	600	1,440
Engineering, Design and Supervision	300	400	500	1,220
Other Programs	100	108	117	325
TOTAL	$3,401	$4,508	$5,617	$13,526

Note:

- Estimates for 1980 through 1982 provided by staff.
- Engineering, Design, and Supervision Costs represent 10% of System Improvements costs excluding Other Program Costs.

III. 5c. System Improvements: Program Benefits

The purpose of the system improvements program is to allow the continued upgrading of the wastewater system, not just in the BMDD, but elsewhere throughout the City. The expected benefits of the four elements of the system improvements program are as follows:

- Contingency Replacement. The primary benefit of this element would be the Commission's ability to respond to emergency situations in an efficient manner which would minimize temporary inconvenience to Commission customers and preclude further deterioration of the system.

- Separation of Combined Systems. The primary advantage to providing separate sewer lines for sanitary sewage and combined sewer overflows during heavy storm flows is the long-term reduction of treatment costs due to more manageable sewage flows.

- Reconstruction and Rehabilitation. By addressing known problems, further deterioration of the system is prevented. Continued deferral of such problems may also result in substantially higher construction costs at a later date.

- Increased Capacity. This program element will eliminate existing capacity shortages and help avert future ones. This not only will enable the Commission to maintain adequate service but will also prevent increased wear and tear on system components.

- Other Programs. Described under program description.

III 5d. Systems Improvement: Program Detail

(i) Contingency Replacement Projects.

B Street Overflow	So. Boston	Dorchester Ave. to Roxbury Canal Conduit	370 ft
Parker St.	Roxbury	Huntington Ave. to Field St.	208 ft
Rehabilitation of Fens Gate House No. 1	Roxbury		
			578 ft

(ii) Separation of Combined System

Adams St.	Charlestown	Winthrop St. to Common St.	230 ft
Adams St.	Charlestown	Chestnut St. to Mt. Vernon St.	180 ft
Albion Pl.	Charlestown	Main St. to END	305 ft
Armory St.	Charlestown	Main St. to END	265 ft
Auburn St.	Charlestown	Russel to Bunker Hill St.	180 ft
Baldwin St.	Charlestown	Rutherford Ave. to Bunker Hill St.	480 ft
Chestnut St.	Charlestown	Adams St. to Lowney Way	110 ft
Chestnut St.	Charlestown	Monument Sq. to Mt. Vernon Ave.	110 ft
Cobden St.	Roxbury	Washington St. to Walnut Ave.	Connection
Common St.	Charlestown	Winthrop St. to Park St.	110 ft
Devens St.	Charlestown	Main St. to Old Rutherford Ave.	295 ft
Ellwood St.	Charlestown	Putnam St. to END	190 ft
Fairmount St.	Hyde Park	Summit St. to Leseur Rd.	315 ft
Ferrin St.	Charlestown	Lowney Way to END	100 ft
Fort Ave.	Roxbury	Centre to BeechGlen St.	660 ft
Frankfort St.	East Boston	Neptune Rd. to Swift St.	700 ft
Homestead St.	Roxbury	Humbolt to Walnut Ave.	Connection
Hutchings St.	Roxbury	Humbolt to Harold St.	Connection
Lawrence St.	Charlestown	Austin To Union St.	265 ft
Main St.	Charlestown	Donstable 150 ft east	150 ft
Main St.	Charlestown	Alene Ct. to Devens St.	80 ft
Main St.	Charlestown	Henley St. to Park St.	180 ft
Mt. Vernon Ave.	Charlestown	Chestnut to 35 ft east	35 ft
New Dudley St.	Roxbury	Roxbury St. to Washington St.	800 ft
New Dudley St.	Roxbury	Dudley St. to Bartletts	800 ft
Old Rutherford Ave.	Charlestown	Union St. to New Rutherford Ave.	765 ft
Prescott St.	Charlestown	Washington St. to Main St.	325 ft
Prospect St.	Charlestown	Lowney Way to Tremont St.	620 ft

III 5d. PROGRAM DETAIL (Continued)

Rockwell St.	Dorchester	Through private land	340 ft
Stockton St.	Dorchester	Through private land	340 ft
Townsend St.	Roxbury	Walnut Ave. to Washington St.	
Walnut Ave.	Roxbury	Crawford St. to Seaver St.	
Washington St.	Charlestown	Harvard St. to Old Rutherford Ave.	765 ft
			9695 ft

(iii) Reconstruction & Rehabilitation

Lafayette Ave.	City Proper	Endicott St. to Prince St.	135 ft
Cedar Lane Way	City Proper	Mt. Vernon St. to Pinckney St.	365 ft
Willow Terrace	W. Roxbury	From Willow St.	125 ft
Weldon St.	Roxbury	Holber to Quincy	130 ft
			755 ft

(iv) Increased System Capacity

Fort Norfolk Pumping Station	Dorchester

PROPOSED SEWER CAPITAL IMPROVEMENT PROGRAM

SUMMARY TABLE

	1980	1981	1982	Total 3-Year CIP
EPA MANDATE				
Mt. Vernon St. Sewer	$ 1,000	$ 449,000	$ 41,000	$ 491,000
Main Interceptor	-	$ 84,000	$ 937,000	$1,021,000
East Side Interceptor	-	$ 164,000	$1,952,000	$2,116,000
I/I Analysis	$ 108,000	$ 10,000	-	$ 118,000
Facility Plan	$ 460,000	$ 853,000	-	$1,313,000
Union Park	$ 320,000	$ 320,000	$ 80,000	$ 720,000
Sub Total	$ 889,000	$1,880,000	$3,010,000	$5,779,000
Other EPA Programs				
SD-1, SD-3	$ 888,000	$ 370,000	-	$1,258,000
SD-6	$ 437,040	$ 437,040	-	$ 874,080
SD-7	$ 320,700	$ 320,700	-	$ 641,400
SD-10	$ 509,100	$ 509,100	-	$1,018,200
SD-11	$ 417,600	$ 417,600	-	$ 835,200
Sub total	$2,572,440	$2,054,440	-	$4,626,880
System Improvements				
Contingency Replacement	$ 780,000	$1,040,000	$1,300,000	$3,120,000
Separation of Combined Systems	$1,561,000	$2,080,000	$2,600,000	$6,241,000
Reconstruction/Rehabilitation	$ 300,000	$ 400,000	$ 500,000	$1,200,000
Increased System Capacity	$ 360,000	$ 480,000	$ 600,000	$1,440,000
Engineering, design and Supervision	$ 300,000	$ 400,000	$ 500,000	$1,200,000
Other Programs	$ 100,000	$ 108,000	$ 117,000	$ 325,000
Sub Total	$3,401,000	$4,508,000	$5,617,000	$13,526,000
TOTAL	$6,862,440	$8,442,440	$8,627 000	$23,931,880

CHAPTER IV

Proposed Capital Improvement Program
Summary Costs, Financing Options
and Impact on Rates

1980-1982

In general, the Commission can finance capital improvements through one or more of the following sources of funds:

1. Funds from current operating revenues.
2. Funds from capital reserves.
3. Funds from Federal and State grants-in-aid programs.
4. Funds from the proceeds of bond sales.

Each of these financing options will be available to varying degrees to finance the Commissions's proposed capital improvement program. The Staff's view is that in the long run, the Commission should select a mix of financing options and a capital structure that reduces its cost of capital, and assures safe and adequate services to its customers at reasonable rates.

The capital improvement program includes two primary types of investments: (1) extensions and improvements and (2) renewals and replacements. Following is a breakdown of the water and sewer programs into these two classifications:

	RENEWALS AND REPLACEMENTS			EXTENSIONS AND IMPROVEMENTS		
	WATER	SEWER	TOTAL	WATER	SEWER	TOTAL
		(000's)			(000's)	
1980	$6,066	$1,481	$7,547	$446	$5,382	$5,828
1981	$6,866	$1,948	$8,814	$279	$6,494	$6,773
1982	$7,601	$2,417	$10,018	$ 68	$6,210	$6,278

Extensions and improvements are capital projects that will improve the quality of service, add to the types of services provided, and/or increase the quantity of service the Commission provides. The costs of the extensions and improvements detailed in this CIP are projected to be financed by issuing bonds. This is in accordance with the Commission's policy, which was adopted in January of 1979, relating to the funding of various types of capital expenditures.

The enabling legislation requires the Commission to determine rates in a manner sufficient to recover all costs. Thus, the costs of financing capital, as well as all other costs, must be recovered from rate revenues. The proposed Capital Improvement Program for 1980, and the related costs, will be included in the proposed 1980 rate schedule. These costs are estimated to be approximately $8 million, including $7.5 million for renewal and replacement projects and $500,000 for debt service costs.

SUMMA
PROPOSED WATER AND SEWER
CAPITAL IMPROVEMENT

	1980	1981	1982	Total 3-Year CIP
WATER				
Metering	$ 1,202,000	$ 735,000	$ 584,250	$ 2,521,250
Distribution System	4,480,900	5,588,990	6,190,300	16,260,190
Engineering, Design and Supervision	226,003	280,691	311,336	818,030
Miscellaneous	603,300	540,000	583,200	1,726,500
SUBTOTAL	$ 6,512,203	$ 7,144,681	$ 7,669,086	$21,325,970
SEWER				
EPA Mandate (BWSC Share)	$ 889,000	$ 1,880,000	$ 3,010,000	$ 5,779,000
Other EPA Programs (BWSC Share)	2,572,440	2,054,440	0	4,626,880
Systems Improvements	3,101,000	4,108,000	5,117,000	12,326,000
Engineering, Design and Supervision	300,000	400,000	500,000	1,200,000
SUBTOTAL	$ 6,862,440	$ 8,442,440	$ 8,627,000	$23,931,880
GRAND TOTAL	$13,374,643	$15,587,121	$16,296,086	$45,257,850