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WASTEWATER ENGINEERING AND MANAGEMENT PLAN

FOR

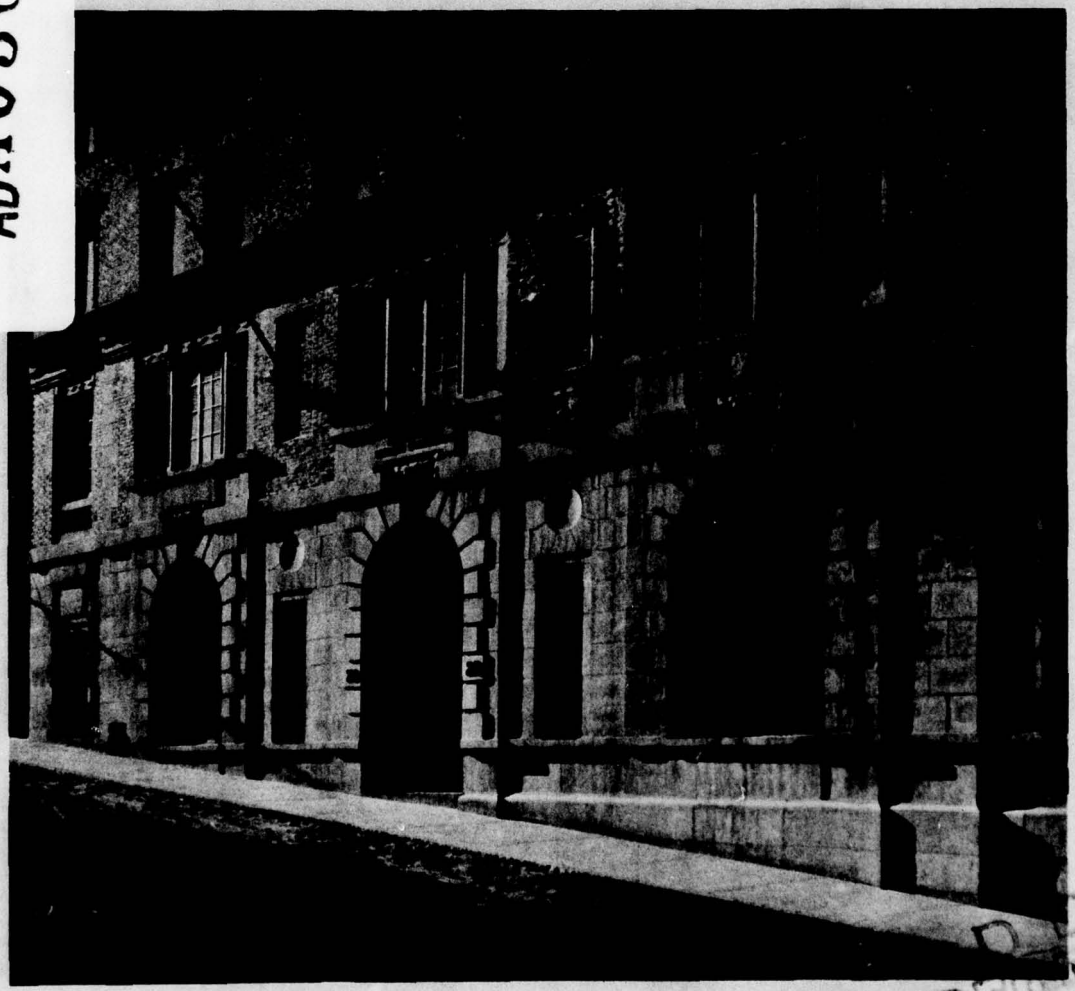
BOSTON HARBOR - EASTERN MASSACHUSETTS METROPOLITAN AREA

EMMA STUDY

TECHNICAL DATA VOL. 12
FINANCING AND MANAGEMENT

PART 2

AD A036807



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INDEX TO EMMA STUDY REPORTS

BROCHURE

SUMMARY REPORT

MAIN REPORT

TECHNICAL DATA VOLUMES

1	PLANNING CRITERIA
2	ENGINEERING CRITERIA
3	INDUSTRIAL PROCESS WASTEWATER ANALYSIS AND REGULATION
3A	STUDY OF CERTAIN INDUSTRIAL WASTES
3B	STUDY OF WASTES FROM LARGE INDUSTRIES
4	WATER ORIENTED WASTEWATER UTILIZATION CONCEPTS
5	LAND ORIENTED WASTEWATER UTILIZATION CONCEPT
6	FORMULATION OF WASTEWATER UTILIZATION PLAN
7	COMBINED SEWER OVERFLOW REGULATION
8	URBAN STORMWATER MANAGEMENT
8A	APPENDIX TO URBAN STORMWATER MANAGEMENT
9	MDC INTERCEPTOR AND PUMPING STATION ANALYSIS AND IMPROVEMENTS
10	DEER ISLAND WASTEWATER TREATMENT PLANT ANALYSIS AND IMPROVEMENTS
11	NUT ISLAND WASTEWATER TREATMENT PLANT ANALYSIS AND IMPROVEMENTS
12	FINANCING AND MANAGEMENT
13	IMPACT ANALYSIS AND EVALUATION
13A	BIOLOGICAL IMPACT ANALYSIS
13B	SOCIO-ECONOMIC IMPACT ANALYSIS
13C	HYGIENIC IMPACT ANALYSIS
13D	VISUAL, CULTURAL AND DESIGN IMPACT ANALYSIS
14	PUBLIC INVOLVEMENT
15	RECOMMENDED PLAN AND IMPLEMENTATION PROGRAM
16	AGENCY REVIEWS

COVER PHOTO

The cover photograph in this Technical Data Volume depicts the Metropolitan District Commission headquarters at 20 Somerset Street, Boston, Massachusetts 02108.

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WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR – EASTERN MASSACHUSETTS METROPOLITAN AREA EMMA STUDY

TECHNICAL DATA [redacted] Volume 12.
PART 2
FINANCING AND MANAGEMENT

FOR THE

METROPOLITAN DISTRICT COMMISSION

COMMONWEALTH OF MASSACHUSETTS

BY

PEAT, MARWICK, MITCHELL & CO.

ACCESSION for
NTIS White Section
DDC Buff Section
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TABLE OF CONTENTS

PART 2

CHAPTER V		Page
	INTRODUCTION	V-1
A.	COST ELEMENTS	V-4
B.	APPORTIONMENT OF COSTS ACCORDING TO USE, NEED, AND BENEFIT	V-8
	. Use Analysis	V-8
	. Need Analysis	V-12
	. Benefit Analysis	V-15
C.	METHODS OF SUB-APPORTIONING COSTS AMONG COMMUNITIES	V-22
	. Flow Measurement	V-23
	. Water Consumption	V-24
	. Population and Population Equivalent Units	V-25
	. Residential Units and Residential Equivalent Units	V-26
	. Water Production	V-28
	. Area	V-29
	. Property Value	V-29
D.	ALLOCATION AND DISTRIBUTION OF COSTS AMONG CLASSES WITHIN COMMUNITIES	V-31
	. Allocation	V-32
	. Service Charges	V-34
	. Billing Mechanisms	V-39
E.	FRAMEWORK FOR EVALUATING ALTERNATIVE APPORTIONMENT, ALLOCATION, AND DISTRIBUTION CONCEPTS	V-41
F.	ANALYSIS AND RECOMMENDED ALTERNATIVES	V-49
	. Cost Analysis	V-50
	. Apportionment	V-54
	. Sub-Apportionment	V-59
	. Allocation	V-65
	. Distribution	V-67
	. Billing	V-69
G.	INDUSTRIAL COST RECOVERY	V-70

TABLE OF CONTENTS (CONTINUED)

PART 2

	Page
CHAPTER VI	
A. INTRODUCTION	VI-1
B. RECOMMENDED STRUCTURE MODIFIED METROPOLITAN DISTRICT COMMISSION	VI-3
. Summary of Key Points	VI-3
. Policy Framework	VI-6
. Management and Administration	VI-8
. Functional Characteristics	VI-12
C. IMPLEMENTATION PLAN: LEGISLATIVE PROGRAM	VI-35
CHAPTER VII	
INTRODUCTION	VII-1
A. PROPOSED COST APPORTIONMENT AND ALLOCATION METHOD	VII-2
B. COST APPORTIONMENT AND ALLOCATION STUDY	VII-12
C. HIGHLIGHT OF THE APPORTIONMENT AND ALLOCATION STUDY	VII-36
D. FINANCIAL CONSIDERATIONS	VII-40
E. SUMMARY OF MAJOR DATA SOURCES, LIMITATIONS AND STUDY ASSUMPTIONS	VII-43

APPENDICES

APPENDIX I-1	
Detailed Profiles of 12 Metropolitan Service Agencies	A-1
APPENDIX II-1	
Other Agencies Programs, and Policies Affecting Wastewater Management	A-104

TABLE OF CONTENTS (CONTINUED)

PART 2

APPENDICES (Continued)

APPENDIX V-1

Description of Section 204(b) (1) (Public Law 92-500) A-110

APPENDIX V-2

Description of Section 204(b) (1) (B) (Public Law 92-500) A-111

APPENDIX V-3

Alternative Methods for Acquiring Existing Facilities A-112

APPENDIX VII-1

Assumptions Related to the Cost Allocation Method and Capital Requirement and Debt Service Costs A-115

APPENDIX VII-2

Cost of Wastewater Management Projects to Participating Communities for Selected Years A-119

INDEX OF EXHIBITS

PART 2

	Number	Page
Approach and Methodology for Dividing Costs and Determining Service Charges	V-1	V-3
Secondary Treatment Plant: Hypothetical Data	V-2	V-10
Analysis of Operation and Maintenance Costs: Hypothetical Data	V-3	V-11
Decision Framework for Designing an Apportionment, Allocation and Distribution Concept	V-4	V-12
Chart of Accounts: Operation and Maintenance	V-5	V-43
Assessment of Apportionment Alternatives in Terms of Evaluation Criteria	V-6	V-57
Comparative Assessment of Feasible Sub-apportionment Concepts	V-7	V-63
Relationship Between Sub-apportionment and Allocation	V-8	V-66
MDC Functional Structure	VI-1	VI-4
Conversion of Population to Flow and Strength Characteristics Using Hypothetical Data	VII-1	VII-7
Summary of Flow and Strength Characteristics for All User Classes Using Hypothetical Data	VII-2	VII-9
Operations and Maintenance Costs for Selected Years	VII-3	VII-14
Debt Service Requirements for Existing Debt and Relation to Wastewater Characteristics	VII-4	VII-15
List of Construction Projects	VII-5	VII-16
Analysis of Cash Flow on Account of Planned Construction Projects	VII-6	VII-19
Bond Sale Schedule	VII-7	VII-20
Schedule of Project Cost Breakdown by Wastewater Characteristics	VII-8	VII-21
Development of Percentages to Allocate New Debt Service Costs	VII-9	VII-23
Allocation of Debt Service for Selected Years to Wastewater Characteristics	VII-10	VII-25
Federal Reimbursements and Industrial Cost Recovery	VII-11	VII-26
Industrial Cost Recovery of Federal Share of Construction Costs for Selected Years	VII-12	VII-27
Communities' Contribution to Total Wastewater	VII-13	VII-29
Major Industry Share of Communities' Wastewater	VII-14	VII-31

CHAPTER V

INTRODUCTION

A. COST ELEMENTS

B. APPORTIONMENT OF COSTS ACCORDING TO USE, NEED, AND BENEFIT ANALYSIS

C. METHODS OF SUB-APPORTIONING COSTS AMONG COMMUNITIES

D. ALLOCATION AND DISTRIBUTION OF COSTS AMONG CLASSES WITHIN COMMUNITIES

E. FRAMEWORK FOR EVALUATING ALTERNATIVE APPORTIONMENT, ALLOCATION, AND DISTRIBUTION CONCEPTS

F. ANALYSIS AND RECOMMENDED ALTERNATIVES

G. INDUSTRIAL COST RECOVERY

CHAPTER V

INTRODUCTION

Service charges for wastewater services provided to a region or several metropolitan communities are established on the basis of a comprehensive analysis that relates the cost of providing service to the amount of service used or needed.

APPROACH

Methods of developing charges differ significantly among service entities. The overall framework common to all, however, includes the procedures of apportionment, allocation, and distribution.

- Apportionment is the procedure whereby wastewater treatment costs are divided among various political entities. Costs associated with a facility that benefits a single community are apportioned solely to that community, while costs associated with facilities that benefit several communities are sub-apportioned among those communities.

- Allocation is the procedure whereby a community's apportioned and sub-apportioned costs are divided among the various classes of users within that community.

- Distribution is the procedure whereby rates are developed for various classes of users within a community and incorporated into a billing system.

Apportionment, allocation, and distribution of costs are based on an analysis of two types of information. Internal information represents the collection and analysis of costs incurred in providing present and future services. External information represents the collection of information from the service area for determining the amount of usage or benefit derived from a wastewater treatment system.

While "usage" is a direct benefit that can be assigned to present users, "benefit" implies indirect factors associated with the existence of such services, their effect upon the environment, and their capability to provide services to future users who are not currently connected to the system. Since decisions regarding the amount of indirect benefit derived from a system necessarily involve subjective judgments, it is often difficult to develop an objective basis for measurement. However, since millions of dollars i

annual costs will be divided among communities and classes of users and non-users, a viable concept must be based on a methodology that carefully considers all aspects of usage and benefit derived.

METHODOLOGY

The recommended methodology is credited to a Report of a Joint Committee of the American Society of Civil Engineers, Water Pollution Control Federation, and American Public Works Association. This methodology incorporates analysis of the three major factors of usage, need, and benefit derived.

- Usage associates a facility with its fundamental purpose. For example, since the primary purpose of an interceptor is to conduct a given volume of hydraulic sewage to a treatment facility, costs associated with constructing and maintaining interceptors are flow-rated.

- Need associates a facility with one or more of the communities for whose purpose it was constructed.

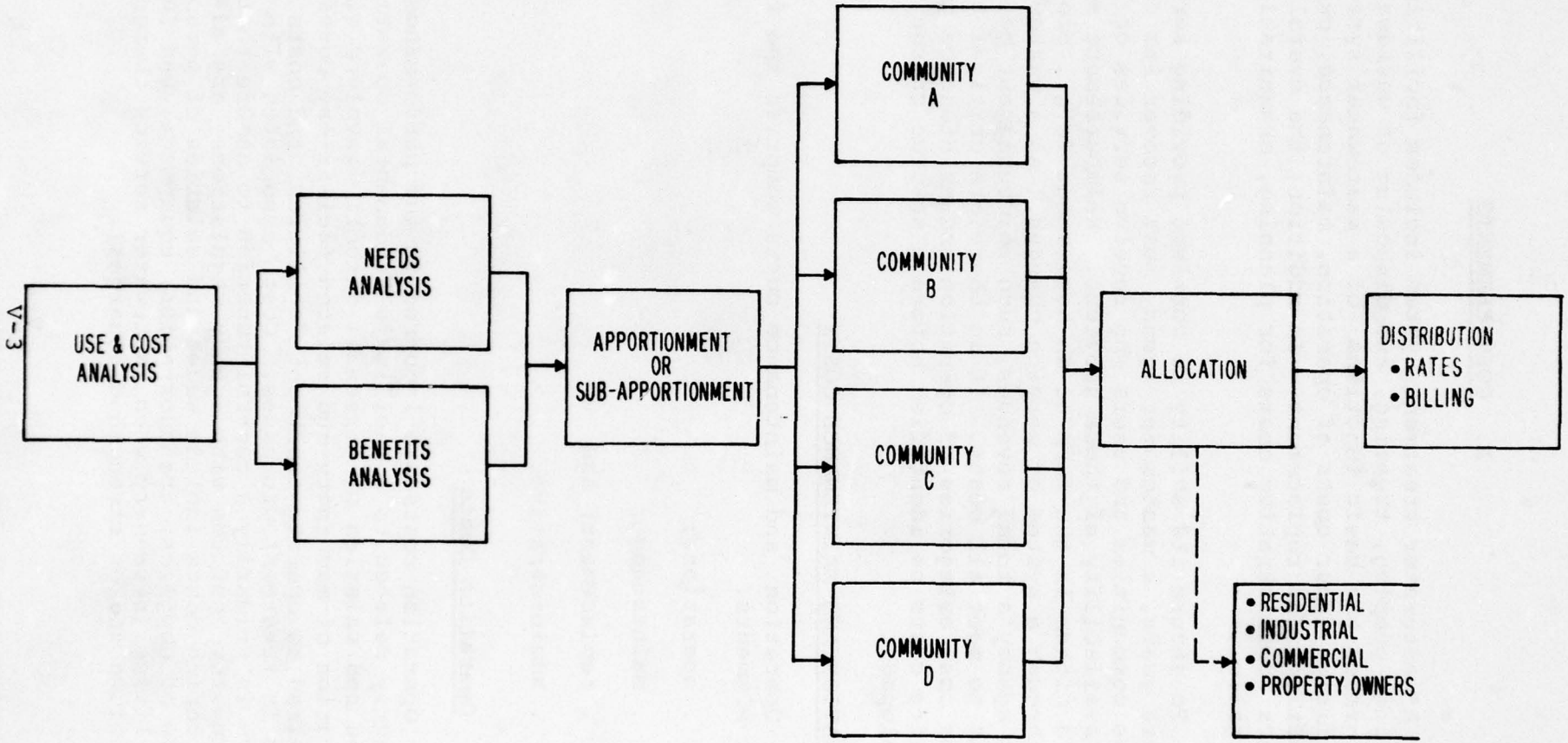
- Benefit derived transcends the fixed boundaries of needs analysis, and associates the benefit provided by wastewater treatment facilities to political entities, citizens, and institutions in the entire service delivery area.

Section B presents an approach to analyzing facilities, and hence costs, in terms of an analysis of usage, need, and benefit derived. Examples of the application of these concepts relate to the specific recommendations developed by the engineering consultants for the EMMA study. A flow chart showing the relationship between the approach and methodology used for determining service charges is presented in Exhibit V-1.

However, prior to any discussion of concepts for apportioning, allocating, and distributing costs, it is important that the general nature of the costs incurred by a large metropolitan wastewater service provider be understood. Accordingly, Section A identifies and describes the cost elements of a metropolitan wastewater treatment system.

EXHIBIT V-1

APPROACH AND METHODOLOGY FOR DIVIDING COSTS AND DETERMINING SERVICE CHARGES



A. COST ELEMENTS

A wastewater treatment system includes facilities for collecting, pumping, treating, and disposing of wastewater. In performing the basic functions of a wastewater system, these facilities incur costs of operation, maintenance, capital construction, and replacement. In addition, the overall system incurs administrative costs for planning, organization, and control.

To ensure its ability to continue providing services in future years, a wastewater agency must recover its costs from those communities and users who receive services or benefit from the availability of those services. Reimbursement may be provided either in the form of an assessment (e.g., property tax) or through a system of service charges. As a wastewater management agency's total revenues, such reimbursement must be sufficient to meet all costs. It is therefore critical that the two major cost categories of operation and maintenance costs and debt service costs be identified before a service charge structure is developed.

OPERATION AND MAINTENANCE COSTS

Operation and maintenance costs comprise the following four elements:

- operations;
- maintenance;
- replacement; and
- administrative.

Operation Costs

Operation costs are incurred in the performance of functions directly related to a facility's fundamental operation, including wages and salaries of personnel directly involved with the operation of machinery and related facilities, costs of fuel required to operate treatment facilities, and costs of chemicals used in treatment processes. Costs associated with monitoring, which is primarily a control function to assure that discharged wastewater conforms with agency regulations, are also included. Monitoring costs include wages and salaries of personnel, and costs of supplies, transportation, equipment, and laboratory facilities (necessary when wastewater service charges are based on volume and/or strength discharges).

Maintenance Costs

Maintenance costs are involved in keeping facilities operational throughout their expected useful life. For example, a maintenance expenditure to repair a defective part includes wages paid to workers as well as the replacement cost of the defective part.

Since wastewater agencies usually cannot allow facilities to become inoperable, preventive maintenance is practiced to prevent breakdowns of equipment and facilities. This formalized maintenance program is usually staffed by competent personnel and supported with adequate equipment and a replacement parts inventory.

Replacement Costs

The preservation and maintenance of the capacity and performance of a wastewater treatment facility throughout its useful life often necessitates the replacement of certain key components. The feature that distinguishes replacement costs from repair costs is magnitude. Although all replacement costs are incurred for the purpose of repairs, only large expenditures (i.e., several thousands of dollars) are considered replacement costs.

In the past, wastewater agencies financed replacement costs through current revenues or capital funding. Under P.L. 92-500, replacement costs must be included with operation and maintenance costs and supported in full by annual revenues.

Administrative Costs

Administrative costs are incurred in planning, organizing, and controlling the wastewater agency's organizational, financial, and operational affairs. Administrative costs generally include the salaries of commissioners and the executive director, accounting services, insurance, meetings, etc. In large agencies, cost centers are often identified for specific administrative functions such as planning and public relations.

In conclusion, operation and maintenance costs are incurred primarily in the process of providing wastewater services to users who discharge to the system. All included functions and associated costs relate to present or past usage. Accordingly, these costs are paid with current revenues rather than through long-term financing.

DEBT SERVICE COSTS

Sewage collection and treatment facilities are generally financed in part by grants and in part through the sale of municipal bonds. Over the years, this financing combination has varied according to federal and state participation in grant programs.

Currently, federal grant participation finances 75% of construction costs for most projects. Additional grant participation by state governments can contribute a significant portion of the remaining costs. In Massachusetts, for example, the state contribution is 15% for most treatment facilities. Thus, total federal and state program grants amount to 90% for construction costs, with 10% remaining for local financing.

Municipal bonds of either the "general obligation" or "revenue" type are the most commonly used for financing the local share of debt service costs for treatment facilities. Alternatives to bonding include long-term borrowing from financial institutions or advance payments by users and future users in anticipation of construction. Neither method is widely used due to the larger incremental financing cost involved in long-term borrowing and the unpopularity of advance payment.

General obligation bonds are backed by the faith and credit of the local government and its power to repay the obligation through property tax assessments. Revenue bonds are entirely supported by service fees collected from users of the system. In addition to satisfying statutory provisions, an agency seeking to issue revenue bonds must show sufficient organizational viability to be self-sustaining throughout the time period in which bonds are outstanding.

Bonds, whether general obligation or revenue, are usually issued for a period of years equal to the estimated service life of the facilities financed. For wastewater treatment projects, this time period is usually 30 years. If bonds are issued to mature beyond 30 years, annual depreciation should be taken against equipment and facilities to ensure annual recovery of the depreciated amount rather than the debt service amount.

One of several retirement methods may be used to repay the bonds. One popular method calls for an even retirement, with the sum of the principal and interest remaining approximately the same throughout the maturity period. Another calls for "ballooning" of payments toward the latter years. Regardless of the repayment method used, the annual amount of principal and interest that must be repaid constitutes the debt service cost of a wastewater agency.

Excess Capacity Costs

When the capacity provided in a wastewater facility significantly exceeds the load anticipated at the time of installation, the additional capacity may be identified as a separate cost element. Excess capacity costs associated with a treatment facility are computed by applying the percentage of the unused capacity at time of implementation to the total amount of debt issued to finance the facility's construction. That portion of capacity and its associated costs are then identified as a service benefit to future users; as such, they must bear responsibility for repayment of that portion of the debt service costs.

An alternative method of computing excess capacity costs involves a periodic recomputation of the actual load to design capacity. The computation is performed each time the service charge system is reviewed. Based upon the traditional assumption of an increasing growth rate for the service area, a greater loadin on facilities decreases the excess capacity percentage. Excess capacity cost estimates are thus reduced to reflect the actual load on facilities, shifting excess capacity costs from future users to present users.

The inclusion of excess capacity costs in cost apportionment and allocation study implies that future users should bear a portio of wastewater treatment costs. Cost apportionment and allocation structures should thus distribute costs to both present and future users, with future users bearing excess capacity costs.

B. APPORTIONMENT OF COSTS ACCORDING TO USE, NEED, and BENEFIT

Charges for wastewater services are developed based on an analysis of facilities and costs in terms of their use, need and benefit. In this section a conceptual approach to apportioning costs on the basis of use, need, and benefit analysis is presented.

USE ANALYSIS

Analysis on the basis of "use" considers a facility's fundamental utility or purpose. For example, since an interceptor's purpose is to conduct a given volume of wastewater to a centralized treatment facility, its "use" relates to flow. While the strength of wastewater discharged to an interceptor system may be considered, this factor will not warrant significant design changes.

Since the cost of constructing, maintaining, and repairing interceptor systems are thus all considered flow-rated, those costs can be distributed on the basis of flow to communities, user classes, and individual users. Assuming $100,000 operation and maintenance costs related to a hypothetical "north interceptor" system and $200,000 of annual debt service requirements, a preliminary cost structure may be arranged as follows:

HYPOTHETICAL DATA

Facility	Amount	Usage Related to: % Flow	$
1. North Interceptor			
Operation and Maintenance Costs	$100,000	100%	$100,000
Debt service costs	200,000	100%	200,000
Total Costs	$300,000	100%	$300,000

All other wastewater treatment facilities are analyzed similarly. The analysis for treatment plants is more complex, as their fundamental uses involve considerations of strength as well as flow. The degree of treatment provided usually serves to identify cost analysis variables. For example, a primary treatment plant is fundamentally used for treating wastewater flows, detoxifying these flows, and removing solids. Secondary treatment provides an additional treatment capability by reducing the amount of biochemical oxygen demand (BOD).

In analyzing a treatment plant according to its functional use, significant individual components are associated with use. For example, "screen and grit chambers" represent a significant component involved in the primary treatment process. Further engineering analysis reveals that screen and grit chambers are designed according to flow and solids considerations. Quantifying this relationship further, 60% of the screen and grit chamber is "flow"-related and 40% is "solids"-related. The capital costs of the screen and grit chambers are distributed accordingly.

Some plant components cannot be specifically identified with any particular design use (e.g., administration and control buildings, improvements to grounds, road construction). The amount deemed to be capital replacement costs may also be difficult to associate with use. Accordingly, the capital costs of these facilities can be divided in accordance with the percentage results of the analysis for other components. Exhibit V-2 shows how the debt service costs related to a secondary treatment plant are analyzed and arranged according to use, using hypothetical data.

Analysis of operation and maintenance costs according to use involves a higher degree of judgment, primarily due to the discretion involved in classifying individual expenditure items and in assigning personnel services to specific areas. A recommended approach is to view the facility as a combination of "cost centers" linked with particular treatment functions (e.g., primary treatment, secondary treatment, chlorination, sludge disposal) and then associated with a particular wastewater characteristic. An example using hypothetical operation and maintenance costs totaling $80,000 is presented in Exhibit V-3.

EXHIBIT V-2

SECONDARY TREATMENT PLANT
HYPOTHETICAL DATA

Components	Annual Debt Service Costs	Flow		Chlorine Demand		BOD		SS	
		%	$	%	$	%	$	%	$
Primary Treatment:									
Screen & Grit Chambers	$ 1,500	60	900					40	600
Sedimentation Tanks	5,000	80	4,000					20	1,000
Digestive Tanks	12,000	10	1,200					90	10,800
Chlorination Tanks & Equip.	3,000	10	300	90	2,700				
Secondary Treatment:									
Final Sedimentation Tanks	10,000	50	5,000			50	5,000		
Trickling Fillers	25,000	10	2,500			90	22,500		
Sub Total	$ 56,500	24.6	13,900	4.8	2,700	48.7	27,500	21.9	12,400
Main Central Building	$ 10,000								
Annual Capital Replacement	20,000								
Sub Total	$ 30,000	24.6	7,380	4.8	1,440	48.7	14,610	21.9	6,570
Total Debt Service Costs	$ 86,500	24.6	21,280	4.8	4,140	48.7	42,110	21.9	18,970

EXHIBIT V-3

ANALYSIS OF OPERATION AND MAINTENANCE COSTS
HYPOTHETICAL DATA

Component	O & M Cost	Cost Related to: Flow		Chlorine Demand		BOD		SS	
		%	$	%	$	%	$	%	$
Primary Treatment	$ 10,000	50	5,000	25	2,500			25	2,500
Secondary Treatment	20,000	15	3,000			85	17,000		
Chlorination	5,000	20	1,000	80	4,000				
Sludge Disposal	30,000	—	—	—	—	—	—	100	30,000
Sub Total	$ 65,000	13.8	9,000	10	6,500	26.2	17,000	50	32,500
Administrative Costs	15,000		2,070		1,500		3,930		7,500
Total	$ 80,000	13.8	11,070	10	8,000	26.2	20,930	50	40,000

All treatment facilities, including interceptors, pumping stations, treatment plants, storm water detention centers, and other appurtenances operated by the agency (e.g., monitoring stations, laboratory facilities) are analyzed and classified similarly.

Use analysis can thus provide the foundation for structuring charges for the discharge of wastewater having normal or domestic as well as abnormal strength. These charges are based on contributed flows and strengths from various users, and reflect the actual costs involved in treating particular wastewater elements.

NEED ANALYSIS

A wastewater collection and treatment system necessarily involves investment in facilities for collecting, transporting, and processing wastewater. As these facilities are designed and constructed to meet the needs of the service area, the communities within that service area pay the related costs of construction and operation.

In large multi-community service areas, costs must be divided among all participating communities. Through an analysis of need, the costs of individual facilities are apportioned to those communities that "need" the services provided. An application of need analysis follows, using facilities recommended by the study's consulting engineers.

Interceptors

As regional systems are predicated on economy of scale, they contain few unique facilities. A length on an interceptor may be built to accommodate the specific needs of a fringe community and the costs associated with that portion of the interceptor (and possible appurtenant facilities) apportioned to that community. However, since the flows from the fringe community must pass through interceptor sections of downstream communities to reach the treatment plant, those additional "needs" are attributed to the upstream fringe community and costs are apportioned accordingly.

Advanced Treatment Plants

Two advanced treatment plants have been proposed for the future service area. Flows from surrounding communities will be diverted to these plants for advanced treatment and then discharged to nearby receiving waters.

The proposed service areas of the two plants are as follows:

Plant Location	Service Area
Upper Charles River	Ashland
	Framingham
	Natick
	Sherborn
	Wellesley
	*Southborough
	*Hopkington
Neponset River	Walpole
	Norwood
	Canton
	Stoughton
	*Sharon

*While Southborough, Hopkinton, and Sharon are not presently served by MDC facilities, an engineering recommendation has been made that these towns become part of the service area of these two treatment plants. The capacity of each plant will be designed to accommodate future flows from these communities.

As operation and maintenance and debt service costs associated with each of these facilities will be unique to each service area, they would be segregated from all other costs and apportioned to the participating communities. Other projects included in the recommendation would be apportioned on the basis of need, as follows.

- Storm Detention Facilities- Storm detention facilities are required due to the existence of combined sewers, in Boston, Brookline, Cambridge, Chelsea, and Somerville. Associated costs would be apportioned to this group and sub-apportioned among the communities on some equitable basis.

- Correction of Inflow Problems- Facilities to correct inflow problems will be constructed along the Boston waterfront. Costs related to those projects that are for correcting sewers owned and maintained by the City of Boston would be apportioned to the City of Boston, and costs related to MDC facilities would be apportioned to the communities whose flows pass through these sections.

- Nut Island Treatment Plant- All expansion and upgrading projects related to the Nut Island Treatment Plant would be apportioned to the communities constituting the plant's service area.

- Deer Island Treatment Plant- All costs involved in constructing, operating, and maintaining secondary treatment facilities would be apportioned to communities whose flows are directed to the plant.

- Existing Facilities and Costs- Since individual facilities cannot be identified with specific communities, the entire service area could be divided into north and south districts and costs associated with the facilities in each district apportioned to the respective service areas of each district. Even this gross apportionment, however, will not eliminate some judgmental factors in determining respective service areas.

Future Needs

Future as well as present needs are considered in the design of facilities, and excess capacity is provided in the initial construction. However, identifying the composition and location of the "future need" segment of a service area is a difficult task. Zoning laws, population shifts, and density are common determinants used by engineers in establishing capacity for future use. In accordance with these assessments, design years for a treatment plant usually extend 10 to 15 years into the future, and design years for interceptors commonly include 25 to 30 year growth provisions.

A facility's excess capacity is predominantly related to the capital costs incurred. Since excess capacity costs represent a percentage of unused capacity, these costs are segregated from all other costs and apportioned or sub-apportioned to communities on some equitable basis.

BENEFIT ANALYSIS

While analyzing the specific needs of communities is considered the first step in apportioning costs among communities in a service area, such analysis is not always sufficiently comprehensive. Several other factors and considerations affect the design and location of wastewater treatment facilities, including environmental considerations, cost factors, and physical and topographical factors.

Environmental concerns with the physical and social impact of wastewater facilities on the service area, for example, often affect the location of facilities. Accordingly, the degree of compromise between "need" and environmental considerations must be considered when apportioning costs to specific communities.

The relative costs of alternative solutions may represent another significant factor affecting both the design and location of facilities. When decisions reflect cost considerations, an analysis considering the total benefit to the entire service area may be more appropriate than an analysis based solely on need.

Lastly, the physical and topographical features of the service area may be a major factor, possibly outweighing a needs assessment, in locating facilities. Accordingly, the engineering recommendations must be re-examined to identify benefits that may transcend community boundaries. Although benefit analysis involves considerable judgment, it properly reflects the element of judgment involved in selecting physical solutions to wastewater problems.

Advanced Treatment Plants

When the two proposed advanced treatment plants are analyzed on the broader basis of benefit, strong support for apportioning their related costs to all communities located in the metropolitan service district arises based on the following considerations:

- A major reason for locating the plants upstream was to provide water augmentation to the Charles and Neponset Rivers. Assurance of adequate flows in these two rivers not only benefits the adjacent downstream communities but also provides recreational possibilities to all metropolitan residents.

- Location of these upstream plants was based on part on an attempt to avoid the possible environmental degredation of Deer and Nut Islands and Boston Harbor.

- The cost of the alternative to upstream plants (i.e., to expand the available land area at Nut Island to permit enlargement and upgrading) would have exceeded the projected costs of the two treatment plants.

The considerations suggest that the "benefit" derived from the advanced upstream treatment plants should be associated with all metropolitan communities in the service area.

Stormwater Detention Facilities

The stormwater detention engineering recommendations constitute a cost efficient method for dealing with stormwater overflows caused by the combined sewers in certain municipalities. Even periodic overflows are not acceptable to the environmental and recreational goals established for the Charles River and Boston Harbor areas.

Although cost had a bearing on recommending a solution, the decision to correct the problem was a result of policy formulation that reflects a new and growing concern for the environment. Accordingly, it is difficult to justify the assignment of stormwater detention costs to only those areas with combined sewers. Although construction of such sewers is no longer permitted, the existing combined sewers were constructed at a time when their construction was legal.

A study entitled Problems of Combined Sewer Facilities and Overflows, 1967, sponsored by the Federal Water Pollution Control Administration, U.S. Department of the Interior, and performed by the American Public Works Association, presents a comprehensive survey of the effects and means of correcting combined sewer overflows and separate storm and sanitary sewer discharges in the United States. A report of the study's findings and conclusions addresses the problem of pinpointing communities that should assume responsibility for the overflows, pay related costs, or benefit economically from reduced flows resulting from separation projects.

The report states that "the resultant problem of combined sewer overflows is traceable to the pattern of urban growth. This position is founded on the premise that combined sewers, those carrying storm water as well as sanitary sewage and industrial wastes, are expected to overflow and are designed to provide for such overflows. At one time sanitary engineers and public health officials felt that such overflows were sufficiently small and diluted that they posed no water pollution problem. This was probably true at the time. But, under today's condition of urban growth, the burgeoning of impervious areas and increases in runoff volumes and rates, these overflows have increased in frequency and duration and pose threats to the nation's water resources."

In a separate section, the report notes that many fringe communities served by the regional entities use separate sewer systems, but that in many cases these separate flows discharge into sewers carrying combined sanitary and storm water from central cities. "The net result of such conditions is that this separate sanitary sewage becomes combined sewage by 'association' and adds to the overflow problem."

In Appendix H to the report and under a section entitled Combined Sewers in Metropolitan Service, the following is stated:

> "In many instances the initial connections from outside areas have been made to already available portions of the core city's lines. The outside wastes thus introduced have not only admixed with those generated within the city but, depending on local circumstances, may have flowed through the full length of the receiving system. Where combined sewers have been so employed the augmented, dry weather flows have automatically reduced the dry-weather/wet weather ratio. More frequent and longer overflows during times of rain have been the certain consequence of such encroachment, no matter how generous the initial design assumptions may have been."

These findings suggest that pinpointing responsibility for sewer overflows resulting from combined sewers must extend beyond a consideration of those communities actually using

combined sewers. The problem is directly interwoven with the growth and development of the ubran area and the subsequent additions of fringe communities to a collection system.

The report also cites the economic impact of polluting overflows, considering the effects of such discharges on the environment. "These effects include:

1. Water deterioration and loss of value and usability of these resources for multiple purposes;

2. Damage to the water for recreational purposes;

3. Creation of local nuisances by shoaling of storm-carried debris and sewage solids;

4. Creation of offensive appearances of waterways, thus denying the public's 'right to enjoy' the beauties of natural water areas and surrounding lands."

These analyses suggest the inequity of apportioning the related costs from storm detention projects to only those communities with combined sewers. An alternative would be to consider these costs as environmental costs and apportion them to all communities serviced by the entity.

Other Facilities

The EMMA study and its recommended physical solutions constitute a basin-wide approach to preventing water pollution. The approach views the entire drainage basin as a single unit, and contends that solutions to selected problems will benefit every part of the drainage basin rather than solely the part where facilities are constructed. Solutions aimed at either correcting existing problems or in anticipation of future problems should be related to environmental improvements that will benefit all communities in the drainage basis.

For example, the recreational opportunities expected to result from the implementation of certain facilities in the EMMA study area were summarized in May 1974 by environmental consultants as follows:

"Increased recreational opportunities and their secondary economic impacts on the service sector associated with recreation and tourism are expected to figure among the most notable benefits of implementing advanced wastewater treatment systems in the Eastern Massachusetts Metropolitan Area. Changes in water quality will increase the water-based and water-related activities on the rivers and harbor shore line. These include:

Water-based Activities:

1. Swimming
2. Water Skiing
3. Power Boating
4. Non-power Boating
5. Game Fishing
6. General Fishing

Water-related Activities:

1. Picnicking
2. Hiking
3. Bicycling
4. Camping
5. Sightseeing
6. Horseback riding

Development of recreation facilities will probably occur, increasing recreation accessibility."

The costs related to all facilities should thus be shared by the communities within the drainage basin. In addition to advanced treatment plants and storm water detention facilities, this would include pumping stations, interceptors, and sludge processing equipment.

Benefit to Present and Future Users, and Non-Users

The environmental benefits derived from wastewater-related projects and facilities strengthen the concept supporting apportionment of a part of the cost to future users. Of greater significance, however, is the impact of sewers and treatment plant construction on land development. This topic was discussed in a recent report entitled Environmental Quality, prepared by the Council on Environmental Quality in December 1974. Although the report cautioned that the impact of sewers on land development has received little attention in the past, it cited some of the results of studies conducted in certain areas of the country.

The report stated the following:

> "An examination of growth in the Far Northeast section of Philadelphia over the period 1945 to 1962 indicated that access to trunk sewers and high density zoning were the two most important factors influencing the price of residential land, and that the absence of sewers tended to restrict development. Similarly, a more subjective analysis of the development process in Fairfax County, Virginia, concluded that the installation of interceptor sewers and the general pro-growth attitude of county officials were the prime determinants of the pattern of development in that area. Another more quantitative study of the entire Washington, D.C. area also documents, though somewhat ambiguously, the importance of sewers in determining the location of the extensive development that has surrounded the city over the past decade."

The report then noted the relationship between excess capacity and land development.

> "The location and rate of extension of interceptor sewer lines through previously undeveloped areas seem to have more impact on land use than any other set of decisions on wastewater facilities. Interceptor sewers are defined as the major lines that run from the collector sewers to the treatment plant. Because the location of a new interceptor significantly increases the number of buildable lots along its right of way, a key issue is its capacity. There is a general tendency for such lines to be oversized in order to assure the necessary capacity for future development, but the oversizing itself can contribute to the extent of development that occurs. Such oversizing thus becomes a self-fulfilling prophecy."

In the preliminary environmental impact reports directly related to the EMMA wastewater study, the following impacts on property owners were cited as a result of sewer and treatment plant construction in the study area:

"Changes in property values can be attributed to four kinds of project impacts:

(1) Increases in the quality of the environment near the improved water body attract improved facilities and services.

(2) Areas become more attractive for development because of availability of services.

(3) The plan requires the removal of existing housing and other facilities; the price for those remaining increases because of the reduction in supply.

(4) Residences are changed in order to be near the water; the increases in waterfront property prices can be expected to be offset by decreases in prices at former residence sites."

This unquestionable benefit to property owners should be considered in any cost distribution scheme; it clearly supports a concept that apportions a percentage of the costs to existing property owners. In some areas of the country, property owners have thus been identified as the beneficiaries of the provision of excess capacity and costs have been apportioned to them accordingly.

C. METHODS OF SUB-APPORTIONING COSTS AMONG COMMUNITIES

Once facilities and costs have been analyzed and a method of apportioning costs to communities established, a method for sub-apportioning costs common to more than one community must be devised.

Operation and maintenance costs are expected to rise many times their present level, largely as a result of higher treatment objectives. (For example, operation and maintenance costs in the MSD are expected to rise from a present level of approximately $8 million annually to $39 million.) Correspondingly, higher costs will have to be borne by the residential, commercial and industrial units serviced by the wastewater facilities. Accordingly, greater attention will be directed to methods of distributing costs both among and within communities.

Since the discharge by individual classes of users within a community differs both in volume and in strength, it is important to assess the impact of each class on the wastewater treatment system in developing an appropriate charge structure. Sub-apportionment, defined as the equitable distribution of costs associated with facilities that provide service to more than one community, thus represents a major step in the cost distribution process.

Various methods are used to generate information upon which costs are sub-apportioned among communities. The most popular concepts are based on:

- flow measurement;
- water consumption;
- population;
- residential units;
- water production;
- area; and
- property value.

FLOW MEASUREMENT

Measuring the flow of wastewater discharged by a municipality is one method used to develop information about that municipality's use of the system, and consequently its share of costs. Under this system, meters are installed at each connecting point to measure both the volume and strength of wastewater discharged to the system by all classes of users within a community or section of community. Since installation of a meter can be directly attributed to a specific community, equipment installation and operation and maintenance costs are typically borne by that community.

Advantages

The most significant advantage of the flow measurment method is that it provides an actual quantitative measurement of the sewage discharged to a system. Through periodic sampling to determine strength, an agency can sub-apportion costs based on both volume and strength characteristics.

This method is also efficient, as a single reading replaces collection and summarization of data from hundreds and possibly thousands of individual users. Furthermore, since the method considers the infiltration factor (which most other methods do not), flow-related charges may prompt a connecting community to repair older sewers and broken connections.

Disdavantages

It is usually most advantageous to adopt the flow measurement method when an agency is being formed and facilities are in the initial phases of construction, as the concept requires the identification of points of interception and corresponding installation of equipment. For agencies that have been providing service for a number of years, this procedure is often difficult to implement. Some agencies have no records identifying all connecting points, and some existing connecting points would most likely require unearthing and re-engineering to accommodate meter installations, maintenance, repair, and periodic readings.

In systems with numerous connections, this method is expensive due to the costs of purchasing, installing, maintaining, and repairing metering equipment, as well as periodically recording data. The concept is also somewhat limited in information provided. Although it yields a good quantitative measure of the entire community's contribution, it does not delineate the

contributions of individual classes of users, a prerequisite for allocating costs and developing charge structures.

WATER CONSUMPTION

Use of the amount of water consumed for sub-apportionment among benefiting communities is based on the premise that the amount of wastewater discharged by an average household, commercial establishment, or industry is a direct function of the amount of water that entered each premise.

The administration of a system of sub-apportionment based on water consumption is an important consideration. Agencies that perform both water and sewage functions will handle the task of data accumulation easily. However, agencies that do not provide water services must establish relations and agreements with area water purveyors for providing the necessary data. This task is complicated when numerous water purveyors operate within the service area.

Furthermore, an alternative method is required to account for differences in the strength of wastewater discharged by various classes of users. This is most efficiently accomplished by excluding the domestic and commercial user due to the compatibility of the discharged wastes and the predictability of their strength characteristics. Industrial users of water, on the other hand, vary from industry to industry. Accordingly, information describing each company's industrial processes and estimating the strength of its discharges must be gathered from all major industries in the service area.

Based on both reliable assumptions regarding the characteristics and strengths of domestic wastewater and information contributed or collected from area industries, costs may be sub-apportioned among communities according to flow and strength characteristics.

Advantages

Water consumption is a judgmental method of sub-apportioning wastewater treatment costs based on the generally close relation between water entering and leaving a premise. In the many areas having water measurement systems, no additional investment in measuring equipment is required. Although not all units in a service area may be metered for water consumption, the amount of water consumed by these units can be reasonably inferred from statistical information derived from the remaining service area.

Disadvantages

The major disadvantage of this method relates to the difficulty of reaching general agreement on the premise that sewage is a function of water usage. On a gross level of distributing costs, such as in sub-apportionment, the resistance is not as great as in developing charges for users. Numerous specific uses of water can be cited to disprove the concept's basic premise. For example, summer use of water for lawns, irrigation, and swimming pools does not result in a discharge to a wastewater treatment system. A solution to this problem is to measure water consumption during the winter months and use that figure as a basis for year-round water usage.

A more significant problem relates to industries that consume significantly more water than they discharge to a wastewater collection system. Exception meters can be installed to measure the discharged wastewater. However, each exception meter requires a separate reading, and the cost of installing a meter can only be justified by large users of water.

The water consumption method also involves considerable administrative effort. As mentioned, arrangements must be made with individual communities and water purveyors to obtain water consumption statistics, a system of reporting by industry must be implemented and maintained, and each exception meter requires a separate visit to read and record discharges to the system.

Lastly, this method does not provide any mechanism for measuring or estimating the amount of infiltration occuring in a community's collection system.

POPULATION AND POPULATION EQUIVALENT UNITS

Population is another characteristic commonly relied upon to sub-apportion wastewater treatment costs, based on the dual assumption that sewage volume increases as population increases and that population increases create greater service demands.

Supporting this method is the fact that populated areas are characteristically heavily industrialized. Thus, the population concept appears to assign costs in proportion to use and need, emphasizing communities that demand the most service of wastewater treatment facilities.

To account for industrial discharges, the concept of population equivalent units is utilized. Under this method, the wastewater discharged by all major industries is measured or estimated and then converted to population equivalent units (which may also be calculated for strength characteristics of industrial discharges). A community's share of sub-apportioned costs is then determined by the ratio of its total population and population equivalent units in the service area.

In some service areas, only a portion of a community's population receives sewerage services. Accordingly, it must be decided whether to consider the total population or only that portion connected to a collection system. For some cost elements, such as operation and maintenance and debt service costs, consideration of only those connected to the system seems more equitable, since these costs are directly traceable to present users. For excess capacity or "environmental" costs, consideration of total population seems most equitable.

Advantages

Estimates based on population have the distinct advantage of simplicity in determination and administration. Population statistics may be obtained from regularly scheduled federal or state censuses or with reliable estimating procedures (for time intervals between censuses).

Disadvantages

The major disadvantage of the population and population equivalent unit concept is its administrative requirements. Since it may not be feasible to perform the equivalent unit computation for every commercial and industrial establishment, the units are computed on an exception basis, possibly resulting in inequitable sub-apportionment of costs for communities with large commercial bases.

RESIDENTIAL UNITS AND RESIDENTIAL EQUIVALENT UNITS

Under this method, wastewater costs are charged based on a determination of average water consumption per residential unit. Statistics for large volume users are compared with those for average volume users to determine residential equivalent units. For example, if a company consumes four times the amount of an average household, its equivalent unit is four. When this procedure is followed for all significant industries within a community, the total sub-apportionment to the community is based upon the community's total of residential and residential equivalent units.

Initially, it is necessary to develop a reliable estimate of water consumption per residential unit. This is accomplished through water consumption statistics supplied by water purveyors or cities and towns. The procedure for subsequent years is simply to determine the number of residential units within a community. This requires only the gathering of water consumption data for industry, and possibly large commercial establishments.

The basis upon which treatment costs are related to water consumption is questionable when large users of water discharge an amount that differs significantly from that consumed. As a solution, exception meters to measure the volume discharged to the system have been used as a basis for determining equivalent units.

Some agencies have further refined the technique to account for strength of sewage and the related treatment costs associated with treating high nutrient or toxic water normally discharged by industry. Measurements for BOD and SS content as a percentage of normal domestic sewage flows are compared with industrial discharges to derive additional equivalent flow units that compensate for the quality of wastes discharged.

Advantages

This method is unique because it relates flow to treatment costs without requiring continuous measurement. Any measurement required is performed on an exception basis for only a small percentage of the service recipients. Consequently, the method is considerably easier and therefore less expensive to administer than other methods that measure all discharges. Additional cost advantage can be achieved by delegating the responsibility for accumulating and submitting water consumption data according to pre-established schedules to participating communities.

Disadvantages

A disadvantage of the residential equivalent unit method is that some data collection is actively required. Although part of this responsibility can be delegated to participating cities and towns, agency staff must handle the overall administration of the program, deal with uncooperative participants, and monitor the activities of all participants to ensure that reports are submitted correctly.

Before adopting this method, an agency must address the likelihood that the concept's underlying assumption will be challenged by participants who do not feel that water consumption is a sound, reliable criterion upon which to base cost apportionment. In some situations, water consumption may truly not be indicative of wastes discharged, and exception metering may be required. The issue of exception metering must be resolved in advance, including whether the agency, community or user will pay for the meter.

WATER PRODUCTION

Water production statistics are maintained by MDC for 30 of the 43 communities in the MSD. Water provided to each is metered, with each community paying according to the volume of water received. A flow-related charge for wastewater services could easily be computed using the same water production statistics for water services not provided by MDC.

Advantages

Water production statistics are maintained by MDC for 30 of the 43 communities in the Metropolitan Sewerage District. Water provided to each is metered, with each community paying according to the volume of water received. A flow-related charge for wastewater services could easily be computed using the same water production statistics for water services not provided by MDC.

Relating wastewater charges to water production data satisfies the overall concerns of water conservation. Provided that the gross charge structure does not offer incentives to use greater quantities of water, the dual purpose charge for water supply and wastewater treatment is likely to stimulate water conservation efforts within a community.

Further, a community's charge based on water production may be passed on to individual users through customary billing mechanisms.

Disadvantage

Since wastewater treatment charges based on water production statistics are flow-related only, they do not consider the strength of wastewater discharged to the collection system. Accordingly, some method must be devised to account for abnormal strength discharges. A reporting system similar to that used in determining population or residential equivalent units would provide the required information. However, adjusting gross water

production data for strength considerations may be more cumbersome than a system that deals separately with each major discharge of wastewater. As an alternative, each discharger could be billed separately in the form of a surcharge based on the strength element of water discharged to the system.

Another disadvantage of this method is that it includes no provision for the measurement of groundwater infiltration or surface runoff in areas with combined sewers. However, this disadvantage is characteristic of any sub-apportionment method that does not meter the wastewater at a connecting point.

AREA

As a rough estimate of potential usage, area can be used as a basis for sub-apportioning capital costs, excess capacity costs, costs related to combined sewer projects, and some administrative projects.

Although area is not a practical basis for distributing all costs, it provides an alternative method for distributing some cost elements that are difficult or impossible to relate to flow and strength characteristics. The major deficiency attributed to the area method is that zoning and land use regulations vary among communities. Such variations will affect growth rates and consequently future use and need for wastewater services.

PROPERTY VALUE

Under the property value method, the ratio of the value of property in each community to the total value of property in all communities equals the share of costs sub-apportioned to each community. Some areas use only real property values, while others include real and personal property value in the computation.

Property valuation has long been a popular basis upon which to distribute the costs of public services. The tax levy (ad valorem) is the charge mechanism used to collect revenues from individual property owners.

Advantages

Simplicity is the primary advantage attributed to the use of property value as a basis for sub-apportioning costs. Property value is an acceptable basis for distributing debt service costs and excess capacity costs, based on the anticipated rise in property values that typically results from the availability of

public services such as wastewater treatment. Since property owners benefit from the availability of services, they should assume responsibility for supporting part of the costs associated with providing such services.

Disadvantages

The most common criticism of the property value concept is that it does not measure the degree or amount of usage derived from the service system. For example, an owner of $50,000 in property is charged more for services than an owner of $30,000 in property, although the $30,000 property owner may be deriving twice the benefit.

This shortcoming is magnified when the concept is applied in service areas where property and real estate are used for widely different purposes. For example, in a heavily commercialized sector of a service area, the burden of paying for services may be disproportionate to the benefit received.

D. ALLOCATION AND DISTRIBUTION OF COSTS AMONG CLASSES WITHIN COMMUNITIES

Once all costs have been properly apportioned and sub-apportioned to communities, those costs must be allocated among various classes of users within each community. MDC has not in the past been concerned with cost allocation within communities. However, as a recipient of federal grants under P.L. 92-500, MDC will become increasingly involved in the structuring and administration of community user charge systems. Although specific responsibilities have not been conclusively defined, a recent "unofficial" interpretation indicates that user charge systems involving regional sewerage systems should be structured in accordance with the following guidelines.

- Definition- User charges are payments to a grantee by recipients of waste treatment services to offset the costs of operating and maintaining treatment works provided by the applicant.

- Regional Systems- In regional systems, all member communities must have a uniform user charge system covering jointly used facilities, and the grantee must have the right to enforce this requirement.

- Administrative Requirements- All users must pay their proportionate share of the costs incurred in operating and maintaining the system. A reserve fund should be established to cover anticipated replacement of plant equipment.

- Types of User Charge Systems- A user charge system may be based on proportionate payments from either individual users or classes of users, for either estimated or measured wasteload contribution to the treatment works. A system based on individual users compares the estimated or measured proportional contribution of individual users to the total treatment works loading. Similarly, a system based on classes of users having similar flows and strength characteristics assigns each class its share of operation and maintenance costs in accordance with its proportional contribution to the total treatment works loading.

Individual communities, with MDC's guidance and assistance, will be required to develop approvable user charge structures. The methodology for developing such a structure involves the allocation of costs among various classes within each community. Suitable rate structures are then developed and incorporated into a billing mechanism for distribution to users and future users.

ALLOCATION

The allocation of costs among various classes of users is accomplished utilizing the same community data used for sub-apportioning costs among communities. For example, assume the following simplified example for the operation and maintenance costs of a treatment plant jointly used by two communities, A and B.

Community Data

Community A:

Residential Flows	15 MGD
Industrial Flows	5 MGD
BOD content in Industrial Flows	700#/MGD

Community B:

Residential Flows	30 MGD
Industrial Flows	10 MGD
BOD content in Industrial Flows	600#/MGD

Other Data:

Average BOD content in Domestic waste	300#/MGD
Flow Related O & M Costs	$500,000
BOD Related O & M Costs	$300,000

Sub-Apportionment of Flow Related Costs

	Flows	Apportionment Share	Share
Residential Flows-Community A	15 MGD	15/60 x 500,000	$125,000
Residential Flows-Community B	30 MGD	30/60 x 500,000	250,000
Industrial Flows-Community A	5 MGD	5/60 x 500,000	41,700
Industrial Flows-Community B	10 MGD	10/60 x 500,000	83,300
	60 MGD		$500,000

Sub-Apportionment of BOD Related Costs

	BOD#	Apportionment Share	Share
Residential BOD-Community A	4,500#	45/230 x 300,000	$ 58,700
Residential BOD-Community B	9,000#	90/230 x 300,000	117,400
Industrial BOD-Community A	3,500#	35/230 x 300,000	45,500
Industrial BOD-Community A	6,000#	60/230 x 300,000	78,400
	23,000#		$ 300,000

Summary of Cost Apportionments and Allocation by Class

	Community A		Community B		Total
	Resid.	Ind'l.	Resid.	Ind'l.	
Flow Related Costs	$125,000	$41,700	$250,000	$ 83,300	$500,000
BOD Related Costs	58,700	45,500	117,400	78,400	300,000
Totals	$183,700	$87,200	$367,400	$161,700	$800,000

Based on the above calculations, community A is sub-apportioned a total of $270,900, of which $183,700 is allocated among residential users and $87,200 among industrial users. Community B is sub-apportioned a total of $429,100, of which $367,400 is allocated to residential users and $161,700 to industrial users.

Some cost elements may also be allocated to non-users. For example, requirements mandate only that operation and maintenance costs be allocated to users and distributed in the form of a user charge. Thus, debt service costs may be allocated to property owners or future users.

Once all costs elements have been allocated to various classes of users and non-users, user charges and other cost distribution mechanisms are developed for distributing costs to individual users and non-users.

SERVICE CHARGES

Service charges are direct charges to users within the community to offset the costs incurred for providing wastewater treatment services. These charges may be billed directly to each unit by the regional agency or by each participating municipality.

Volume of Water Used

One of the most popular billing concepts used in charging for wastewater services is the establishment of charges based on the amount of water entering the user's premises. The charge for wastewater services is the product of the amount of water consumed times a predetermined rate.

The popularity of the concept is based on the consensus that water is a major component of sewage, and that the uses of water do not vary significantly within classes of users. Thus, within certain classes of users, a reliable assumption can be made about the uses, volume, and characteristics of water discharged to the wastewater system.

Wastewater service charges determined on the basis of water consumed tend to restrict water usage, especially when rate structures do not offer lower rates for increased consumption.

Industries that utilize water for various aspects of production may be financially motivated to alter existing systems. For example, flow-through cooling systems may be re-engineered to recirculatory systems. Such engineering changes result in decreased loadings on the sewerage system which conserve water resources.

Flexibility is a major consideration when adopting this billing concept; provision must be included to accommodate users to whose water consumption and discharge habits the concept and its assumptions do not apply. Exception meters (installation and related charges usually paid by the user) for measuring the discharged amount provide a suitable alternative. The agency responsible for billing and distributing costs should maintain the right to ensure the meter's quality and proper functioning periodically, as well as to read the meter to determine the user's charge.

An alternative must also be developed for residential users whose water consumption is not metered. Since this typically represents only a small precentage of the total residential population, average consumption and billing statistics are often satisfactory.

Volume Plus Industrial Surcharges

Although water is its major component, other elements and characteristics of sewage should be considered in developing appropriate service charges. Substantial investment is involved in the construction of treatment facilities to remove nutrients and toxic materials from the wastewater prior to its discharge to a receiving body of water. Additionally, expenses are incurred to monitor these elements daily and to purchase chemicals and agents needed in the overall treatment process. These additional expenditures support use of a service charge concept that recognizes the characteristics as well as the volume of wastewater.

Users who discharge large quantities of low strength wastewater would pay only the costs associated with flow, while users contributing wastewater of high nutrient or toxic substances would pay proportionately for the associated costs of treatment. Users would be charged separately for volume and characteristics. If, for example, BOD and SS are identified as characteristics to be considered in the billing system, a user's bill would reflect a unit charge for BOD content and a unit charge for SS content.

A charge system that considers both volume and characteristics may be implemented on an exception basis. Under this approach, a certain acceptable level (typically equal to the characteristics and composition of domestic wastewater) of wastewater constituency is designated as normal. Wastewater discharges are then surcharged for strength in excess of that level.

Such a surcharge would have to be computed for only a small percentage (i.e., selected industrial classifications and certain types of institutions) of the users within the service area. Domestic users would be automatically excluded.

This method of charging requires that the agency, city, or town have the capability for monitoring and measuring discharges. Personnel and equipment are required for collecting samples, analyzing those samples, and transmitting the results of analysis to the billing unit for billing purposes. In municipalities with heavy industrial concentrations, these activities would have to be conducted on a full-time basis; in municipalities where industrial activity is insufficient to justify an investment in specially trained personnel and equipment, the regional agency might accept responsibility for measuring, analyzing, billing, and collecting surcharges.

Some agencies have streamlined the activities required in billing for sewerage characteristics. The East Bay Municipal Utility District (EBMUD), for example, is a special purpose agency providing treatment services to the city of Oakland, California and eight surrounding cities and towns.

EBMUD's service area is characterized by a diversity of industry, including slaughterhouses, leather tanning, and paint manufacturing. To determine the bill for the strength of sewage discharged, each industrial user is classified according to principal business activity. Rates per 100 cubic feet of water consumed are assigned to each classification, based on the average strength of wastes discharged, determined through extensive sampling. As a result, slaughterhouses pay at the rate of $.30 per 100 cubic feet of water consumed, paint manufacturers $.25 per 100 cubic feet, and food manufacturers $.15 per 100 cubic feet. Fifteen such business classifications have been established.

By building charges for strength into measured water consumption, EBMUD has eliminated the necessity of frequent sampling for billing purposes. Sampling is performed only for monitoring

and enforcement activity and may be used to adjust billing rates periodically. This method enables the agency to bill for both volume and strength at low cost. However, costs to implement the system initially may be high due to the substantial sampling and analysis required to establish rates.

Flat Rates

A flat rate service charge is a pre-established uniform charge based on estimated demand for services. The charge is generally derived through analysis of water consumption statistics and may take into account different classes of users.

A flat rate system of service charges is easy to administer. Rates are determined in advance for each residential unit, with multi-family housing units charged according to the number of residential units included. Bills may be prepared annually, quarterly, or monthly. Existing systems, such as water service billing systems, may be converted to handle these activities conveniently and efficiently. Only historic and annual water consumption data relating to a sample of users within a class are required to establish rates.

Many agencies use the flat rate system, combining it with another rate system for billing users whose demand for wastewater service is variable. Costs are distributed to these users on an exception basis utilizing a service charge concept that more fairly reflects usage.

Other Service Charge Bases

Other bases (e.g. number of sewer connections, size of sewer connections, number and type of plumbing fixtures) may be used for distributing costs. Since their relationship to the amount of wastewater actually contributed to a system is indirect, these methods are used in situations where no other system can feasibly be implemented.

OTHER DISTRIBUTION CONCEPTS

The guiding principle in determining fair and equitable charges is to distribute costs on the basis of use, need, and benefit derived from the system. Since facilities are constructed for both present and future users, a percentage of costs is often distributed to future users and property owners. The two vehicles used are joining fees and property taxation (ad valorem).

Joining Fees

Joining fees are one-time charges billed to users at the time they connect to the system. Joining fees represent repayment of part of the costs incurred in constructing and financing the wastewater facilities. The portion of construction costs most closely associated with joining fees is excess capacity costs, which were incurred to allow new users to join the system without creating any overflow or over-capacity problems.

For the MDC, joining fees can be considered a method for collecting excess capacity costs. Statistics relating to tapping permits issued at the community level provide sufficient data for determining the amount due from a community. Tapping fees may also be structured according to type of user, permitting joining fees to account for various types of new joiners as well.

When a community joins the system, its joining fee is derived by multiplying an actual or estimated number of connections (by class of user) by a flat charge per connection. It is significant that joining fees may discourage a community from joining the system, to the detriment of surrounding communities.

Property Taxation

Property taxation is another method used to distribute specific cost elements within a community. Capital costs can be distributed to property owners to reflect the increase in property values that often accompanies construction of wastewater facilities.

The major benefit of property taxation is its ease of implementation and administration. Of further benefit to those assessed is the fact that property taxes are deductible for federal income tax purposes.

Ad valorem taxation is considered an appropriate and equitable method for distributing excess capacity costs. Some agencies and municipalities use both ad valorem taxation and service charges to distribute costs. Under this combination system, users pay current service costs through service charges, and property owners pay excess capacity costs through ad valorem taxes.

BILLING MECHANISMS

Once rates have been determined, a billing mechanism must be developed to convert those rates into user charges. The billing mechanism may either be incorporated into an existing water billing system or established independently.

Existing Water Billing System

The utilization of an existing water billing system is a common means of billing for wastewater treatment services. Under this approach, the wastewater charge is included in the bill for water services either as a flat charge or based on water usage. Computerization provides substantial flexibility in incorporating these "piggy-back" billing systems at low cost.

Utilizing an existing billing system is advantageous when the bill can be computed simply. However, when a fixed or flat rate is not appropriate, an independent billing system must be implemented.

Independent Billing System

An independent billing system for wastewater treatment services is usually administered by the wastewater entity providing services. Wastewater charges are individually computed and mailed directly to each user. Wastewater entities utilizing independent billing systems generally provide local collection services in addition to treatment services.

An independent billing system is most suitable for rendering more complex bills. For example, an industrial surcharge system that relies on wastewater samples and the application of a formula requires explanatory notations to the user. Accordingly, it is more appropriate for the user's wastewater treatment services to be billed separately from water consumption.

EVALUATING ALTERNATIVE BILLING CONCEPTS

An evaluation of alternative billing concepts must consider the present sytem of billing and collection. For example, if converting from a property taxation method to a service charge system will place a substantial burden on participating municipalities, the regional agency may decide to implement retail billing. A decision to adopt water consumption as a basis for

billing must necessarily consider present water biling systems and procedures, the existence of meters to measure water usage, and the capabilities of these systems to incorporate wastewater service charges.

BILLING FREQUENCY

An agency must determine the frequency with which it will bill users. Considerations include the availability of information, agency's cash needs, cost of billing, system availability, and amount of bill (e.g., annual bill of $100 may prove more difficult to collect than quarterly bill of $25).

SUITABLE ALTERNATIVES FOR CHARGING

It is unlikely that a single billing concept is appropriate for all participating municipalities. Data from some service sectors will be neither available nor reliable and some users will protest the concepts utilized. In anticipation of opposition, the agency must prepare to offer suitable alternatives.

ENFORCEMENT CAPABILITIES RELATED TO REVENUE SYSTEMS

An agency's ability to collect charges and enforce payment is an important factor in the design of a revenue system. Collection and enforcement powers not only ensure that the agency will be able to meet its cash needs, but are necessary to determine an interest rate in bond offerings and bank borrowing.

Enforcement capability will depend greatly on the role of the regional agency in billing for services. If it chooses the wholesaler approach, several methods for ensuring against default by the community are available. Inter-municipal agreements may be used to delineate the responsibilities of each party and to detail the methods available to the regional agency for enforcing payment. Contracts may include provisions for payment in advance, minimum annual payments, and minimum payments throughout the term under contract.

Enforcement of inter-municipal contracts must be supported by agency powers and capabilities, either incorporated within its charter or contractual. Such powers may include the ability to levy and collect taxes on all property within the community, and the right to curtail services (although such action may be impractical).

E. FRAMEWORK FOR EVALUATING ALTERNATIVE APPORTIONMENT, ALLOCATION, AND DISTRIBUTION CONCEPTS

While analysis of use, need, and benefit provides a sound conceptual framework for developing methods for apportioning, allocating, and distributing wastewater treatment costs, the overall framework within which these methods must be developed involves consideration of several additional factors, including:

- external influences such as federal laws and rising costs;
- service area characteristics, including physical size, number of users, number and location of facilities, and age of system;
- capabilities of service area systems for measuring, sampling, and billing; and
- evaluation criteria.

Together with use, need, and benefit analysis, these factors constitute the framework within which methods for apportionment, allocation, and distribution of wastewater treatment costs must be developed. A diagram of this framework is presented in Exhibit V-4.

Before these factors are discussed in detail, however, current procedures for dividing costs among MSD communities should be reviewed to establish a reference point for comparing alternative concepts.

CURRENT PROCEDURES

Current procedures for dividing costs among MSD communities (comprehensively developed in Chapter II, Section A) are based on two major costs elements: operation and maintenance costs and debt service costs.

The MSD's operation and maintenance costs reflect the costs incurred in providing wastewater treatment services on a daily basis, as well as improvement and replacement, engineering, and administrative costs. (The Metropolitan Sewerage Fund's chart of accounts for operations and maintenance is presented in Exhibit V-5). The MSD's debt service costs include the annual amount of principal and interest due on outstanding debt issued to finance the construction of treatment facilities.

EXHIBIT V-4

DECISION FRAMEWORK FOR DESIGNING AN APPORTIONMENT, ALLOCATION AND DISTRIBUTION CONCEPT

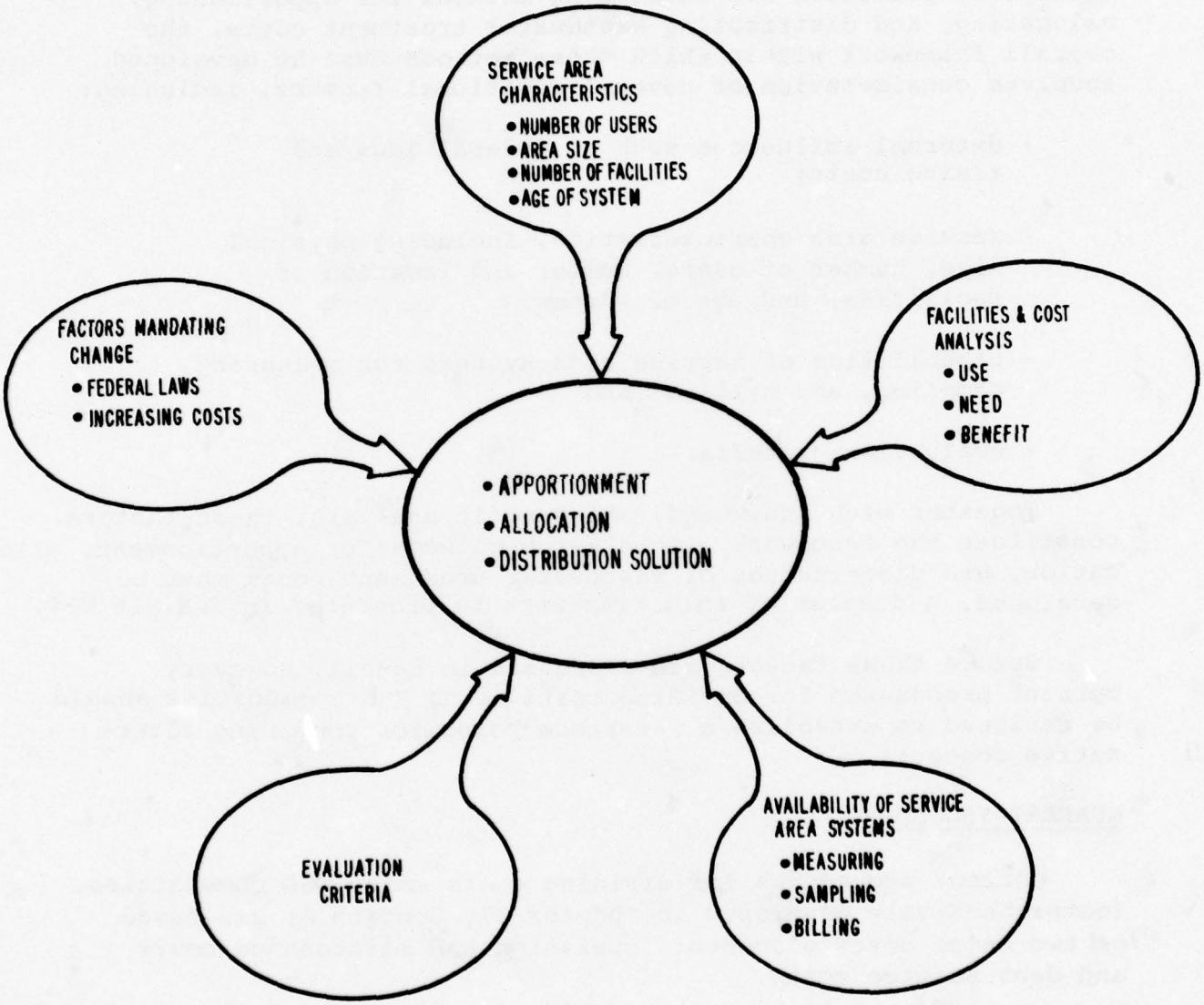


EXHIBIT V-5

CHART OF ACCOUNTS

OPERATION AND MAINTENANCE

Account Number	Account Name
2430-0100-01	Salaries - Permanent
2430-0100-02	Salaries - Other
2430-0100-03	Services - Non-Employees
2430-0100-05	Clothing
2430-0100-06	Housekeeping Supplies and Expenses
2430-0100-07	Laboratory and Medical Supplies and General Care
2430-0100-08	Heat and Other Plant Operations
2430-0199-09	Farm and Grounds
2430-0100-10	Travel and Automotive Expenses
2430-0100-11	Advertising and Printing
2430-0100-12	Repairs, Alterations and Replacements
2430-0100-13	Special Supplies and Expenses
2430-0100-14	Office and Administrative Expenses
2430-0100-15	Equipment
2430-0100-16	Rentals

Neither of these cost elements is on the basis of use characteristics (e.g., flow, BOD) since MDC has not in the past been involved in distributing costs at the user level. Operation and maintenance costs are apportioned solely on the basis of population, with a community's share determined by applying its percentage of the total population in the MSD to the total operation and maintenance costs for all facilities in the MSD. (For partially sewered communities, the population of only the involved portion of the community is considered in determining its apportionment percentage.)

Chapter 92 of the General Laws specifies that debt service costs are to be divided as follows:

- Debt related to sewers and sewerage works authorized prior to December 31, 1958 and on any debt incurred after January 1, 1958 for the completion of construction authorized by Chapter 645 of the Acts of 1951 as amended, and for debt incurred for the construction of disposal works, shall be paid by all the cities and towns belonging in whole or in part to the MSD. The aggregate capacity of municipal sewers of each municipality divided by the total capacity of all municipal sewers determines the proportion to be paid by each municipality.

- Debt service costs attributed to the following are borne by the municipalities benefited:

  - extension sewers to provide service for additional communities;

  - sewers to provide additional service for one or more municipalities; and

  - relief sewers.

The costs apportioned to municipalities represent the extent of MDC's involvement in distributing costs. Allocation and distribution to users are performed by each individual community.

EXTERNAL INFLUENCES

While MDC's role in cost distribution has been minimal in the past, the external influences of federal requirements and rising costs suggest that its role will expand significantly in the future.

Federal Requirements

P.L. 92-500 provides generous grants covering as much as 75% of the cost of treatment works; however, grant provisions delineate recipients' responsibilities relating to cost distribution. Provisions that specifically deal with the present method of dividing costs relate to the implementation of user charges and an industrial cost recovery system.

- User Charges - P.L. 92-500 states that user charges must include at least the operation and maintenance costs of the service provided, relate to flow, and be proportionate to each user's share.

- Industrial Cost Recovery - Preliminary guidelines stipulate that industrial discharges be monitored and that industrial cost recovery be based on actual flows as a percentage of design flows.

Rising Costs

The future cost of providing wastewater treatment services is expected to rise substantially as higher treatment standards are enforced. As a result of higher costs, it is anticipated that both muncipal leaders and users of the system will grow increasingly concerned with distribution methods.

At the municipal level, officials will undoubtedly be interested in the method used for apportioning costs among municipalities. It is likely that they will represent the interests of large industrial users within their community boundaries, to protect the community against the loss of tax revenues that would result if industries were to relocate due to disproportionately high treatment cost or tax assessments.

Large industrial users are in turn likely to focus their attention not only on the methods and assumptions used for apportioning and allocating costs, but the methodology used in analyzing the cost of providing services. Some may justifiably demand annual cost reviews and audits.

As a result of federal requirements and rising costs, the methods currently used for dividing costs among communities, users, and non-users must change. Specifically, user charges and an industrial cost recovery system will have to be implemented in MDC's service area.

To implement user charges and/or a cost recovery system, charge structures that properly reflect the proportionate use and benefit derived by municipalities, users, and non-users must be developed. While a sound charge structure can be developed through an analysis of use, need, and benefit, such analysis will require increased involvement by MDC in the following areas:

- at the community level, to develop usage data by community and class of user, monitor and measure discharges of large users, and maintain or supervize user charge systems; and
- use, need and benefit analysis to ensure proportionate distribution of costs among users and non-users.

SERVICE AREA CHARACTERISTICS

Wastewater treatment costs can be apportioned, allocated, and distributed properly only on the basis of information regarding the amount of use and benefit derived from the system. The degree of analysis and the methodology for measuring or estimating use and benefit derived are directly related to several characteristics of the service area:

- Physical Size - The service area's physical size directly affects the ability of a single agency to provide the personnel and equipment required to collect information concerning use
- Number of Users - The number of users significantly affects both the quantity and quality of information that must be collected to determine use. It is often advantageous for a system servicing numerous users to estimate use for a large percentage of users and to deal with those remaining on an individual basis.
- Number and Location of Facilities - The number and location of facilities operated by the service provider has an obvious impact on both cost analysis and administrative requirements involved in maintaining cost apportionment records. The administrative burden of analyzing costs by specific facility may exceed any anticipated benefit.
- Age of System - The MSD is one of the oldest metropolitan sewerage systems in the United States. As a result, the flow passing through interceptors in some areas cannot be traced to its point of origin. Hence, costs for some older facilities cannot be apportioned to benefiting communities because those communities cannot be specifically identified.

CAPABILITIES OF SERVICE AREA SYSTEMS

Another important factor to be considered in the development of apportionment, allocation, and distribution concepts is the capabilities of present systems either in the service area or within MDC that can perform measuring, sampling, and billing functions.

- Measuring - Where systems capable of direct measurement (e.g., a meter installation at the point of connection between interceptor and local sewer) do not exist, usage must be estimated (e.g., assumption made that the use of water among individual classes of users does not vary significantly and that amount discharged is proportionate to that entering premise).

- Sampling - Sampling is necessary when the strength of the wastewater discharged to the system by a user is required for billing purposes. A sampling system includes manpower, sampling equipment, vehicles, and laboratory facilities for analyzing samples.

- Billing - A billing system, which prepares a bill for the amount of service purchased by a user, significantly reduces the amount of work required in implementing a user charge system.

EVALUATION CRITERIA

The following seven criteria have been developed to serve as standards in evaluating methods of cost apportionment, allocation, and distribution.

Criterion 1 - Effectiveness

Effectiveness is defined as the ability to produce designated results with a minimum expenditure of time and money. In addition, effectiveness characterizes a procedure or methodology's ability to accomplish a specified task or objective.

Criterion 2 - Manageability

Manageability relates to the administrative requirements for implementing and managing a system of cost apportionment, allocation, and distribution. It considers the various organizational requirements and responsibilities of agencies involved in administering the system and their necessary interfaces.

Criterion 3 - Consistency With Federal Requirements

Consistency with federal requirements measures a particular recommendation in terms of its agreement with published federal requirements under Public Law 92-500. While these regulations have not been specifically defined for large metropolitan service districts, it is possible to judge a recommendation's consistency based on an interpretation of published data.

Criterion 4 - Equitability

A subjective judgement, equitability compares present methods for dividing costs among municipalities with the anticipated financial impact of alternative concepts.

Criterion 5 - Promotes Resource Management

A recommendation may be viewed in terms of its ability to promote effective resource management. For example, charges for wastewater services that are based on water consumption discourage wasteful use of water, and charges for water infiltrating through a community's collection system encourage that community to repair its system.

Criterion 6 - Political Feasibility

Political feasibility represents a recommendation's degree of acceptance by both political decision-makers and citizens within the MSD. While political feasibility is difficult to assess until a concept is formally presented to the citizens, it can usually be estimated realistically.

Criterion 7 - Comprehensiveness

Comprehensiveness assesses whether a recommendation or plan properly considers all classes of users and non-users who may benefit from the existence or provision of wastewater services.

Each recommendation relating to the apportionment, allocation, and distribution of wastewater charges will be evaluated on the basis of those criteria deemed applicable to its particular features.

F. ANALYSIS AND RECOMMENDED ALTERNATIVES

Based on a detailed review of all the methods available for apportioning, allocating and distributing wastewater treatment costs, and within the context of the conceptual framework discussed in Section E, several recommendations were formulated relating to:

- cost analysis;
- apportionment;
- sub-apportionment;
- allocation;
- distribution; and
- billing

Many of the recommendations provide the option of adopting alternative methods for performing an activity or function. Accordingly, each recommendation should be thoroughly reviewed and discussed to establish a basis for selecting the most appropriate and feasible alternative.

COST ANALYSIS

In developing recommended alternatives relating to cost analysis, PMM&Co considered the following:

- federal regulations for developing user charges;
- feasibility of subjecting existing cost structure to analysis ; and
- construction schedules for proposed projects.

FEDERAL REGULATIONS FOR DEVELOPING USER CHARGES

In accordance with federal regulations, user charges must be based on "parameters" which directly affect operation and maintenance costs. "Parameters" are interpreted to mean any significant pollutant that the wastewater treatment entity is required to remove. Operation and maintenance costs must include a provision for replacement costs for plant equipment that must be replaced prior to the completion of a treatment facility's service life.

Under present regulations, debt service costs need not be included in a user charge system and may be apportioned and distributed on the basis of property valuation.

FEASIBILITY OF SUBJECTING EXISTING COST STRUCTURE TO ANALYSIS

PMM&Co reviewed the existing structure of operation and maintenance and debt service costs for MDC,as well as the system used to account for the two cost elements. Recordkeeping for operation and maintenance costs is coordinated at MDC headquarters, and then forwarded to the State Controller's Office. Records provide a breakdown of total operation and maintenance costs for each facility operated and maintained by MDC, by major account classification.

Accounting for debt service costs is handled at the state level. Bonds authorized and outstanding do not specifically relate to the facilities constructed with the borrowed funds. Although it is possible to trace the statutory authorization

(by chapter and act) for each outstanding bond, this information is insufficient to relate specific facilities to the timing and issuance of bonds used in their financing.

CONSTRUCTION SCHEDULES FOR PROPOSED PROJECTS

In reviewing the preliminary construction schedule, it was recognized that treatment efficiencies will change during the period of time over which the proposed projects are scheduled to be constructed. Since cost analysis requirements will change as treatment efficiencies change, the cost analysis required for primary treatment differs from that required for secondary and advanced treatment.

RECOMMENDATIONS

The overall objective in developing recommended alternatives for cost analysis was to develop a structure that would uniformly apply to the analysis of all facilities, both those presently operated and maintained and those proposed for the future service area. Accordingly, the following recommendations were proposed for discussion.

RECOMMENDATION #1 - ANALYZE OPERATION AND MAINTENANCE COSTS

Operation and maintenance costs reflect the actual day-to day costs of providing wastewater treatment services. To divide them among recipients of wastewater treatment services, these costs must first be related to wastewater characteristics. PMM&Co recommended that operation and maintenance costs be analyzed in terms of wastewater characteristics, such as flow, suspended solids, chlorine demand, and biochemical oxygen demand.

RECOMMENDATION #2 - RELATE ALL DEBT SERVICE COSTS TO FLOW

It is administratively difficult to relate debt service costs to wastewater characteristics. Additionally, in large regional or metropolitan service areas, bond funding may be authorized for a group of interrelated facilities (e.g. interceptors, pumping stations, treatment plants) to be constructed

over an extended period of time. Bonds are sold to finance partially completed facilities, with payment to begin before facilities are completed and operational. Since it is not possible to relate specific bond issues to a particular facility included in a project, it is not feasible to relate existing debt service costs to individual facilities. An analysis of actual debt service costs that considers flow and strength characteristics not only involves significant judgement, but requires excessive administrative effort.

As a result, PMM&Co. recommended that debt service costs not be analyzed and associated with any wastewater characteristics other than flow. Associating all debt service costs with flow would eliminate much of the judgment and reduce the administrative work involved in analyzing debt service costs.

RECOMMENDATION #3 - RECOGNIZE EXCESS CAPACITY AS A SEPARATE COST ELEMENT

PMM&Co. recommended that MDC strongly consider recognizing excess capacity built into wastewater treatment systems as a separate cost element. In smaller systems, related costs can thus be apportioned to future users and reimbursed through joining fees. In larger systems that are constantly undergoing improvement, it is administratively difficult to maintain a joining fee structure that relates to the actual cost of providing capacity for a new user. PMM&Co. therefore recommended that property owners be identified as a class that benefits from the provision of excess capacity.

EVALUATION OF RECOMMENDATIONS BASED ON CRITERIA

The following criteria apply to the cost analysis recommendations:

- effectiveness;
- manageability;
- consistency with federal regulations; and
- promotes resource management.

Effectiveness

The purpose of analyzing wastewater treatment costs is to associate them with wastewater characteristics. This association permits distribution of costs to users of the system in proportion to their contribution. Since analysis of operation and maintenance costs will achieve this objective, it must be judged effective.

Analysis of costs as recommended will enable the agency to distribute wastewater treatment costs on the basis of contributed flows and strength characteristics. The analysis will also provide the data required to construct industrial surcharges. Lastly, the recommendation provides for the separate identification of excess capacity costs, which permits apportionment to beneficiaries.

Manageability

Limiting the analysis of costs to operation and maintenance costs significantly reduces the administrative burden associated with cost analysis. Analysis of operation and maintenance costs can be performed within a reasonable length of time, thereby assuring the timely availability of cost analysis data necessary for implementing user charges.

Consistency with Federal Regulations

PMM&Co's recommendations for cost analysis agree with federal requirements which specify that operation and maintenance costs must be recovered through service charges that are proportionate to wastewater treatment service usage.

Promotes Resource Management

Analyzing operation and maintenance costs according to flow and strength characteristics will permit the development of charge structures that relate costs of wastewater services to usage. This relation of charges to usage or strength will provide some incentive to conserve water resources and limit the discharge of certain waste characteristics.

APPORTIONMENT

The apportionment of costs among the political entities constituting a metropolitan service district must be based on an analysis of need and benefit. While such analysis is beyond the scope of this study (as well as beyond the capabilities of any single organization) PMM&Co. assessed the various apportionment methods in terms of the Metropolitan Sewerage District's situation and requirements.

APPROACH TO DEVELOPING APPORTIONMENT RECOMMENDATIONS

PMM&Co. considered each apportionment concept separately, within the context of the service area's physical features and characteristics, MSD's underlying principles and evolution, and the evaluation criteria developed.

Service Area's Physical Features And Characteristics

The following features and characteristics of the service area were considered:

- Number of Facilities - MDC maintains two large primary treatment plants, eleven pumping stations, 225 miles of interceptors, and one storm detention facility. It is not possible to identify the specific communities that each of the facilities serves due to the age of some of the facilities, the evolutionary expansion of the service area, and the lack of complete records.

- Population Density - In some areas within the MSD, it is not possible to associate the services of specific facilities with communities. While part of the problem relates to the commingling of the old Boston Main Drainage System with facilities constructed and operated by MDC, population density is another factor. Several portions of the service area are too densely populated to determine not only how many users are connected to a facility, but also which communities are serviced.

- Drainage Basin - All communities presently within the MSD or recommended to join the future MSD line within the same drainage basin. Since these communities are physically related by their common topographical features, physical solutions to wastewater problems for individual communities do not differ significantly from those for neighboring MSD communities.

- Number of Communities - MDC is one of the oldest and largest metropolitan wastewater service agencies in the United States. It presently services the wastewater needs of 43 municipalities, with eight additional

fringe communities expected to join. It would be administratively difficult to divide a service area as large as that of MDC into sub-service areas, as the concept of apportionment on the basis of need requires.

Metropolitan Service District's Underlying Principles and Evolution

The following aspects of MSD's underlying principles and evolution were considered in analyzing the application of the concepts of need and benefit

- Evolutionary Expansion - Since many facilities are shared facilities, an analysis of need would have to be performed whenever a new community is accepted into the district. As many as eight communities are expected to join in the future.

- Purpose of Uniting - The original purpose of uniting the communities in the metropolitan area was to permit a joint approach to planning, constructing, and operating wastewater treatment facilities. Accordingly, planning focuses on solutions that address the wastewater needs of the entire metropolitan area rather than the individual communities included.

- Planning considerations (discussed in Section B) that extend beyond the boundaries of individual communities include:

    - cost of alternative solutions;
    - environmental considerations;
    - economic considerations; and
    - social considerations

ALTERNATIVES FOR DIVIDING COSTS AMONG MUNICIPALITIES

Two alternatives for dividing costs among municipalities were evaluated.

- Alternative I - Perform an analysis of need for all present facilities operated by MDC and recommended future projects. Based on the results of the analysis, apportion facilities and their related costs to specific communities.

. Alternative II - Perform an analysis of benefit derived based on the metropolitan service area as a physically interrelated entity, assigning benefits from all facilities (present and future) to all communities within the MSD.

Alternatives I and II were assessed in terms of the evaluation criteria selected; a summary is presented in Exhibit V-6.

CONCLUSION AND RECOMMENDATION

Based on the evaluation of Alternatives I and II, in terms of the criteria selected, and in recognition of the physical features of the MSD and the fundamental purpose for which the district organized, PMM&CO. concluded that Alternative I is not an appropriate cost apportionment procedure for the MSD. However, the unique features of need analysis upon which Alternative I is derived should not be overlooked. Since need analysis represents a totally objective means of viewing the cost apportionment problem, its application may at times be more relevant than that of benefit analysis.

Recommendation

PMM&Co. recommended that Alternative II be considered the procedure for apportioning costs among participating municipalities. This recommendation is based on the characteristics of that alternative which substantially meet all the criteria developed to evaluate alternative procedures. Prior to final acceptance of this recommendation, however, MDC should discuss its merits with EPA officials to ascertain whether acceptance and implementation of the recommendation would meet grant requirements under P.L. 92-500 (see Appendix V-1).

EXHIBIT V-6

Assessment of Apportionment Alternatives

In Terms of Evaluation Criteria

Criteria	Alternative I	Alternative II
Effectiveness	Considerable administrative time and money would be required to implement Alternative I. The results of needs analysis would be highly judgmental for some present facilities.	Alternative II reduces the administrative requirements of cost apportionment. Considering the physical characteristics of the service area, it seems to be a more suitable approach than Alternative I.
Manageability	It would be difficult to analyze each facility on the basis of need and apportion its costs to the respective communities. Numerous facilities would have to be reanalyzed each time a new community joined the MSD. An extremely sophisticated cost accounting system would have to be maintained. It would not be possible to apportion the existing debt service costs because bond sales are not traceable to specific projects.	This alternative proposes that the costs of all facilities and operations be shared by all communities in the MSD. For a service district as large as that of the MSD, in terms of both the number of participating communities and the extensive number of facilities operated and maintained, Alternative II is considerably more manageable than Alternative I.
Consistency with Federal Requirements	Although federal requirements regarding cost apportionment for regional metropolitan service districts are vague, they imply that facilities and costs should be apportioned on the basis of need. This implication is derived from PMM&Co's interpretation of the federal government's requirement that user charges be based on the proportionate flow contributed to treatment works. Based on this interpretation of "proportionality," PMM&Co concludes that Alternative I agrees with federal requirements for determining user charges.	Alternative II represents a reasonable approach to apportioning costs in a large metropolitan service area. However, the application of this alternative may not be in conformance with federal grant requirements specified under Section 204 (b)(1) of the Federal Water Pollution Control Act Amendments of 1972 and related guidelines issued August 21, 1973, "Grants For Construction of Treatment Works," Appendix B (f)(1). (See Appendix I for discussion.)
Equitability	Reapportioning existing MSD facilities in accordance with Alternative I would involve reassignment of cost responsibilities to individual communities based on need. This would result in a significantly different cost apportionment than that currently in use. Considering the future of the present service area and the facilities operated by MDC, the considerable judgment that would be involved in apportioning on the basis of need might result in an unfair division of costs. Further, since specific need is only one of many factors considered in planning and constructing wastewater treatment facilities for a metropolitan service area, PMM&Co judges Alternative I as not being a fair method for dividing costs among municipalities.	Alternative II would result in a proportionate division of costs among participating communities because costs would be shared by all communities in the MSD. This procedure is considered more equitable than that proposed under Alternative I since it considers all factors influencing wastewater treatment services in a metropolitan service area.

EXHIBIT V-6 (Cont.)

Promotes Resource Management	This criterion judges the incentive a procedure provides users to conserve resources and for communities to maintain local facilities in good working condition. If coupled with a good system of measurement, Alternative I would undoubtedly promote resource management because it relates the specific need of a community to the cost of servicing that need.	Under this procedure for apportioning costs, little incentive is offered to conserve resources or repair local facilities. However, this criterion may be satisfied in other procedural stages of cost allocation and distribution.
Political Feasibility	Assuming that the current procedure for apportioning costs in the MSD reflects the public's will, Alternative I is not politically feasible.	Alternative II is judged to be a politically feasible solution for apportioning costs since it closely resembles current procedures.
Comprehensiveness	Alternative I is not comprehensive because it does not acknowledge the environmental, social, and economic benefits of wastewater treatment facilities, nor does it reflect other considerations (besides needs analysis) that characterize the decision-making process in planning, constructing, and operating a metropolitan wastewater treatment system.	This alternative meets the criterion of comprehensiveness as it recognizes the numerous factors involved in providing metropolitan wastewater services.

SUBAPPORTIONMENT

Subapportionment is the means by which the costs of a wastewater treatment system are divided among various political entities. Since PMM&Co. recommended that all facilities be viewed as providing benefit to all communities, both operation and maintenance and debt service costs are considered joint costs to be subapportioned to the various political entities constituting the service area.

To subapportion costs among communities, the service entity must develop data regarding the measured or estimated usage or benefit derived by various classes of users. This is accomplished most efficiently by subdividing the service area into its logical components, the communities. Within each community, information is uniformly gathered by class of user. Three general classes of users, residential, commercial, and industrial, are commonly identified, with subclasses identified as required.

EVALUATING ALTERNATIVE CONCEPTS

The service entity may either assume entire responsibility for gathering data, or delegate some responsibility to the participating municipalities. The ability to collect the necessary data will determine which concept is most appropriate for subapportioning costs. The following must be considered when evaluating and selecting alternative concepts.

Administration

One of the most important considerations is the amount of administrative work required to generate the needed data. For example, a method of subapportionment that is based on water usage depends upon the generation of water usage data for all users within the service area. Arrangements must be made with communities or private water purveyors for providing those data. Where exception meters are authorized, each of the meters must be read. The overwhelming administrative task of collecting, summarizing, and analyzing the usage data must be cost-justified before this method is adopted.

Availability and Physical Characteristics of Existing Systems

Another aspect of the service area that must be considered when selecting a subapportionment concept is the existence of systems and meters in the service area for measuring or estimating usage and benefit derived.

The physical characteristics of those systems must also be considered. For example, if wastewater is to be measured at the point of interception, meters are necessary at each connecting and intercepting point. Thus, the existing service system must be evaluated in terms of the practicality of installing meters at each intercepting point.

Existing Data

Another important consideration in selecting a subapportionment concept is the data available for use in subapportioning costs. Use of existing information will minimize the amount of time, effort, and money necessary to collect required information.

RECOMMENDATIONS

Of the subapportionment concepts developed in Section C, PMM&Co. determined that the following were not appropriate:

- Flow Measurement - Installing meters at the 1,800 connections to the interceptor system maintained by MDC would require a significant capital investment as well as additional operation and maintenance costs to maintain and read the meters.

- Water Consumption - This concept would involve extensive administrative work to develop the required data for all communities and users. However, as methods of metered water billing improve, the concept should be re-evaluated.

- Water Production - Although MDC's water division wholesales water to 30 of the 43 MSD communities, there are numerous independent sources of water within the MSD. These independent sources of water, coupled with the variety of uses of water in the MSD, reduce the viability of water production as an effective subapportionment concept.

- Area - Lack of uniformity in zoning laws and regulations in the MSD renders area an impractical basis for subapportionment.

The following alternatives are considered viable solutions to the problem of subapportioning costs. Accordingly, PMM&Co. recommended that they be considered and evaluated.

RECOMMENDATION #1 - UTILIZE RESIDENTIAL UNITS AND RESIDENTIAL EQUIVALENT UNITS

Subapportionment of costs on the basis of residential units and residential equivalent units requires that the service area be studied to determine the following:

- number of residential units within each municipality; and

- actual or estimated flow of wastewater discharged to the system by large industrial and commercial users (converted to residential equivalent units by dividing average residential water consumption per unit by the flows determined for each major industrial user).

Residential units information is available from census data. However, industrial and commercial flows must be developed with the assistance of users or water purveyors. While communities could be assigned responsibility for generating the necessary data, it is recommended that MDC become directly involved with the generation of data from large industrial users and maintain files on these users for later application to an industrial cost recovery system. Data would have to be collected from approximately 1,400 industrial users.

RECOMMENDATION #2 - UTILIZE POPULATION AND POPULATION EQUIVALENT UNITS

Similarly, two levels of data would have to be generated to utilize this concept: population of each municipality, and population equivalent units based on the amount of water or wastewater discharged to a system by large industrial and commercial users.

This concept is feasible to implement since census information provides much of the needed data. However, flows or estimated flows would have to be determined for industrial and commercial users; this significant task could be assumed by MDC or delegated

to the communities. It is recommended that the responsibility for collecting information from industrial users be assumed by MDC for later use in an industrial cost recovery system.

RECOMMENDATION #3 - QUANTIFY RESIDENTIAL OR POPULATION UNITS INTO FLOW AND STRENGTH CHARACTERISTICS

Cost analysis data developed regarding flow and wastewater strength and characteristics can be utilized for subapportioning costs. Since the concepts of residential and population units are both related to the amount of water consumed, usage data from either concept is quantifiable into flow.

To develop information relating to strength characteristics such as suspended solids or chlorine demand, the strength of domestic sewage per MGD is estimated and applied to the estimated MGD contributed by domestic and commercial users. However, for industrial flow, waste discharged must be sampled. The samples are analyzed to determine total strength contributed by these users, and these totals are added to the community totals for domestic and commercial waste to determine the total community loading.

RECOMMENDATION #4 - UTILIZE PROPERTY VALUE FOR EXCESS CAPACITY

Property value is another method that may be utilized to subapportion costs among the various municipalities in the MSD. PMM&Co.'s recommendation addressing cost analysis noted that excess capacity costs should be identified for the specific purpose of distributing these costs to classes in the service area who benefit from the existence of excess capacity. In the Joint Committee report, property owners as a class were identified as the rightful recipients of benefit from the existence of the excess capacity of wastewater treatment facilities, particularly that cost element identified as excess capacity. PMM&Co. concurred that excess capacity costs should be subapportioned to property owners on the basis of equalized real property value.

ASSESSMENT OF RECOMMENDATIONS BASED ON EVALUATION CRITERIA

A comparative assessment of the above recommendations on the basis of the evaluation criteria is summarized in Exhibit V-7.

EXHIBIT V-7

Comparative Assessment of Feasible Sub-Apportionment Concepts

	Strength Quantification of Flows	Property Valuation
Effectiveness	Achieves desired result of subapportioning costs on basis of strength characteristics. Sampling necessity will benefit ICR requirements and satisfy monitoring responsibilities of service entity.	Most widely accepted method of distributing costs of municipal services.
Manageability	Due to sampling requirements for determining industrial wastewater strength discharges, this concept would initially encounter administrative difficulties.	N/A
Consistency With Federal Requirements	Establishes more reliable data upon which to subapportion costs, rendering division of costs more reflective of actual usage in facilities.	Acceptable for dividing excess capacity costs.
Equitability	Permits division of costs based on flow and strength, reduces estimating, and fairly divides costs among municipalities based on strength of wastewater discharged.	Since benefits accrue to property owners through maintenance of or increases in property values, dividing excess capacity costs of the basis of property valuation is equitable.
Promotes Constructive Behavior	System of sampling and reporting on nature of wastes discharged may influence discharges since personal contact with users is involved. However, initial contact should be supported with user charges for maximum effect.	N/A
Political Feasibility	May or may not be politically feasible, depending on reaction from industry and support from each community.	Politically feasible.
Comprehensiveness	Provides additional degree of comprehensiveness to utilization of either residential or population concept.	Results in subapportionment of costs to non-users as well as users.

EXHIBIT V-7 (Cont.)

Comparative Assessment of Feasible Sub-Apportionment Concepts

	Residential and Equivalent Units	Population and Equivalent Units
Effectiveness	Achieves desired result of subapportioning costs on basis of flow estimates without substantial investment in measuring equipment. Further implementation of this concept may increase the efficiency of implementing user charges since costs can be easily related to a residential unit, which also represents a billing entity.	Achieves desired result of subapportioning costs on basis of flow estimates without substantial investment in measuring equipment.
Manageability	Administrative advantage of estimating flow for entire residential class. However, water usage data must be determined for commercial and industrial classes.	Also has administrative advantages. If water consumption for sanitary usage can be determined per capita, an estimate of the flows from commercial users could be estimated by determining commercial employment and applying per capita water statistics. Thus, the only class for which actual water usage or wastewater discharged would have to be determined would be the industrial class.
Consistency With Federal Requirements	Establishes proportionate usage and is thus acceptable under federal requirements.	Establishes proportionate usage and is thus acceptable under federal requirements
Equitability	Adjustment for discharges from commercial and industrial users permits fair distribution based on partly estimated and partly measured wastewater loading.	Adjustment for discharges from commercial and industrial users permits fair distribution based on partly estimated and partly measured wastewater loading.
Promotes Constructive Behavior	Contract with industrial and commercial users may initiate constructive thinking toward resource conservation. Although communities could be influenced at the apportionment level, this concept does not motivate a community to maintain its collection system in adequate repair because it does not consider ground water infiltration.	Initial contact with industrial and commercial users may be constructive. However, does not motivate municipalities to maintain facilities in adequate repair.
Political Feasibility	Politically feasible based on similarities with population concepts currently used for distributing operation and maintenance costs.	Politically feasible since currently used for dividing operation and maintenance costs.
Comprehensiveness	Estimates or measures flow from all users.	Estimates or measures flow from all users.

ALLOCATION

Allocation represents distribution of the sub-apportioned costs among the various classes of users and non-users within a community. Each user class' proportionate share of wastewater treatment costs is identified, and payment is collected correspondingly.

The information used for allocating costs is often the same information used for sub-apportioning costs. For example, when residential and residential equivalent units is used as a basis for sub-apportionment, information about usage is collected by class of user, and total units becomes the basis upon which costs are sub-apportioned. To allocate costs to the various classes within each community, both residential and residential equivalent units must be again used. The relationship between sub-apportionment and allocation information is shown in Exhibit V-8.

The example also illustrates the administrative and efficiency advantages of a single agency handling both sub-apportionment and allocation. PMM&Co. thus proposed the following recommendation for consideration.

RECOMMENDATION - RESPONSIBILITY FOR ALLOCATING COSTS AMONG CLASSES OF USERS WITHIN EACH COMMUNITY SHOULD BE ASSUMED BY MDC.

Allocation is a new responsibility for MDC. However, as new techniques and procedures are developed for sub-apportioning costs, efficiency dictates that a single agency assume responsibility for allocating costs by class of users. In performing its new responsibilities, MDC should utilize the information generated to determine the share of costs to be borne by each user class within each community.

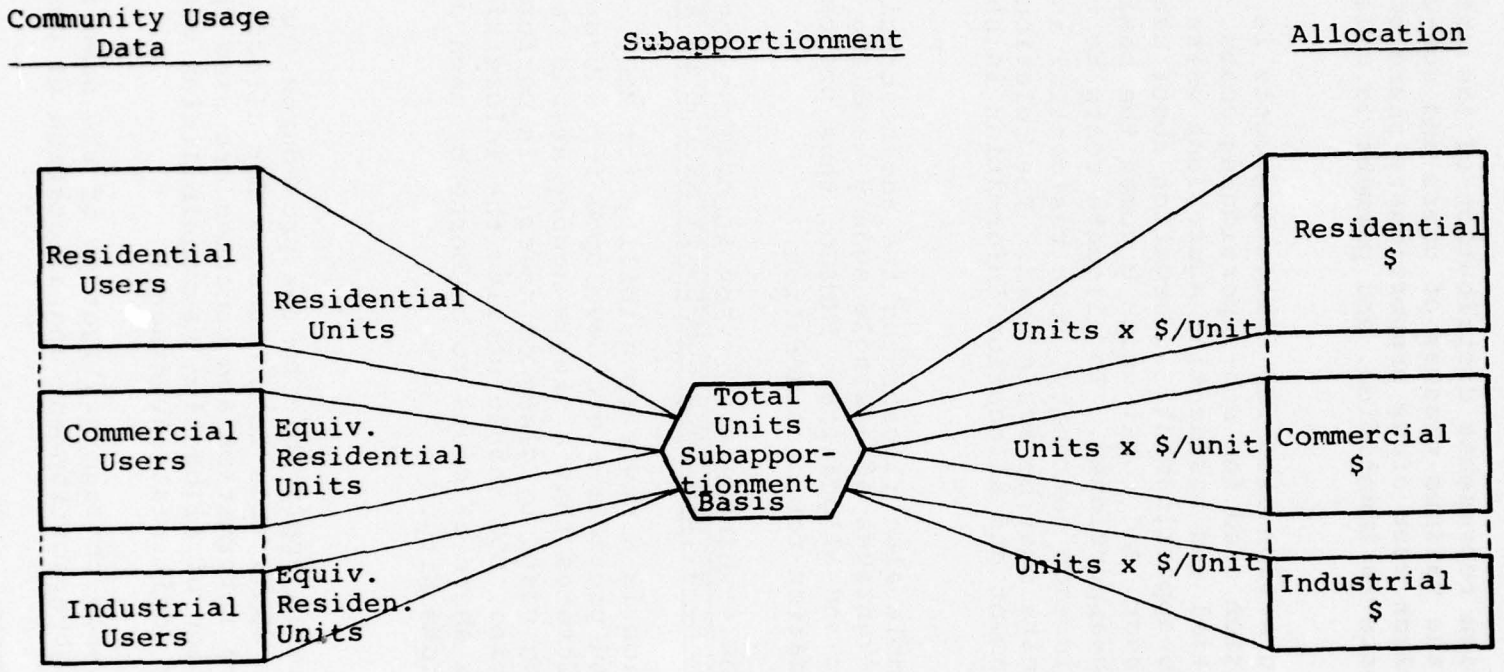
EVALUATION

The criteria applicable to the procedures for sub-apportioning costs are applicable to procedures for allocating costs since the same information and concepts are used for both. However, MDC's assumption of allocation responsibilities would result in the following additional advantages:

- efficiency through utilization of the same information for both sub-apportionment and allocation of costs;
- uniformity in distributing costs among communities; and
- increased control over distribution of costs to users.

EXHIBIT V-8

RELATIONSHIP BETWEEN SUBAPPORTIONMENT AND ALLOCATION



DISTRIBUTION

In conformity with the recommendations for analyzing, apportioning, sub-apportioning, and allocating costs, PMM&Co. recommended a combination of service charges and ad valorem taxation for distributing costs to users and non-users.

RECOMMENDATION #1 - INSTITUTE SYSTEM OF USER CHARGES

The system of user charges should be based on the following concepts:

- Metered Consumption - User charges should be flow-related and based on measured water usage for all residential, commercial, and industrial users.

- Flat Rates - Where flow-related user charges cannot be implemented, flat rates should be developed in proportion to estimated usage by class of user.

- Industrial Surcharges - Selected industrial users should be assessed a surcharge based on the measured or estimated strength of their discharged waste in excess of the average strength of domestic wastes. Industrial surcharges should reflect the degree of treatment the wastewater requires. Surcharges for the following elements should be considered:

  - Primary Treatment - Surcharges based on suspended solids and chlorine demand.

  - Secondary and Advanced Treatment - Surcharges based on suspended solids, cholorine demand, and BOD.

RECOMMENDATION #2 - ASSESS AD VALOREM TAXES TO ALL PROPERTY OWNERS IN THE MSD TO COVER EXCESS CAPACITY COSTS

ASSESSMENT OF RECOMMENDATIONS BASED ON EVALUATION CRITERIA

The above recommendations are assessed as follows on the basis the evaluation criteria developed in Section E.

- Effectiveness - The recommended distribution concepts would achieve the desired result of charging all users on the basis of usage or benefit derived.

- Manageability - Sampling and analyzing industrial wastes will create some initial administrative problems. MDC should begin by selecting large industrial users that utilize water as part of their production processes. Once a system of sampling and reporting is implemented and properly functioning, another level of users may be approached. This procedure should be continued until all large and medium sized industries are included in the surcharge system.

- Consistency with Federal Requirements - Both recommendations comply with federal regulations.

- Equitability - Each user is charged on the basis of measured or estimated contribution to the system.

- Promotes Resource Management - The recommended charge structures fully satisfy this standard when judged in terms of their impact on managing water resources and curtailing certain discharges to the system.

- Political Feasibility - Since flow-related charges are presently in use in some MSD communities, the recommendations seem to be politically feasible.

- Comprehensiveness - The recommended charge structure addresses all significant wastewater elements. Nonusers as well as users are charged in accordance with benefit derived.

BILLING

Billing is a mechanism for rendering service charges to specific users. The following recommendations specify mechanisms to be used and the entity responsible for administering the charges.

RECOMMENDATION #1 - ADAPT EXISTING BILLING SYSTEM UTILIZED FOR WATER SERVICE CHARGES.

RECOMMENDATION #2 - DIVIDE RESPONSIBILITY FOR BILLING USERS AS FOLLOWS:

- Responsibility of Municipalities - The municipalities should be responsible for implementing user charges for all residential, commercial, and small industrial users and billing these classes of users for flow-related charges.

- Responsibility of MDC - MDC should be responsible for ensuring that user charges are implemented and for overseeing their correct application. In addition, MDC should assume responsibility for billing selected industries for flow plus a surcharge for wastewater strengths discharged to the collection system after implementing a system of sampling and reporting for determining such surcharges.

EVALUATION

The above recommendations are evaluated on the basis of the following applicable criteria:

- Effectiveness - Utilization of existing water billing systems for wastewater service charges will achieve the desired result of implementing user charges while minimizing cost.

- Manageability - The dual billing responsibilities will reduce the administrative requirements of any single entity. Centralizing the surcharge system would permit the efficient utilization of special equipment required for sampling and analyzing wastewater discharge.

- Political Feasibility - MDC will require either statutory or contractual powers commensurate with its new responsibilities. Although the political acceptance of this new role is difficult to judge, the related efficiencies should prove compelling.

G. INDUSTRIAL COST RECOVERY

As defined by federal regulations, industrial cost recovery (ICR) is "recovery by the grantee from the industrial users of a treatment works of the grant amount allocable to the treatment of wastes from such users." ICR is a new administrative responsibility that has been assigned to wastewater service entities through passage of Public Law 92-500. While guidelines for the implementation of ICR systems, especially as they relate to multi-community service systems, are quite vague, the following general guidelines have been enumerated in recent federal publications.

ADMINISTRATION

The administrative requirements relating to the implementation of an ICR system can be summarized as follows:

- A cost recovery system must be based on the service area for a single facility.

- An approvable cost recovery system must include payments from any non-governmental user of publicly-owned treatment works identified in the Standard Industrial Classification Manual, 1972, Office of Management and Budget, which fall under the following divisions.

  - Division A - Agriculture, Forestry and Fishing

  - Division B - Mining

  - Division D - Manufacturing

  - Division E - Transportation, Communications, Electric, Gas, and Sanitary Services

  - Division I - Services

  Any user in these divisions may be excluded if it is determined that it will introduce primarily domestic wastes or wastes from sanitary conveniences. In addition, any industry providing a service normally provided in private residences may be excluded from cost recovery payments (e.g., restaurants, laundries, hotels, car washes).

- Industrial discharges must be monitored on a regular basis, and any substantial change in the strength, volume, or flow characteristics must be reflected in corresponding adjustment to the industrial user's share.

CALCULATION OF COST RECOVERY PAYMENTS

The following guidelines have been developed for calculating industrial cost recovery payments.

- Treatment Plants

  - An industrial user's share of the cost of a treatment facility should be based on all factors that significantly influence the cost of the treatment plant, excluding those associated with providing reserve capacity in the treatment plant that was not provided for that user.

  - Strength, volume and delivery flow rates must be considered.

    (Note: A recent unofficial publication addressing the calculation of ICR payments stated that at a minimum, an industrial user's share of costs could be based on flow as a percentage of the design flow of the treatment facility.)

- Sewer Projects - An industrial share must be based on its flow as a percentage of the total flow in the sewer.

- Exempt Projects - Infiltration/inflow correction projects, combined sewer correction projects, and stormwater collection and treatment projects are exempt from ICR payments.

All payments must be made at least annually. The recovery period should be equal to 30 years or the service life of the treatment work, whichever is less.

DISPOSITION OF COLLECTED AMOUNTS

The following guidelines apply to the disposition of collected amounts:

- Fifty percent of the recovered amount, together with any interest earned thereon, must be returned to the United States Treasury.
- Forty percent of the recovered amount, together with any interest thereon, must be used solely for grant-eligible costs of the expansion or reconstruction of the treatment works.
- No regulations govern the disposition of the remaining ten percent.

APPLICATION OF GUIDELINES TO MSD

The specific federal guidelines regarding implementation of an industrial cost recovery system are difficult to apply in a large multi-community service area such as the MSD. The following procedures present particular difficulties.

Cost Analysis

Federal guidelines require that an industrial user's share be based on all factors that significantly influence the cost of the treatment plant, exclusive of excess capacity. Accordingly, each treatment facility should be analyzed to determine the construction costs of the treatment plant by related wastewater characteristics such as flow, BOD, SS, and chlorine demand. This analysis is in addition to that which must be performed for operation and maintenance costs in determining service charges. These federal requirements for cost analysis place a significant administrative burden on regional and metropolitan wastewater service agencies responsible for operating and maintaining numerous treatment facilities.

Apportionment

Under federal guidelines, costs recoverable from a project must be calculated and recovered through consideration of the service area for each single facility. This procedure is similar to performing a need analysis for each facility and apportioning the costs to the communities for whose specific need they were constructed. The general disadvantages associated with a need analysis for determining user charges in a metropolitan service area also apply to a need analysis for apportioning costs for industrial cost recovery.

Cost Distribution

Once costs related to industrial cost recovery have been sufficiently analyzed, they must be distributed to all industrial users listed under SIC codes A,B,D,E & I. Measurement systems are thus needed to determine usage by all industries in the service area in terms of flow and strength characteristics. In some large service areas, strict compliance with these regulations involves sampling and monitoring the wastewater discharges of thousands of industries.

RECOMMENDED APPROACH

A general interpretation of the provisions for ICR in P.L. 92-500 indicates that wastewater treatment services should be conducted on a self-paying basis. Based on this assumption, an ICR system that meets the fundamental requirements of the Act with a minimum of clerical effort should be structured. PMM&CO. recommended that the approach to designing and implementing an industrial cost recovery system parallel the system used for analyzing, apportioning, and distributing costs. Accordingly, the following recommendations were submitted for consideration.

Recommendation 1 - Relate all industrial cost recovery charges to flow.

This would significantly reduce the administrative requirements necessary to maintain an ICR system and still meet minimum federal requirements.

Recommendation 2 - Recognize the general benefit provided by all facilities in the service area to all industrial users in the service area.

Costs applicable to ICR should be divided among all industries in the service area rather than the specific service area of each facility.

Adoption of this recommendation will also reduce the administrative requirements for implementing an ICR system. However, the recommendation does not meet federal requirements regarding industrial cost recovery, based on PMM&Co.'s interpretation of Section 204 (b)(1)(B) of the Federal Water Pollution Control Act Amendments of 1972 and the guidelines of August 21, 1973, "Grants For Construction of Treatment Works," Section 35.925-12. (See Appendix V-2.)

In consideration of the significant administrative burden associated with implementing federal ICR regulations, an official interpretation of federal ICR regulations as they apply to the Metropolitan Sewerage District should be requested. PMM&Co. cautioned that the MDC would qualify for grants available under the Federal Water Pollution Control Act Amendments of 1972 for sewage treatment projects only if the federal ruling is favorable.

Recommendation 3 - Distribute industrial cost recovery charges through a two-tiered distribution mechanism.

Such a mechanism could be structured as follows:

- Small Industries - Industries discharging less than a specified amount of wastewater would be charged on the basis of actual or estimated (water usage) flows.

- Large Industries - Large industrial users would be charged on the basis of flow and equivalent flow units, calculated by comparing the concentration of wastewater elements to the concentration found in domestic wastewater. Equivalent domestic wastewater flows for such concentrations would be determined and added to the measured or estimated flow of the industrial user.

Implementation of this recommendation would comprehensively distribute costs to all industrial users affected by ICR regulations. In addition, it would charge large industries for all significant factors affecting treatment costs while minimizing administrative requirements.

Recommendation 4 - Divide responsibility for billing ICR charges among communities and MDC.

Responsibilities would be divided as follows:

- Municipalities - Municipalities would assume ICR billing for small industries, incorporating these requirements into user charge billing mechanisms.

- MDC - MDC would assume responsibility for billing large industrial users, incorporating ICR charges into its industrial surcharge responsibilities.

CHAPTER VI

A. INTRODUCTION

B. RECOMMENDED STRUCTURE: MODIFIED METROPOLITAN DISTRICT COMMISSION

C. *IMPLEMENTATION PLAN: LEGISLATIVE PROGRAM*

A. INTRODUCTION

This section of the report provides a detailed description of the recommended alternative for wastewater management in the Boston Harbor - Eastern Massachusetts Metropolitan Area (EMMA). The alternative was selected from among the following five options which were carefully considered by the Technical Subcommittee:

- State agency combining the Metropolitan District Commission's (MDC) sewer function and the Division of Water Pollution Control's (DWPC) powers.
- Single-purpose regional district responsible only for sewage collection and disposal.
- Multi-purpose council of government coordinating service delivery for the entire metropolitan area.
- Modified MDC with administrative independence, providing greater responsiveness to the region served.
- State authority operating with complete autonomy, removed from state and local control.

Each of these options was geared toward the achievement of specified goals and objectives for areawide wastewater management. These goals were formulated on the basis of social, economic, cultural, and environmental values as well as in response to standards promulgated in the Federal Water Pollution Control Act Amendments of 1972 (P.L. 92-500).

P.L. 92-500 is a comprehensive federal law that influences every aspect of water pollution control and wastewater management. Each of the six basic functions (i.e., planning, financing, engineering/construction, operations, monitoring, and enforcement) of the management entity reflects the impact of that law. For example, the financing function reflects the availability of 75% federal funding for eligible project costs and the monitoring function responds to the need for stricter surveillance of discharges consistent with federal effluent limitations.

Following a series of public hearings and an extended period of deliberation, the Technical Subcommittee selected a modified MDC (Alternative D) as the recommended management structure. The rationale for this choice included an awareness that changes in a familiar and proven entity would be more easily accomplished and generate less political opposition than would a radical change

such as the assignment of responsibility to a different governmental level.

The modified MDC structure is designed to address the following major deficiencies in the existing intergovernmental wastewater network:

- fragmented and poorly defined authority and responsibility for wastewater management at all government levels;
- restrictive statutes, legislative controls, and administrative regulations;
- lack of sufficient opportunity for direct citizen participation in planning and policy formulation;
- trend away from MDC's "regional" identity as a holding company for cities and towns; and
- lack of flexibility to respond to new trends, conditions, or resources.

* * * * *

This section of the report is divided into two parts. The first describes the recommended alternative in detail, incorporating all changes to the original design proposed by the Technical Subcommittee, and the second contains the legislative program required to implement the recommended structure.

It should be noted that the descriptions of the management entity and the legislative program relate to wastewater management (e.g., sewage treatment and disposal responsibility) only and do not encompass MDC's water, parks, and police activities.

B. RECOMMENDED STRUCTURE: MODIFIED METROPOLITAN DISTRICT COMMISSION

The organization chart, Exhibit VI-1, depicts the functional responsibility to be assigned to MDC's Sewer Division under the recommended alternative. This functional, rather than structural, alignment is consistent with the basic management recommendation that the organization have the authority and flexibility to shape its internal structure in response to changing conditions.

The selection of this alternative by the Technical Subcommittee represents a significant step toward improved wastewater management. Major changes in the scope and magnitude of MDC's activities demand a management structure responsive to citizen needs and unobstructed by administrative and procedural constraints.

This part of the report is organized according to the following major headings:

- Summary of Key Points
- Policy Framework
- Management and Administration
- Functional Characteristics
- Areal Considerations

SUMMARY OF KEY POINTS

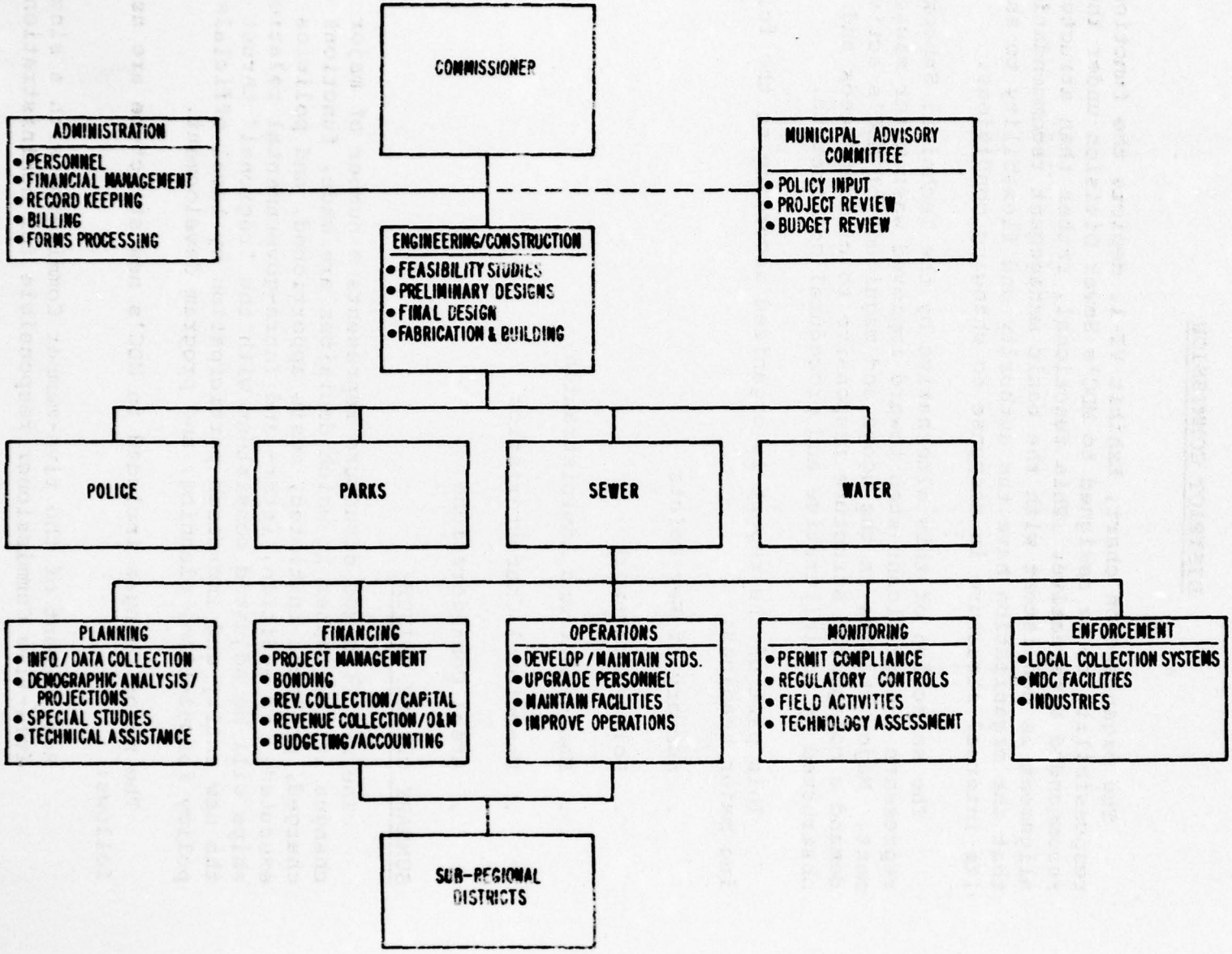
The modified MDC structure represents a number of major changes in the manner in which decisions are made, functions discharged, projects initiated, costs apportioned, and policies executed. In addition, inter- and intra-governmental relationships will be adjusted consistent with the "regional" thrust of the new entity and increased participation by local officials in policy formulation, planning, and program development.

The major changes included in MDC's new structure are as follows:

- Replacement of the five-member Commission with a single full-time Commissioner responsible for administration.

EXHIBIT VI-1

MDC FUNCTIONAL STRUCTURE



- Establishment of a Municipal Advisory Committee, a formalized structure comprising elected municipal officials and citizen members, to provide public input to MDC's decision-making process.

- Expanded engineering/construction capability consistent with the need to manage a facilities construction program representing $855 million in capital costs over the next 15 years.

- Closer relationship between MDC's professional staff and local personnel responsible for elements of the wastewater management network.

- Greater administrative flexibility and freedom from statutory restrictions, including matters related to personnel, budget approval and expenditure control.

- Re-definition of the Metropolitan Sewerage District's (MSD) boundary to include 51 communities, with authority for closer relationships (through contractual arrangements) with communities outside this area.

- Creation of sub-regional administrative units within MSD, to facilitate the development of unit costs, productivity measures, technological improvements, and more effective monitoring.

- Increased authority to promulgate and enforce regulations relating to local discharge into MSD's system of interceptors, trunk lines, pumping stations, and treatment plants.

- Heightened emphasis on monitoring to ensure compliance with permit standards and to provide a basis for evaluating the efficiency of plant operations.

- Direct responsibility for billing industrial users and preparing cost calculations, as input to municipal user charge systems.

These key points are representative of the changes and modifications in both MDC's statutory base and internal management. Each point will involve some resolution through the legislative process. More important, however, is the fact that without local support, prospects for even marginal change in the basic framework for wastewater service delivery and management are unlikely.

POLICY FRAMEWORK

State

The modifications recommended for wastewater management are designed to reaffirm MDC's regional character and build a closer relationship with municipalities. Nonetheless, several programmatic and policy linkages at the state level must be strengthened. Although the recommendations are directed toward providing administrative flexibility, they do not envision MDC as a totally autonomous agency whose independent actions are conducted without consideration of the numerous legitimate state policy interests. MDC will continue to be organizationally linked to state government through the Executive Office of Environmental Affairs (EOEA), the principal agency of the Commonwealth responsible for environmental policy. Consequently, MDC must adhere to EOEA policy decisions reached after review and comment from the communities of MSD, as expressed through their Municipal Advisory Committee. This vertical decision-making and policy formulation approach preserves MSD's regional integrity while ensuring that policy deliberations are conducted at a governmental level high enough to rationalize and negotiate among competing interests.

In addition to the vertical nature of policy making relating to environmental issues affecting MSD, several horizontal linkages within EOEA are critical to the proper functioning of MDC's wastewater management system. Most notable of these horizontal linkages is that with the Division of Water Pollution Control (DWPC). This agency, within EOEA's Division of Environmental Quality Engineering, has the major state role under P.L. 92-500 for planning, financing, monitoring, and enforcement activities (fully described in previous sections of the management report).

In brief, the state planning process (including the annual strategy, priority list and applicable basin plans) will establish the framework for MDC planning and engineering activities. DWPC's monitoring and enforcement authority will have a direct impact on the operations of MDC facilities. The financing role of DWPC applies to the 15% state share for wastewater facilities as well as its approval function for projects eligible for 75% federal funds. These relationships must be fully developed to ensure cooperation in all aspects of the wastewater management system. MDC should capitalize on its placement within the state structure by building a continuing relationship with DWPC and thereby ensure the level and flow of funds necessary to complete the capital construction project.

In terms of the policy framework within which MDC must operate, the procedural aspects of the financing function must be considered. The State Treasurer's role in marketing MSD bonds, assessing municipalities for their share of the annual debt service and operations/maintenance costs, collecting all receipts, and managing the entity's funds will continue over the course of the next several years. This will permit the first phases of the construction program to proceed smoothly and take advantage of the availability of federal funds under P.L. 92-500. Over the next decade, however, it may be advisable for MDC to assume some of the responsibility currently held by the Treasurer to ensure a predictable flow of funds and improve its control over more aspects of the financial management system.

Finally, the policy framework within which MDC decisions relating to wastewater management must be negotiated include both the Governor's Cabinet (Secretaries of 10 Executive Offices) and the Office of State Planning (OSP). As the Cabinet serves as a forum to arbitrate among competing policy, program and resource allocation considerations, it will consider water pollution control and wastewater management issues within a broader context and from a number of perspectives. The implication of OSP's mission to develop a land use plan for the Commonwealth are speculative at this time. It is expected, however, that efforts to identify areas for the application of growth management techniques will be undertaken as part of this land use planning activity. This could have an impact on the location and size of treatment plants, extent and mix of industrial and domestic flows, and configuration of wastewater treatment service areas.

Regional

In addition to the policy, planning, and program linkages required for state level coordination, the regional character of MDC necessitates an interactive relationship with the Metropolitan Area Planning Council (MAPC). Cooperation between MDC and MAPC, while essential to the long-term stability of the region, is particularly critical over the next two years as the MAPC develops the areawide wastewater management plan under Section 208 of P.L. 92-500. The implications of this study for MDC's construction program, including the legal, institutional, and financial aspects covered in the EMMA study, are significant.

MAPC's continuing responsibilities to prepare regional plans covering areas with a direct impact on sewage treatment and disposal also demand policy linkages between the region's planning

entity and one of its most important service providers. Economic development, housing, transportation, recreation, open space, and water supply are but a few of the functional plans which will affect and be affected by wastewater management activities.

MANAGEMENT AND ADMINISTRATION

The recommended institutional structure for MDC's sewage treatment and disposal activity encompasses a number of issues related to the overall management and administration of that entity. Three of the major concerns in this area are:

- Replacement of Commission Structure
- Provision for Municipal Advisory Committee
- Increased Administrative Responsibility

Each of these major issues represents a significant change from the current situation within MDC.

Replacement of Commission Structure

The recommended management alternative includes the replacement of the current five-member Commission with a single full-time Commissioner responsible for overall administration. The Commissioner will be responsible for providing policy leadership for the entire structure and ensuring coordination among MDC's basic program activities. The Sewer Division will be headed by a Director or Chief Engineer especially qualified by training, education, and experience to carry out the complex elements of wastewater management.

The elimination of the four associate Commissioners is recommended in order to focus accountability and responsibility on the individual directly concerned with policy at the agency level. The existing environmental policy framework is already fragmented and has resulted in a diffusion of the impact of citizen participation on MDC's wastewater planning, program development and policy formulation activities. A single Commissioner will provide a single point of entry for citizen participation and permit prompt resolution of conflict between competing interests.

The Commissioner will be appointed directly by the Governor, with a review procedure by the Municipal Advisory Committee. This modified "advise and consent" role provides a real opportunity for the citizens of the region, through their representatives,

to play an active role in selecting an individual capable of directing the entity in response to the needs of the region.

Provision for Municipal Advisory Committee

A Municipal Advisory Committee (MAC) composed of local elected chief executives and private citizens will play a major role in establishing policies for the overall management of wastewater by MDC. The public members of the MAC will represent each community in the expanded Metropolitan Sewerage District. The membership will be increased by the appointment of qualified private citizens who, through membership or employment in an association or profession directly related to environmental protection or wastewater management, can contribute materially to the issues under consideration. This would also include representatives from industry and labor as well as environmental advocates to insure some balance in the determination of issues affecting the region. The number of private citizen appointees will equal not more than one-half of the number of public members so that the total composition will be as close to 2/3 - 1/3 as practicable. The private citizens will be appointed by the Governor for staggered terms of three years to provide continuity and awareness of long-term goals. Each member will be a resident of the area served, with the Governor striving for a geographic distribution of individuals so that no single community is over-represented. The full membership of the MAC should be convened not less than three times a year or at more frequent intervals if required.

To provide for more complete participation by the MAC, an Executive Committee of nine members (six public members and three private citizens) will be selected by the full Committee to meet with the Commissioner on a monthly basis to review progress and recommend, where appropriate, alternative approaches to facilitate implementation.

The MAC will establish its own by-laws and rules of order, with MDC providing the professional and clerical staff support required for effective participation by the members. Examples of MAC's responsibilities include the following:

- Assist in implementing the construction program by participating in legislative and other public hearings, disseminating information to citizens of the area, and promoting greater understanding of the entity's mission by participating in other associations.

- Review and comment on rules and regulations to be promulgated by MDC relating to local collection systems, user charge administration, and other matters related to service delivery but excluding matters solely concerned with internal administration.

- Review and comment on proposed budgets and appropriations, and assessments and charges necessary for MDC's wastewater management programs.

- Submit recommendations regarding the admission of new members to MSD, including suggested joining fees, payment schedules, and voting status.

- Submit recommendations regarding systems improvements, special projects, improved procedures, etc. that promote effective wastewater management.

- Assist MDC in conducting, maintaining, and operating an areawide program of wastewater management through sewage treatment and disposal facilities adequate to achieve the social, economic, cultural, and environmental goals of the area.

- Exercise advisory powers and perform functions and responsibilities deemed necessary as provided by the by-laws of MAC.

MAC's function is consistent with the intent to create an awareness among MSD residents of the scope and cost magnitude of the services provided by MDC. MAC will play an advocacy role in which elected officials and interested private citizens, working in concert with MDC's professional and technical staff, will develop wastewater strategies, policies, and programs to provide the facilities needed for environmental protection.

Increased Administrative Responsibility

The new entity will be required to adopt a number of new administrative procedures and improve or modify current practices to conduct an efficient wastewater management program. Although administrative activities are described for each of the functions listed in subsequent sections of this report, three administrative matters require notation and description under this heading:

- Financial Management and Accounting

- Billing Systems

- Contract Monitoring and Project Control

- Financial Management and Accounting - The administrative requirements to carry out the financing program for construction of facilities and to ensure the continuing availability of funds to operate and maintain those facilities demand MDC's careful consideration. As the agency embarks on the multiple-project construction program, care must be taken to ensure compliance with all elements of federal regulations, including the provisions of Federal Management Circular 74-4, Cost Principles Applicable to Grants and Contracts with State and Local Governments, and Federal Management Circular 74-7, Uniform Administrative Requirements for Grants-in-Aid to State and Local Governments.

  It is critical that internal accounting control be established to identify EPA-eligible project costs. EPA general grant conditions provide that "the grantee shall maintain books, records, documents, and other evidence and accounting procedures and practices, sufficient to reflect (1) the amount, receipt and disposition by the grantee of all assistance received for the project, including both federal assistance and any matching share or cost sharing, and (2) the total cost of the project, including all direct and indirect costs of whatever nature incurred for the performance of the project for which the EPA grant has been awarded." Maintaining records and source documents and requiring contractors to comply with all provisions of grantee administrative procedures will require a significant commitment of resources and will require that MDC assess and, where appropriate, modify its accounting systems.

  In addition to the accounting system for project cost control, other administrative provisions relate to contracts, procurement, recordkeeping, retention and retrieval, and reporting.

- Billing Systems - The administrative requirements for an effective system that incorporates user charge and industrial cost recovery provisions will necessitate a significantly higher level of effort than is currently expended by MDC. Although implementation of the retail aspects of a user charge system is a local responsibility, the determination of costs, apportionment to communities, and allocation to classes of users all require a data collection and analysis capability for billing purposes.

Given the complexities inherent in a billing system that must be continually modified consistent with the staging of projects over the next several decades, it is critical that MDC assemble the staff resources and implement the systems required for the administration of a billing system.

- Contract Monitoring and Project Control - This administrative task links aspects of the engineering and financing functions that require the monitoring of project status for cost reimbursement purposes and the assurance of compliance by contractors with administrative (as opposed to technical) requirements incorporated within project contracts. Ensuring that change orders are properly noted and entered in the project cost control accounting records is fundamental to a determination of eligible project costs. Contracts which are eligible for reimbursement under EPA guidelines include those for consultants as well as for construction projects.

  While project control is often perceived solely as an engineering activity, project activities must be related to other functions performed by the entity. Unless this is accomplished at a higher level, inefficiencies in other elements of the management program may result. For example, purchasing required supplies and equipment and hiring the necessary personnel to operate a treatment facility must be efficiently coordinated with the timing of project completion. Activities conducted out of sequence will be wasteful and inefficient.

FUNCTIONAL CHARACTERISTICS

An organization can be described from three different perspectives:

- Legal, Institutional Framework
- Department Structure
- Functions and Activities Performed

Previous sections of the management report detailed MDC's legal, institutional framework and presented its current departmental structure. This section focuses on the six major functions and activities that constitute MDC's service-delivery system:

- Planning
- Engineering/Construction

- Financing
- Operations
- Monitoring
- Enforcement

A representative list of the subfunctions and activities that are included under each major functional heading precedes the detailed discussion of that function.

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PLANNING

Sub-Functions	Major Activities
1. Information/Data Collection	a) Develop data analysis and utilization system. b) Review population/census data. c) Review building permits. d) Analyze local land use patterns. e) Review economic development activity.
2. Demographic Analysis/ Projections	a) Verify existing population projections. b) Develop density loading ratios. c) Update and modify user charge "equivalency" factors. d) Review land use plans/studies.
3. Special Studies	a) Provide input to EOEA, MDC, OSP and MAPC studies. b) Undertake special wastewater projects. c) Update and maintain Sec. 208 planning recommendations. d) Prepare environmental assessments.
4. Technical Assistance	a) Coordinate resources for assistance to MSD communities. b) Assist MSD communities in wastewater planning. c) Provide input to MDC water, parks and recreation planning. d) Maintain visible field presence.

MDC's planning capability must be expanded to maintain a current awareness of state and regional activities which impact directly on wastewater service delivery and management within the metropolitan area. P.L. 92-500 has established a planning framework incorporating basin, areawide, and state planning strategies. The inter-relationships between Sections 303 and 201 are designed to harmonize the environmental standards of water quality in the receiving waters with the technological standard for effluent discharged by treatment plants. DWPC's basin planning process points out the need for MDC to consider various approaches to

working with municipalities outside the MSD territory but within the basin of rivers to which treated effluent is to be discharged. Additional staff will be required to participate in the state's continuing planning process.

Similarly, the implications of the Section 208 planning process for many of MDC's programs and functions demand close coordination with MAPC. This coordination will be necessary not only during the period of plan preparation but on a continuing basis throughout plan implementation, maintenance, and revision. Although specific recommendations relating to long-term planning and management linkages cannot be developed until the areawide wastewater management planning process has been completed, it is clear that under either a unified or coordinated structure, planning and management are related aspects of an overall strategy.

Two other planning activities are critical to MDC's success in developing solutions to water pollution control problems. The first relates to the need to develop and implement procedures for data utilization (including collection, analysis, storage, and retrieval) and the second relates to the provision of planning assistance to communities and districts outside MSD but within the basin over which it has control.

Finally, although external linkages are the most critical aspect of MDC's wastewater planning activity, additional benefits will accrue to the entity's water and parks division through staff expansion. An integrated plan for the entire MDC area could be more readily developed by centralizing planning staff support.

ENGINEERING/CONSTRUCTION

Sub-Functions	Major Activities
1. Feasibility Studies	a) Undertake site reviews for new facility locations. b) Prepare gross preliminary cost estimates. c) Review topographical and hydrological factors. d) Determine need and scope for environmental assessments.
2. Preliminary Engineering	a) Prepare or supervise the preparation of preliminary drawings and specifications. b) Indicate options and alternatives. c) Review and evaluate alternatives against fiscal, social, cultural and environmental factors. d) Select alternative for detailed design after public hearings.
3. Final Plans and Specifications	a) Prepare or supervise the preparation of final drawings and specifications. b) Make borings and undertake other tests. c) Prepare detailed cost estimates, construction and other materials preparatory to bid. d) Supervise bidding process. e) Award contract for construction of facilities.
4. Fabrication and Building	a) Undertake the construction, reconstruction, or repair of facilities. b) Supervise the construction of projects let out on bid. c. Conduct tests to ensure compliance with project specifications. d. Conduct periodic reviews to ensure proper construction and/or enforcement of improved standards.

Sub-Functions	Major Activities
5. Improved Operations	a) Investigate and adopt new technologies. b) Develop improved operational, procedural and technological approaches. c) Pursue more efficient methods for treatment and disposal. d) Monitor effectiveness of facility operations.

MDC will soon embark on a massive facilities construction program. Over 50 projects representing capital costs of $855 million have been recommended for implementation over the next 15 years. While much of the work will be performed under contract with outside firms, MDC staff will have a major role in both the engineering and construction aspects of the overall program. Additional staff will be required if their functions are to be performed efficiently and productively.

The introductory description of the sub-functions and activities that must be conducted indicates the overall scope of MDC's responsibility. In many respects, MDC's experience with previous construction gives it a significant advantage over less mature management entities. On the other hand, the timing and magnitude of this effort will necessitate a carefully planned contract management and project control schedule. While all function are critical to wastewater management, the most vital over the next 15 years will be engineering/construction; non-performance in this area will jeopardize every element of the entity's mission. Proper scheduling will provide some assurance that work progresses in a manner consistent with the financing plan and in accordance with NPDES permit conditions. However, unless the following two elements are supervised and managed by competent professionals, the engineering/construction function will be unable to respond to the difficult challenges of this multiple project facilities construction program:

- Project Management
- Contract Administration

PROJECT MANAGEMENT

Project management refers to those engineering/construction activities that will be handled by staff engineers and construction specialists within MDC. These projects will generally be smaller in scope than the major facilities construction projects and will include extension, branch and connector sewers, small pumping stations, and some interceptors (which constitute a major part of the overall program). Not only must each of these projects be properly managed and controlled in terms of time and cost, but they also must be integrated to ensure proper staging with other projects carried out under contract. An additional aspect of the management requirement for these projects is described under the sub-heading Management and Administration; in view of its importance in relation to the engineering/construction function, it also warrants mention in this section.

Each construction project must be separately managed, with accounting records, source documentation, and project cost controls established to ensure reimbursement for eligible costs. A project management system consistent with federal standards (i.e., FMC 74-4 and FMC 74-7) must provide the level of detail required for effective grants management. Both direct and indirect costs must be identified through proper documentation and through the establishment of a clear audit trail.

CONTRACT ADMINISTRATION

This aspect of the engineering/construction function relates to projects undertaken by contractors and sub-contractors to construct major facilities designed to improve MDC's wastewater treatment and disposal program. In addition consultant contracts for the purpose of undertaking preliminary engineering work and during the final stages of planning must also be controlled. While this may require less technical staff time, it will involve significant administrative time for supervision, monitoring, and evaluation by the planning and engineering staff.

To ensure compliance with both FMC 74-4 and 74-7, as well as with general grant conditions imposed by EPA, each contractor will be expected to maintain its own system of accounting controls to ensure that project costs are properly reported.

Since the construction staging program involves a number of concurrent projects, it will be critical for MDC to institute procedures geared toward assessing and monitoring contractor

administrative capability. Only through such a commitment to provide both engineering and administrative oversight can MDC expect to realize the full potential of funding from federal and state sources.

In addition to the project-oriented activities within the engineering/construction function, one additional aspect merits description: improved operations due to advances in treatment plant technology. One of the logical derivatives of a Congressional commitment to improve the quality of the nation's waterways will be an advancement of the state-of-the-art in the design, construction, and efficient operation of publicly owned treatment works.

Technology advances may be expected within the next decade as over 2,000 projects under Section 201 of P.L. 92-500 are commenced. While MDC may reasonably be presumed to benefit from these grant activities, the entity should also contribute to this process through its own engineering activities and by providing incentives to consultant engineers to incorporate technology assessment within their facilities design and cost/benefit studies. MDC may also initiate research projects designed to demonstrate the advantages of new techniques.

FINANCING

Sub-Functions	Major Activities
1. Project Management	a) Prepare preliminary cost estimates. b) Maintain financial management/ project cost control system. c) Monitor construction contracts/ rates of expenditures. d) Prepare financial close-out reports.
2. Bonding	a) Determine capital financing requirements. b) Utilize available mechanisms for project financing. c) Analyze alternative "pay-back" procedures. d) Monitor debt service schedule.
3. Revenue Collection/ Capital	a) Prepare documents for Sec. 201 75% payments. b) Prepare documents for state 15% payments. c) Prepare documents for local 10% payments. d) Implement Industrial Cost Recovery system. e) Record and report all revenues.
4. Revenue Collection/ O&M	a) Implement user charge system. b) Monitor schedule of payments. c) Record and report all revenues.
5. Budgeting/Accounting	a) Assemble and present budget requests. b) Establish and maintain financial management systems consistent with state statutes and federal requirements. c) Develop formats for financial reporting to MSD communities. d) Record and report all transactions.

The financing function involves a number of related activities which together represent the entity's financial management system. Since MDC will remain within state government, some of the procedural elements of financing will remain the same. However, given the need to respond to the financial incentives of P.L. 92-500 and consistent with the reaffirmation of MDC's regional character, greater flexibility and freedom from standardization must be provided. While no reduction in the controls essential to fiscal integrity will be required to achieve this flexibility, there must be a shift from the pre-audit, budget and project approval approach to a post-audit, performance evaluation technique, based on audit reports by the State Auditor and EPA.

To facilitate an understanding of the changes required in the financing function consistent with the overall goal of reducing bureaucratic obstacles, the following four areas warrant special emphasis:

- Budgets
- Bonds
- Expenditures
- Revenues

BUDGETS

Although MDC will remain within EOEA and, as a state agency, have its annual funding provided through appropriations by the state Legislature, there must be a reduced involvement in budget review by all existing elements and an increased role for the Municipal Advisory Committee. This reduced involvement by outside reviewers will ensure MDC of the flow of funds necessary to serve the cities and towns of MSD.

This flexibility applies to both MDC's general appropriations budget and capital outlay budget. These budgets should be reviewed and endorsed by the Municipal Advisory Committee and submitted directly to the Legislature. The amount requested, as approved by representatives of the cities and towns which finance 100% of MDC's sewage treatment and disposal services, would be subject to reduction only by a 2/3 vote of the Legislature once the measure had been reported out by Ways and Means.

This limitation on the extent of legislative control can only be justified and should only be initiated after the MDC has established the internal controls to satisfy the Legislature that the highest standards of professional management were being employed by the MDC. Budget preparation, review and adoption, as well as the appropriation process itself, must be conducted openly.

Under current procedures, each wastewater treatment facility that MDC intends to construct is subject to legislative approval. This project-by-project review, even though a number of projects may be included within a single petition, has fragmented MDC's long-range facility planning activities by focusing on the separate parts rather then the totality of the system. MDC will soon embark on a facilities construction program which requires a total system approach. Accordingly, elimination of an individualized project review and approval process is recommended. This can be accomplished by converting from a project appropriation process to a program authorization approach. This will facilitate the overall management of MDC's capital outlay fund.

BONDS

The current administration procedure for the sale of MSD bonds authorizes the State Treasurer to issue contingent debt to finance projects approved by the Legislature. Under the modifications recommended for MDC's management structure, the Treasurer will continue to issue MSD bonds. However, alternative approaches more consistent with the overall direction toward establishing a more independent regional entity should be considered as other changes occur in MDC's management.

While no procedural change is recommended in the area of project financing, conversion from a project appropriation orientation to an authorization approach will provide greater flexibility for the Treasurer to issue bonds. MDC must also carefully monitor the State's position in the bond market by evaluating the effects of fluctuations in interest rates attributable to the Commonwealth's credit rating.

EXPENDITURES

Two elements of the existing expenditure control procedure will require change if the recommendations for improving

MDC's financing function are implemented. The first relates to the inflexibility of the state's subsidiary expenditure system; the second deals with the allotment process which limits the timing of expenditures by apportioning line-item amounts on a percentage basis throughout the course of the fiscal year.

MDC operates its facilities on a round-the-clock basis. Loadings are dependent on a number of uncontrollable variables, the most obvious of which is the weather. Breakdowns in the system are unpredictable and require immediate corrective action, whether through the installation of new parts or dispatching a work crew. Costs for operations and maintenance are also subject to shifts in priorities necessitated by actual events. Expenditures for chemicals may be higher than estimated and energy costs are subject to market fluctuations. Thus, neither the workload nor its expenses follow a conventional pattern.

Accordingly, the subsidiary expenditure account controls and the allotment process represent administrative obstacles to MDC and, since no state funds are involved, these controls should be eliminated in favor of providing accountability at the agency level. The Municipal Advisory Committee's participation and the broader use of audits will provide sufficient controls over expenditure levels.

REVENUES

Four elements of the financing function relate to MDC's revenues. Each represents a process to identify amounts due from various service recipients within MSD. The four elements (assessments, user charges, industrial cost recovery, and grants) have been described in other parts of this report. They are noted again to demonstrate the administrative work loan involved in this single aspect of the financing function. Appropriate systems must be operational when MDC embarks upon its new construction program. Since initial financing activities are scheduled to commence in early 1976, attention should be directed to this matter immediately.

OPERATIONS

Sub-Functions	Major Activities
1. Operating Standards	a) Review and upgrade operating standards. b) Incorporate within performance reporting system. c) Establish schedule/procedure for facilities review. d) Maintain "failure rate" records for each facility.
2. Personnel	a) Develop and implement training programs for all operators. b) Coordinate with NEIWPCC on upgrading and recruiting personnel. c) Analyze new personnel requirements, and develop proper task statements. d) Review and evaluate all operations personnel.
3. Maintenance of Facilities	a) Develop parts replacement criteria and schedule. b) Implement maintenance schedule. c) Develop cost benefit standards for replacement/construction. d) Maintain parts inventory/record-keeping system.

Operating and maintaining the facilities under its control becomes increasingly important as MDC begins to conduct the recommended construction program for wastewater treatment within MSD. Although the financial impact (as described in the previous section) represents the major element of this program, efficient operations performed by talented and dedicated professional and technical staff will be necessary to protect the $855 million investment of federal, state, and local government. One aspect of the user charge system that has frequently been overlooked is the institution of a procedure to replace parts and components of treatment facilities.

A program of scheduled maintenance and/or parts replacement must be established to assist MDC in performing its operations functions. Effective management practices indicate the need to institute perpetual inventories for supplies and equipment, thereby ensuring the ability to correct malfunctions that reduce the operating efficiency and performance of treatment plants. Programs of this type would be developed to improve operations and contribute to improved management.

Although MDC's current operations are somewhat decentralized (e.g., staff are assigned to treatment plants, major facilities have their own budgets and subsidiary expenditure accounts), the new organizational structure would represent an even greater thrust toward a decentralized mode of operations. The construction of satellite plants in the Upper Neponset and Middle Charles Rivers may provide an opportunity to establish sub-districts within MSD not only to facilitate supervision of operations but also to establish a basis for the comparative evaluation of treatment plant operations. Testing new techniques or procedures, undertaking pilot projects, and evaluating new technologies would be more readily accomplished under a decentralized system.

Each district would operate as a state administrative unit rather than an independent entity responsible for providing wastewater service. With the proper degree of independence from state regulations and statutory restrictions, operations will be able to achieve a higher level of efficiency and performance. The decentralized system will be supported by a central administrative staff unit, and thus be free from day-to-day administrative responsibilities.

Decentralization through sub-districts will also provide a closer link between regionalized treatment services and local collection systems. This relationship will not only improve MDC's visibility and credibility, but would provide a more manageable framework for planning, monitoring, and enforcement. In addition, it would offer opportunities for direct citizen participation at a level and on a scale that corresponds to citizens' perception of the "region" within which services are rendered. Additional opportunities for citizen input would also exist at the agency level.

MONITORING

Sub-Function	Major Activities
1. Permit Compliance	a) Coordinate with EPA and DWPC in determining permit standards. b) Establish "failure rate" monitoring and reporting procedures. c) Monitor effluent discharges at all facilities. d) Train personnel in monitoring techniques. e) Develop reporting and data analysis capability.
2. Regulatory Controls	a) Implement Sec. 208 monitoring standards, where appropriate. b) Develop standards for municipal compliance. c) Review or develop non-structural management techniques. d) Develop standards for monitoring industrial wastes.
3. Field Activities	a) Recruit and train monitoring staff. b) Develop schedule for field monitoring. c) Monitor municipal systems, industrial locations, and MDC facilities. d) Prepare reports and follow up all monitoring activities.
4. Technology Assessment	a) Analyze cost/benefits of field monitoring operations. b) Assess effectiveness of staff operations. c) Coordinate with state agencies in development or adaptation of new technology. d) Undertake and evaluate pilot program. e) Convert to technology, if appropriate.

MDC's monitoring responsibility will comprise activities to ensure that the effluent discharged from its treatment plants is in compliance with the NPDES permit issued by EPA/DWPC. The activities will include measuring flow, volume, and characteristics of the sewage; testing and analyzing discharges for toxicity, bacteria, nutrients, oil, or other hazardous substances; and developing recordkeeping and reporting procedures for internal management and decision-making as well as external contacts with the permitting authority.

These self-monitoring activities must be clearly established in MDC's policies and procedures to ensure a continuous commitment to efficient operations, effective planning/engineering, and productive and timely financing for the reconstruction, replacement, or repair of facilities. Although the activities will initially require trained specialists and technicians, the advancement of new technology will ultimately reduce the labor and cost associated with self-monitoring of point source treatment plants. Initially, however, the deployment of staff to the major facilities within MSD will provide the field capability essential to a decentralized system.

Since MSD's system of interceptors, pumping stations, and treatment plants is physically interconnected, the self-monitoring activities carried out at each treatment facility represent an effort to check the constituency of sewage transported by local collection systems to regional interceptors and plants. Consequently, greater attention must be directed toward monitoring local sewage collection systems. This may be accomplished either through regulations establishing enforceable standards and requiring periodic reports with strict penalties for failure to comply, or periodic sampling by MDC. Since the former will encourage the direct involvement of localities and will probably be less expensive, it should be carefully considered.

In addition to these direct responsibilities for self-monitoring, MDC shares responsibility with DWPC for monitoring industries that discharge process waste to the system. The effectiveness of pre-treatment facilities must be regularly reviewed by both agencies to ensure that effluent limitations and water quality standards are adequately addressed.

The Department of Environmental Quality Engineering within EOEA includes DWPC as one of its principal divisions. DWPC is the principal agency of the Commonwealth with authority and responsibility for monitoring water quality, effluents, treatment works, and industrial wastes. This responsibility was vested in DWPC under the provisions of Section 17 of Chapter 21, MGL as most recently amended by Chapter 546 - Acts of 1973.

The specific statutory references to DWPC's monitoring responsibility are to:

- require dischargers to establish monitoring, sampling, recordkeeping and reporting procedures and facilities, and to submit to the director data gathered therefrom and such other data as he shall reasonably request;

- examine periodically the water quality of the various coastal waters, rivers, streams, lakes, and ponds of the Commonwealth;

- require submissions for approval of reports and plans of abatement facilities on any part thereof, and inspect the construction thereof for compliance with the approved plans; and

- enter at reasonable times any property, public or private, for the purpose of investigating or inspecting any condition relating to the discharge or possible discharge of pollutants, and may make tests, inspect monitoring equipment, and examine any reports.

At a minimum, the state monitoring effects should achieve the following objectives:

- develop and maintain knowledge of the quality of the groundwater in the state;

- obtain an understanding of the cause and effect relationships of the state's water quality; and

- assess the effectiveness of water pollution control programs, including the determination of compliance

or noncompliance with legal requirements, such as permit conditions.

This broad grant of authority places DWPC in a critical position with respect to the operations of MDC facilities. The activities that constitute MDC's monitoring responsibility are subject to verification through inspection by DWPC, which has primary monitoring responsibility at the state level.

A self-monitoring program can only be successful if a direct line to the Commissioner to report on operating failures is established. The monitoring function must be clearly separate from other functions within MDC in order to provide an objective appraisal of the quality of service rendered. After establishing a procedure to record and verify facility failure and/or malfunction, periodic spotchecks can be utilized to ensure the accuracy and reliability of reports.

ENFORCEMENT

Sub-Functions	Major Activities
1. Local Collection Systems	a) Enforce regulations established for municipalities. b) Establish penalties and fines for noncompliance. c) Establish hearing and appeals procedures.
2. MDC Facilities	a) Coordinate with DWPC and EPA on effluent limitations. b) Review reports and modify standards, as required. c) Coordinate with NOAA on ocean discharge. d) Coordinate with EPA on sludge disposal.
3. Industries	a) Coordinate with DWPC and EPA on pre-treatments. b) Establish procedures for assistance in meeting standards. c) Establish hearing and appeals procedures.

Under Chapter 705, Section 12 of the Acts of 1945, MDC is authorized to adopt rules and regulations concerning the discharge of sewage, drainage, noxious substances or wastes into any sewer under its control, or any sewer tributary to its system of sewers. Under its authority, MDC has the power to levy and collect from an offending municipality additional assessments as deemed necessary to compensate for the unlawful disposal of wastes into its system. However, such additional assessment must not exceed the lesser of an amount equal to one twentieth of one percent of the taxable value of the municipality, or $200,000.

This "enforcement" authority relates only to the establishment of rules and regulations to enforce certain standards of construction or performance by member municipalities. In summary, the existing rules and regulations provide for:

- construction of local sewers in a manner that separates storm wastes from ordinary sewage;

- restrictions regarding constituency of sewage;

- restrictions regarding garages where gasoline is used; and

- required installation, by the owner of any property serviced by a building sewer carrying industrial wastes, of a control or measuring device and other appurtenances to facilitate observation, sampling, and measurement of the waste. The records from the meters and measuring devices must be furnished to MDC upon request.

MDC has requested additional enforcement authority under the provisions of a legislative petition now under consideration by the Massachusetts Legislature.

If MDC is to conduct an effective regional wastewater management program which depends on the cooperation of all member communities within MSD, it must have the authority to develop and enforce performance standards. Compliance by municipalities must be assured since the enforcement authority provided to other agencies under state and federal law will require MDC's diligence in meeting permit provisions. Negligence by one municipality may result in fines and penalties imposed on MDC, the cost of which must be borne by all members of the MSD. To carry out its expanded responsibility for enforcement, MDC will have to establish procedures for administrative hearings on matters not subject to adjudicatory proceedings initiated by DWPC.

Close cooperation and coordination between MDC and DWPC will be necessary to provide an appropriate level of enforcement which does not result in duplication of effort or conflict of objectives. DWPC's enforcement authority includes the following major powers.

- prescribe effluent limitations, permit programs and procedures applicable to the management and disposal of pollutants, including, where appropriate, prohibition of discharges;

- adopt ... rules and regulations ... necessary for the proper administration of the laws relative to water pollution control;

- undertake action whenever there is spillage, seepage or other discharge of oil into any inland or offshore waters, which spillage may be subject to a $10,000 per day fine or two years imprisonment;

- conduct facilities inspections for the purpose of determining whether there is compliance with permits issued; and

- issue permits for point source discharges subject to the conditions established by the DWPC to ensure compliance with effluent limitations, proper operations, self-monitoring, reporting, sampling and recording.

Consistent with the penalities provided under P.L. 92-500, the Commonwealth may institute actions against violators in either a criminal prosecution (fines of $2,500 - $25,000 per day or imprisonment for not more than one year) or a civil prosecution (fines up to $10,000 per day).

AREAL CONSIDERATIONS

The territorial issues that MDC must address concern three basic questions:

1. What will be the boundary of the Metropolitan Sewerage District?

2. Should there be any control over actions within a river basin or only within the defined boundary?

3. What is the relationship of MSD to other municipalities and districts within the Eastern Massachusetts Metropolitan Area?

These issues of boundary, extraterritorial powers, and support service relationships are treated separately in this discussion of the area configuration of MSD within a more expansive geographic region.

BOUNDARY

The Metropolitan Sewerage District boundary will be expanded to include the 51 municipalities recommended for inclusion in the

engineering study. Accordingly, representatives from each of three cities or towns will have voting privileges on the Municipal Advisory Committee whenever there are costs attributable to the service received by each community. However, the amended legislation will name each of the 51 communities to be included.

Therefore, to promote the regional identity of MSD, authority regarding the determination of future membership will be vested in the Municipal Advisory Committee. No change in the statutory list of communities will be required if, upon petition of a municipality, membership is requested and approved. No power of "annexation" is granted which would require a municipality to join MSD. This freedom to determine the most appropriate geographic configuration will be tempered by DWPC's authority to mandate the formation of districts that it considers necessary from a water quality perspective.

Extraterritorial Powers

Three major rivers -- Charles, Mystic and Neponset -- flow within the area of the Metropolitan Sewerage District. The entire river basin for the latter two waterways is within MSD. The Charles River basin, however, extends beyond MSD's boundary, limiting the overall control over discharges into the river from point sources outside the district.

As part of its construction program, MDC has proposed a 30 MGD advanced treatment plant for the Middle Charles area. One of the principal purposes of this facility will be to augment flows in the river. Upstream facilities in Milford, Medfield and Millis are also planned and have been incorporated into the engineering considerations for facility planning. These treatment plants will be regulated by DWPC and operated by local personnel.

Since each community along the Charles River has an interest and a stake in improving water quality, a natural partnership, transcending issues of boundary, exists. To capitalize on the immediacy of concern generated by PL 92-500, some form of extraterritorial powers should be granted to MSD to permit an association with towns outside its boundary but within the basin.

Support Service Relationships

An opportunity now exists for MDC to provide assistance to municipalities and districts outside MSD but within the metropolitan area. In response to the funding incentives provided by

P.L. 92-500 and as a result of DWPC's enforcement activity, many communities are beginning to address the question of sewage treatment and disposal. For those not yet at the point of constructing facilities, the Section 208 wastewater management planning studies may be proposing regulatory controls related to water quality.

MDC is fortunate to have a highly professional staff of engineers, planners, finance officers, and treatment plant operators, as such skills will be in great demand over the next several years. MDC should be in a position to offer its services to other communities on either a no-charge technical assistance basis or under contract for a fee based on actual cost of service. This assistance should not encompass major projects or serve as a replacement for hiring essential personnel. Rather, it should fill the void in situations where diseconomies of scale would result if a municipality or district incurred the full cost of the assistance.

C. IMPLEMENTATION PLAN: LEGISLATIVE PROGRAM

Restructuring of the management entity as described in the first part of this section will involve several legislative changes. While many of the recommendations for improved administrative management can be accomplished by MDC under existing authority, most of the major structural changes will require the enactment of new laws.

The legislative program to implement the restructuring and modification of MDC will require: a) amendments to existing statutory provisions in MDC's enabling laws (e.g., C.28, C.92), b) amendments to other statutes relating to the administration of state agencies (e.g., C.31, C.29), and c) new provisions to be added to the general laws of the Commonwealth.

This section of the report describes the required statutory provisions. The exact language and legislative format would be prepared by MDC. Since the review of existing law was geared to the implementation of a specific organizational option, attention was focused on those Chapters of the Massachusetts General Laws that have a direct and material bearing on the powers, duties, and responsibilities of the selected organizational model. Accordingly, the review of statutory provisions did not include every chapter and section of the state laws. As MDC prepares the complete legislative package, it may be necessary to include other provisions.

A priority of ranking (i.e., 1=essential, 2= recommended, 3=desirable) is assigned to each section heading, and the timing of submission for each section of the implementing legislation is recommended. This time phased approach recognizes that a total package including all the statutory changes recommended may jeopardize the enactment of certain essential provisions required for effective wastewater management. Political resistance will be more readily counteracted and constituent support more effectively coordinated if a series of annual recommendations rather than a single package is developed.

IMPLEMENTATION PLAN

	Citation	Current Heading	New Heading	Content	Priority	Year
a.)	C.28;1	Metropolitan District Commission	Commissioner, Metropolitan District Commission; Appointment	Provide for single Commissioner to be appointed by Governor with approval of Municipal Advisory Committee (MAC) (N.B. also amend C.806 of 1974 which authorized Secretary of EOEA to appoint Commission)	2	1977
b.)	C.28;2	Salaries; Commissioners	Salary; Commissioner	Provide that Salary of Commissioner shall be annually established in budget approved by MAC	2	1977
c.)	C.28;3	Commissioner; powers and duties	Same	Provide that Commissioner may enter into contracts on his own authority except that contracts in excess of $25,000.00 shall be sent to the Executive Committee of the MAC and that contracts in excess of $100,000.00 must be approved by that Committee (N.B. also amend C.1230 of 1973 re: Authority of Secretary to Review and approve contracts)	2	1977
d.)	C.28;4	Secretary; Appointment	Appointments by Commissioner; Staffing Plans	1) Provide that Commissioner may appoint such administrative, professional or technical staff, assistants or consultants as may be deemed necessary, not subject to C.31. 2) Require the preparation and annual submission of staffing plans including the number of employees, grades and or salary levels required to carry out a wastewater management program.	1	1976
e.)			Municipal Advisory Committee; Appointment; Term of Office	1) Provide that a Municipal Advisory Committee shall be created to assist and advise the Commissioner. 2) Provide that the Chief Executive Officer (Mayor, Board of Selectmen, City Manager) from each of the communities in the Metropolitan Sewerage District (MSD) shall serve, ex officio, on the MAC. 3) Provide that the Governor shall appoint, for staggered terms, members of the general public, all residents within the MSD, equal to 1/2 of the public officials total. Vacancies shall be filled for unexpired terms, the appointment to be made from the total population within the MSD.	1	1976

Citation	Current Heading	New Heading	Contents	Priority	Year
f.)		Municipal Advisory Committee; Organization; Meetings	1) Indicate that MAC shall organize by the election of a Chairman and Vice-Chairman and that clerical and staff assistance shall be provided by the MDC as required. 2) Provide for the formation of an Executive Committee to be comprised of 9 members (6 public officials, 3 private citizens) who shall be authority to act on behalf of the MAC. 3) Provide for MAC meeting schedule (i.e. not less than three times a year) one of which will be devoted to approving the budget. Also provide for monthly meeting of Executive Committee.	1	1976
g)	-	- Municipal Advisory Committee; powers and duties	1) Refer to text in previous section for a representative listing of powers and duties. 2) Provide that MAC shall have the authority to: a) Approve the annual budget, municipal apportionment of costs and user rates. b) Review and approve all grant requests to EPA or other governmental agencies. c) Review candidate recommended by governor as Commissioner. d) Review and comment on all rules and regulations promulgated by the MDC. e) Determine membership of MSD by admitting new communities.	1	1976
h)	-	- Transitional provisions	1) Strike all references to Associate Commissioners in C. 28 2) Provide that Commissioner shall be lawful successor to Commission and that all functions, rights, duties and obligations are transferred to the Commissioner. All votes taken by force and effect and all monies previously appropriated shall be available for expenditure by Commissioner. 3) Continue all rules and regulations until lawfully rescinded. 4) Amend relevant provisions of C.806 of 1974 (e.g., 31-38). 5) Amend relevant provisions of C.21A (i.e., 7).	2	1977

	Citation	Current Heading	New Heading	Content	Priority	Year
i.)	C.92; 1	Construction and Maintenance of Sewer Works	Metropolitan Sewerage District; Membership; Construction and Maintenance of Sewer Works	List the 51 municipalities who will compensate the Metropolitan Sewerage District and include a provision that additional members may be added by vote of the Municipal Advisory Committee upon petition of a municipality or district and recommendation of the Commissioner. (N.B. also refer to Chapter 21)	1	1976
j.)	C.92; 1	Construction and Maintenance of Sewer Works	Authority to Contract for services	1) Indicate that the Commissioner is authorized to contract with any city, town or district, including communities currently within the MSD, to carry out any function or provide any service, or aspects thereof, for which the MDC is responsible or has the capability to perform. This would not relate to membership which must be determined by the MAC.	2	1978
				2) Indicate that the Commissioner is authorized to contract, with or without consideration, for the acquisition, by purchase, lease or other devise, of land, buildings or other facilities required for wastewater management purposes.	3	1978
k.)	C.92; 1A	Annual Financial Statement; Hearings; Notice of Hearings	Same	1) Add requirement that financial statement should include the following: a) percentage of use by each class of user; b) amounts allocated and to be allocated to each class of user; c) amounts apportioned to each member of the MSD; d) cost by class of user for each member; e) statement of revenues by source (e.g. assessments, federal grants, state reimbursements); and such other information as the MAC may from time to time require.	2	1977
				2) Add requirement that a long-range (20 years) facilities construction and financing plan be prepared and annually up-dated.	3	1979
				3) Indicate that this information must be submitted to the MAC and that it shall be reviewed and approved by the MAC prior to submission to the General Court.	1	1976
				4) Require that notice not only go to Municipal Chief Executives but that notice by provided in at least 4 newspapers of general circulation and that each individual or organization expressing an interest in receiving notice shall be so notified.		
				5) Indicate that the notice shall include not only the time and place for such meeting but also an agenda and brief synopsis of the items to be considered and voted upon.	1	1976

Citation	Current Heading	New Heading	Content	Priority	Year
1.) C.92; 33	Malicious injury to sewers; penalty	Same	1) Provide that treble damages, when assessed shall be paid directly to the MDC to be used for facilities repair or parts replacement.	2	1977
			2) Authorize the Attorney General to bring an action to recover all costs and expenses so assessed.	2	1977
m.) C.92; 34	Disposition of money forfeited on binds and contracts for work on metropolitan sewers	Same	1) Indicate that all money forfeited shall be turned over to the MDC to be held in reserve which, by majority note of the MAC Executive Committee, may be used for unforeseen expenses related to sewers and sewage treatment.	2	1978
			2) Establish restrictions on use of funds to ensure that proper controls exist.	2	1978
n.) C.92; 35	Cost of system, payments by cities and towns; apprortionment	Principal and Interest Costs	1) Incorporate provisions of H-5759 of 1975 relative to population and population equivalents. (N.B. - The use of the state census as the basis for determining population is questionable. If an alternative basis, including one which uses estimates, can be devised it should be used.)	1	1976
			2) Provide that method of apportioning principal and interest costs to municipalities may be changed by 2/3 vote of MAC to adopt an alternative.	2	1976
			3) Change "commission" to "commissioner".	1	1976
o.) C.92; 35A	Cost of System; apportionment by commission; certification to state treasurer.	Industrial Cost Recovery	Incorporate provisions of H-5759 of 1975 with the following changes:	1	1976
			1) Include provision that money held in MDC Wastewater Management Fund may be paid out according to federal law or by vote of the MAC for purposes permitted by federal law or regulation.		
			2) Change "commission" to "commissioner, after review and comment by the MAC".		
p.) C.92; 35B	Cost of Extensions; Apportionment; Certification to state treasurer	Cost of Extensions	Incorporate provisions of H-5759 of 1975 with the following changes:		
			1) Delete reference in last sectence re: establishing proportion "by law" and insert provision that method will be established by regulation of commissioner which shall be reviewed by MAC.	1	1976
			2) Change "commission" to "commissioner after review and comment by the MAC".	1	1976

	Citation	Current Heading	New Heading	Content	Priority	Year
q.)	C.92; 36	Maintenance and operation; payments by cities and towns; apportionment	User charges for Operation and Maintenance	Incorporate provisions of H-5759 of 1975 with the following changes:		
				1) Change "commission" to "commissioner after review and comment by the MAC".	1	1976
r.)			Regulation of Connections to the Metropolitan Sewerage District	Incorporate provisions of H-5759 of 1975 with the following changes:		
				1) Change "commission" to "commissioner after review and comment by the MAC".	1	1976
s.)			Entry by MDC personnel to inspect waste sources	Incorporate provisions of H-5759 of 1975	1	1976
t.)	C.92; 37	Annual Determination of proportions	Annual Determination of Proportions	Incorporate provisions of H-5759 of 1975 with the following changes:		
				1) Provide for review and comment by MAC and a vote by them authorizing the commissioner to proceed by whatever means he may be authorized to employ to ensure the collection of the required revenue.	1	1976
u.)	C.92; 38	Annual determination of amount required for interest, sinking fund and maintenance	Payment by Cities and Towns	Incorporate provisions of H-5759 of 1975 with the following notation:		
				1) The role of the treasurer and the payment to the Commonwealth should be continually reviewed to determine if a more appropriate procedure could be established.	3	1980+
v.)			Regulatory and Enforcement Authority	Incorporate provisions of H-5759 of 1975 with the notation that new authority to issue regulations will be provided at some future date.	3	1979
w.)	C.92;39	Plumbing of Estates; Branch intercepting sewers	Plubing of Estates; branch intercepting sewers; municipal borrowing	1) Remove words "except Boston" from second paragraph of section.	3	1980
				2) Remove percentage restrictions regarding borrowing outside the debt limit by municipalities.	2	1980
x.)			New members; fees	1) Provide that the Commissioner shall cause to be prepared a fee schedule for any municipality or institution petioning for membership in or service by the MSD. Such information shall be turned over to the MAC to facilitate their review.	2	1978

Citation	Current Heading	New Heading	Content	Priority	Year
y.) C.92; 60	Payment of Cost of Maintenance of Sewerage, Water and Park Systems	Allocation of Administrative Overhead	1) Provide that all indirect costs for administrative overhead shall be allocated on the basis of the actual % of work attributable to each district consistent with the standards of FMC 74-4; Cost Principles Applicable to Grants and Contracts with State and Local Governments.	1	1976
z.) C.92; 81	Sale of lands not needed for maintenance of sewerage systems	Same	1) Provide that the city or town in which the surplus real property is located shall have first preference to acquire the property, subject to such terms and conditicns as may be established by the Commissioner with the approval of the MAC.	2	1977
aa.) C.92; 100	Accounts and Annual Report	Same	1) Provide that reports shall be consistent with provisions of FMC 74-7; Uniform Administrative Requirements for Grants-in-Aid to State and Local Governments for those federal funds included in the report.	2	1976
			2) Provide that the each member of the MAC and each city and town, through the town or city clerk shall receive a copy of such report.	1	1976
bb.) C.29; 3	Required statements; Offices having appropriations; estimates; filing	Same	1) Provide that the procedures for the MDC shall be governed by statues, by-laws and regulations established for that entity.	1	1977
cc.) C.29; all sections, esp. 47A	State Finance	Same	1) Provide a general exemption for the MDC from the provisions of this statute. A section by section review would be impractical to undertake. The statute must cover budgets, appropriations, capital projects, receipts etc. consistent with the recommendations contained in the narrative and the adoption of other recommended laws.	1	1978
dd.) C.31	Civil Service	Same	1) Provide a general exemption in addition to changes in C.28 which guarantees rights of current employees but allows new positions to be open.	1	1978

CHAPTER VII

INTRODUCTION

A. PROPOSED COST APPORTIONMENT AND ALLOCATION METHOD

B. COST APPORTIONMENT AND ALLOCATION STUDY

C. HIGHLIGHTS OF THE APPORTIONMENT AND ALLOCATION STUDY

D. FINANCIAL CONSIDERATIONS

E. SUMMARY OF MAJOR DATA SOURCES, LIMITATIONS AND STUDY ASSUMPTIONS

INTRODUCTION

Cost allocation alternatives and possible methods of apportioning wastewater treatment costs were investigated by PMM&Co. as described in Chapter V.

Numerous factors were considered in evaluating alternative allocation methodologies. In addition to present policies and practices, the proposed system design configurations, potential new institutional and management structures, and developing regulations relating to user charges and Industrial Cost Recovery all needed to be considered.

After considerable review and study by the Technical Subcommittee, and the Metropolitan District Commission, with consulting support from Metcalf and Eddy, Inc., and PMM&Co., the Subcommittee, charged with managing the overall study, selected a proposed cost allocation methodology.

This chapter summarizes the selected cost allocation methodologies and the relative cost impact on communities resulting from the application of those methodologies. A summary of major data sources, limitations, and study assumptions is provided in Section E.

A. PROPOSED COST APPORTIONMENT AND ALLOCATION METHOD

The proposed method for cost apportionment and allocation comprises four major elements:

- cost analysis,
- cost apportionment,
- sub-apportionment and allocation, and
- distribution.

The conclusions and recommendations for each of these elements are described in the following pages as they relate to development of user charge structures and Industrial Cost Recovery.

COST ANALYSIS

The selected methodology proposes that all costs be categorized into two cost elements: (1) operations and maintenance and (2) debt service. Each cost category is to be analyzed in terms of the wastewater characteristics of flow, Biochemical Oxygen Demand (BOD), and Suspended Solids (SS).

Implementation Approach

Implementation of this method (assigning operations and maintenance costs to the three wastewater categories: flow, BOD and SS) depends upon the efforts of Commonwealth and MDC accounting systems to gather the required information. Present systems do not isolate these costs.

MDC could consider engineering assistance as a supplement to its accounting systems for developing necessary cost data. Some modifications to present systems, however, would be required to support the engineering analysis. Engineering studies could be utilized: 1) whenever significant treatment facilities are implemented, or 2) at fixed intervals, such as every three years.

All debt service costs related to facilities completed and on-line as of June 30, 1975 are to be related to flow for cost analysis purposes. Future debt service costs will be analyzed according to flow, BOD or SS.

Associating future debt service costs with the selected wastewater characteristics is more laborious than it appears in the abstract discussion in Chapter V, Section B.

Application of the concept for a large metropolitan service supplier requires considerable judgment.

This complexity is partially caused by the sale of bonds which are issued in multiple numbers to finance the local share of capital costs of wastewater treatment projects. First, a single bond may finance several projects, each differing in terms of the breakdown of wastewater characteristics it services. Second, cash reimbursements by federal and state granting sources are uneven.

Two alternate approaches, described below, may be used. When it is possible to categorize capital funding requirements by type of facility being constructed, the facilities for which capital funding is required may be grouped according to their purpose or use. For example, interceptors, pumping stations, and combined sewers are primarily flow related. The capital funding requests for these projects would create an audit trail through to the actual bond issue. An administrator would then assign all debt service costs resulting from the specific bond issue to the wastewater characteristics (flow in this example).

When it is not possible to categorize future funding requirements by specific type of facility being constructed, the facilities for which funding is required may be grouped into phases. Phases may be assigned according to time or priorities of the projects in the construction schedule. An example of the former is a 30 year construction program divided into six 5-year sub-programs. MDC's proposed construction schedule, which would classify projects in terms of priority, is an example of the latter.

Using this approach, all projects scheduled during a time period would be analyzed to detemmine the cost attributable to selected wastewater characteristics. Costs for a given period would be subsequently totalled according to wastewater categories, and percentages would be computed. These percentages would be applied to the debt service costs of bonds sold during the time period in question.

APPORTIONMENT

A uniform method of apportionment was selected to divide operations and maintenance and debt service costs. All communities connected to the system would pay at the same rate.

Communities which join the system in the future will be apportioned the debt service costs incurred in constructing the interceptor when required. In addition, the newly joining communities will be apportioned their share of operations and maintenance and debt service costs for system-wide facilities.

Implementation Approach

The selected apportionment method is the same as the one currently used because all communities presently pay at the same rate. Accordingly, implementation of this apportionment concept should not in itself produce any new organizational requirements. However, other elements, such as cost analysis and sub-apportionment will require additional personnel to implement and operate as recommended.

SUB-APPORTIONMENT AND ALLOCATION

The approach selected for sub-apportioning costs to communities and allocating these costs among user classes utilizes population and population equivalent units (P&PE) It is based partially on estimated discharges for some user classes and on actual wasteload measurement for others. The following methods were selected:

- Residential (Domestic) - Wasteloads from the domestic class of user are to be estimated, using sewered population as the unit of measure.

- Commercial - Discharge from commercial users is to be converted into population equivalent units considering flow only; those commercial users whose discharge characteristics are significantly different from those of domestic users will be converted to P&PE considering flow and strength.

- Industrial - Discharges from industrial users will be converted to population equivalent units. Equivalent unit calculations will consider the volume and eventually strength of discharge, measured in terms of BOD and SS.

Responsibility for identifying each user type and deciding whether to estimate or measure will rest with MDC in cooperation with the communities. The overriding criterion will be cost-effectiveness.

Implementation Approach

The selected apportionment and allocation method allows MDC to remain a wholesaler, but provides retailer-type information useful in order to divide costs fairly among MSD communities.

Several fundamental information systems must be developed, however, before MDC can fully implement the recommended apportionment and allocation method. These systems must provide discharge data concerning commercial and industrial users. Alternative procedures for generating information about these two user classes are described below.

1. Commercial Users

Many commercial users discharge wastes similar in strength to those discharged by residential users. Accordingly, only the volume discharged to the system need be estimated. One of the most feasible methods for estimating commercial discharge is through the use of water usage data. In some cases employment data may be used.

- Water Usage Data - Water usage data may be requested from water suppliers or from specifically identified commercial users. The former is preferred because it requires less communication to secure, and it is uniform. Using the data provided, commercial wastewater discharge can be converted to equivalent population units.

- Employment Data - Commercial employment data can also be used to estimate commercial discharges. In this method, a flow factor (derived by engineers) is applied to per capita employment to estimate total volume discharged by commercial users. Equivalent population units can then be calculated.

2. Industrial Users

Under the selected approach, the volume and strength of discharges from industrial users must be measured. Considering the size of MSD and the number of industrial users, one approach to be considered is to require reporting by industry,

periodically monitored and surveyed by MDC. This approach is consistent with the wholesaler role of the MDC for providing services and would assist in fulfilling federal requirements of NPDES.

Industrial dischargers would report the volume and strength characteristics of discharges to municipal sewers by means of an industrial discharge reporting information system. Profile information of all industrial establishments concerning characteristics of wastes discharged to collection networks, etc. would be solicited.

- Industries that do not discharge process wastes would report domestic wastes discharged. Either water usage data or employment data converted to volume (using a formula similar to that used for estimating commercial discharges) could be used.

- Industries that discharge process wastes would be required to report the volume and strength of discharges to the system. Since it may not be physically or financially feasible for all industrial users to measure their actual discharge, water usage data could be employed as an estimating unit for volume. Factors for sanitary uses of water should be considered since process wastes may possess higher strength characteristics. Large industrial dischargers should be encouraged to install discharge meters because actual water usage may be significantly different from discharged amounts.

Using the selected approach, industrial discharge would be converted to population equivalent units requiring complex formulas. For this reason, the success of P&PE as a method for dividing costs among municipalities has been greater for agencies with primarily flow-related cost distribution systems. Consequently, P&PE is easier to implement with the present system, which is considered primarily flow-related.

A modification of P&PE is achieved by Domestic Discharge Quantification. Under this approach, a formula is applied to a statistic (for example, "population") to yield estimated flow, which is then converted to strength characteristics. An outline of this approach is presented in Exhibit VII-1, using hypothetical data.

EXHIBIT VII-1

CONVERSION OF POPULATION TO FLOW AND STRENGTH CHARACTERISTICS USING HYPOTHETICAL DATA

Assumptions

Per capita water usage: 30,000 gallons annually
Population: 20,000
BOD in Parts Per Million (PPM): 300
SS in Parts Per Million (PPM): 250
Factor to convert PPM to pounds per million gallons: 8.345.

1) Calculation of estimated annual flows:

Per capita water usage x population = Annual Flow
30,000 x 20,000 = 600 million gallons

2) Calculation of estimated BOD in tons per year

$$\frac{\text{PPM x Conversion Factor x Total Annual Flow (mg)}}{\text{2,000 pounds per ton}} = \text{Tons}$$

$$\frac{300 \times 8.345 \times 600}{2{,}000} = 751 \text{ Tons BOD}$$

3) Calculation of estimated SS in tons per year:

$$\frac{\text{PPM x Conversion Factor x Total Annual Flows (mg)}}{\text{2,000 pounds per ton}} = \text{Tons}$$

$$\frac{250 \times 2{,}000 \times 600}{2{,}000} = 626 \text{ tons SS}$$

Summary of Discharges from Domestic Users

Annual Flows: 600 million gallons
Annual Tonnage BOD: 751
Annual Tonnage SS: 626

The same approach, using different conversion factors, is used to estimate flows and strengths discharged by commercial users. The quantified flow and strength data can then be added to that determined for industry. An example of how this would appear is shown in Exhibit VII-2.

Using this approach, summaries are prepared for each of the participating communities. Costs, analyzed on the basis of flow, BOD, and SS, can then be sub-apportioned to all participating communities and subsequently allocated to the three user classes.

DISTRIBUTION AND BILLING

Distribution relates to the method of charging for services; billing is the mechanism that transfers the cost burden (charge) to the final user. In accordance with the selected approach, user charges will be developed to distribute costs to all users. Existing water billing systems should be used as the primary billing mechanism.

In communities or areas where water billing systems do not exist, flat rates to bill residential users may be developed and implemented by the various municipal governments.

Industries that discharge process wastes to municipal systems will be surcharged for wastewater strengths that are greater than those characteristically discharged by residential and commercial users.

Implementation Approach

Industrial surcharge billing will be the responsibility of participating municipalities. However, because (1) MDC will have all the technical data concerning discharges from industries, and (2) formulation of surcharge formulas may be complex and technical, MDC's active participation in the development of surcharges, identifying each community's industrial users and the amount of their surcharge by strength factors (i.e., BOD and SS) is anticipated.

Accordingly, increased communication between MDC and its member communities, for purposes of identifying the annual wastewater costs that have been apportioned to each member, is essential.

EXHIBIT VII-2

SUMMARY OF FLOW AND STRENGTH CHARACTERISTICS FOR ALL USER CLASSES USING HYPOTHETICAL DATA

Users	Flow (mg)	Flow %	BOD (tons)	BOD %	SS Tons	SS %
Domestic (Residential)	600	77	751	74	626	74
Commercial	120	15	150	15	125	15
Industrial	60	8	112	11	94	11
Totals	780	100%	1,013	100%	845	100%

Important information to be provided to each community may include the following:

1. Community data used in apportioning and allocating costs.

2. MDC annual expenditures analyzed according to wastewater characteristics for the following cost elements:

   . operation and maintenance costs; and
   . debt service costs.

3. Recommended allocation of cost among the following user classes where appropriate:

   . residential;
   . commercial;
   . industrial; and
   . others.

Development and implementation of user charge systems (charges by the community to the individual users) will continue to be the responsibility of each participating community. MDC personnel and technical assistance will be available to assist communities in developing user charge system. Since MDC, as a grantee agency, will be responsible for developing an equitable user charge system, it will also be responsible for overseeing each charge system and recommending appropriate changes.

INDUSTRIAL COST RECOVERY

The selected methods for apportioning, distributing, and collecting Industrial Cost Recovery (ICR) charges can be summarized as follows:

. The portion to be recovered will be apportioned uniformly to all industrial establishments in MSD. Apportionment will be based on flow, BOD, and SS, in proportion to the amounts discharged by industrial establishments in the service area.*

*An interpretation has been made of EPA requirements that a physical inter-connection between treatment systems must exist in order to apply the concept. Such an interconnection is considered by MDC to exist.

. Distribution and collection of charges will be the responsibility of each municipality, using guidelines set forth by MDC.

Implementation Approach

The calculation of ICR portions to be recovered is shown in Section B.

ICR programs will apply to all industrial establishments that discharge process wastes to municipal systems. Accordingly, thousands of industrial establishments with discharges of varying amounts and strengths will be affected by ICR. Definitions of industrial users are contained in 40 CFR 906-8 and 40 CFR 925-12. EPA guidelines for the design and implementation of ICR systems are to be issued in the near future and should be considered for the classification of industrial establishments, the allocation of proportionate costs and funds management.

B. COST APPORTIONMENT AND ALLOCATION STUDY

The objectives of the cost apportionment and allocation study were (1) to determine the relative cost impact on communities resulting from the application of the proposed cost apportionment and allocation methodology, and (2) to determine the impact on municipal assessments as a result of the newly proposed construction program. Cost apportionments and allocations were developed for the years 1974, 1980 and 1990.

The cost apportionment and allocation study was developed generally in accordance with methods described in Section A, However, because existing systems have no provision for estimating and measuring wastewater discharges by community and by user class, community data that were used in facility design considerations were used in the apportionment and allocation study. Two variations are significant:

1. Under the selected method described in Section A, population data (without conversion to flow estimates) represent a major unit for estimated discharges from the residential user class. Commercial and industrial discharge is converted to population equivalent units. For the study, discharge--quantified for volume and strength for all user classes--was used to apportion and allocate costs.

2. The user classes selected for the study were (1) large industrial and (2) all others. The "all others" category consists of small industries, all dry industries and domestic and commercial users. In accordance with the proposed method, three distinct user classes (domestic, commercial, and industrial) are identified for allocating costs.

Community cost apportionment and the subsequent allocations to user classes within each community are based upon the costs associated with the volume and strength discharged by each

user class. The approach and procedures used for apportioning and allocating costs are described in the following sections.

COST ANALYSIS

The costs associated with wastewater treatment were divided into (1) operations and maintenance, and (2) debt service.

Operation and Maintenance (O&M)

O&M costs for the years 1980 and 1990 were provided by Metcalf and Eddy, Inc., identified separately for flow, BOD, and SS. The 1974 O&M costs were derived from the Commonwealth's PD 92 and reflect actual MDC expenditures for that fiscal year. All 1974 O&M costs have been related to volume. O&M costs, related to volume and strength characteristics for all three time periods, are presented in Exhibit VII-3.

Debt Service Costs

As of June 30, 1974, MSD's outstanding long-term debt was $87,047,000, as reported in PD 92. During the period June 30, 1974 to June 30, 1975, an additional $6,200,000 in long-term debt was issued. The scheduled retirement of this debt for the selected periods is shown in Exhibit VII-4. All outstanding debt is considered to be flow-related.

Calculation of debt service costs resulting from construction of the projects proposed in the engineering study is significantly more complex. As a first step, the net costs to the cities and towns must be calculated, considering federal and state grants and the timing of their respective reimbursements.

To calculate the net capital costs to communities, each project in the proposed construction schedule was assigned a start and end date in accordance with the phases identified for each project. Project costs were supplied by M&E. Six additional projects that are being constructed or are scheduled to be constructed as a result of earlier studies but that were not included in the original construction schedule, were also included for determining net capital requirements. Exhibit VII-5 presents the various start and end dates for all phases of each project.

EXHIBIT VII-3

OPERATIONS AND MAINTENANCE COSTS FOR SELECTED YEARS

Year	Total Costs	Costs Allocated to Wastewater Characteristics		
		Flow	BOD	Suspended Solids
1974	$ 9,660,834	$ 9,660,834	$0	$0
1980	13,403,700	10,606,600	346,100	2,451,000
1990	27,543,000	18,211,300	5,964,300	3,367,400

Source: .1974 Costs - Commonwealth of Massachusetts Public Document 92, 1974 Assessments of the Metropolitan Districts
.1980 and 1990 Costs - Metcalf & Eddy, Inc. The costs are in 1975 dollars without consideration for inflation factors.
.See Section E for additional information on data sources and study assumptions.

EXHIBIT VII-4

DEBT SERVICE REQUIREMENTS FOR EXISTING DEBT AND RELATION TO WASTEWATER CHARACTERISTICS

Year	Existing Debt Service	Allocation		
		Flow	BOD	Suspended Solids
1974	$ 6,787,619	$ 6,787,619	$0	$0
1980	6,777,949	6,777,949	0	0
1990	3,851,957	3,851,957	0	0

Source: Commonwealth of Massachusetts and PD92, 1974 Assessments of the Metropolitan Districts

METROPOLITAN DISTRICT COMMISSION

EXHIBIT VII-5 - LIST OF CONSTRUCTION PROJECTS

PROJECT NUMBER	NAME OF PROJECT	TOTAL COST($)	PROJECT PROGRESS SCHEDULE*					
			STEP ONE		STEP TWO		STEP THREE	
			START DATE	END DATE	START DATE	END DATE	START DATE	END DATE
0.1	SQUANTUM P.S.	1,350,000	4-1975	2-1976	4-1976	3-1977	4-1977	2-1979
0.2	READING EXT. S. AND P.S.	4,237,000	4-1975	2-1976	4-1976	3-1977	4-1977	2-1979
0.3	BRAINTREE-WEYMOUTH EXT. S.	6,443,000	4-1975	2-1976	4-1976	3-1977	4-1977	2-1979
0.4	UPPER NEPONSET VALLEY S.	3,154,000	4-1975	2-1976	4-1976	3-1977	4-1977	2-1979
1	SLUDGE MANAGEMENT (PRIMARY)	25,571,000	4-1975	2-1976	4-1976	3-1977	4-1977	2-1979
2	I/I ANALYSIS (SOUTH SYSTEM)	983,000	4-1975	3-1976	2-1977	1-1979	3-1980	2-1983
2.1	CHARLES RIVER MARGINAL CONDUIT	30,000,000	4-1975	4-1975	4-1975	4-1975	4-1975	2-1978
3	DORCHESTER BAY COMB. S. OVERFLOWS	77,000,000	1-1976	4-1976	2-1977	3-1978	2-1979	1-1981
3.1	NORTH CHARLES RIVER RELIEF SEWER	7,400,000	2-1976	2-1976	2-1976	2-1976	2-1976	2-1978
4	I/I ANALYSIS (NORTH SYSTEM)	1,212,000	4-1975	3-1976	2-1977	1-1979	3-1980	2-1983
5	N.I. PRIMARY EXP. (INCL. OUTFALL)	50,536,000	1-1977	4-1977	2-1978	4-1979	3-1980	2-1983
6	D.I. PRIMARY EXP.	41,301,000	1-1977	4-1977	2-1978	4-1979	3-1980	2-1983
7	N.I. SECONDARY EXT.	86,703,000	1-1977	4-1977	2-1978	1-1980	4-1980	1-1984
8	D.I. SECONDARY EXT.	150,000,000	1-1977	4-1977	2-1978	1-1980	4-1980	1-1984
9	SLUDGE MANAGEMENT (SECONDARY)	28,094,000	1-1977	4-1977	2-1978	1-1980	4-1980	1-1984
10	MIDDLE CHARLES R. W.W.T.P.	48,603,000	1-1977	4-1977	2-1978	4-1979	3-1980	2-1983
11	UPPER NEPONSET R. W.W.T.P.	41,139,000	1-1977	4-1977	2-1978	4-1979	3-1980	2-1983
12	CHARLES R. COMB. S. OVERFLOWS	84,000,000	1-1977	2-1978	1-1979	2-1980	1-1981	4-1982
13	NEPONSET R. COMB. S. OVERFLOWS	23,000,000	1-1977	4-1977	1-1979	2-1980	1-1981	4-1982
14	FRAMINGHAM EXT. S.	22,461,000	2-1977	1-1978	3-1978	2-1979	1-1980	4-1981
15	INNER HARBOR COMB. S. OVERFLOWS	36,000,000	1-1978	2-1979	1-1980	4-1981	1-1983	4-1985
16	LOWER BRAINTREE CONN. S.	400,000	2-1978	4-1978	2-1979	1-1980	4-1980	3-1981
17	BRAINTREE-WEYMOUTH P.S.	2,920,000	2-1978	4-1978	2-1979	1-1980	4-1980	1-1982
18	HINGHAM F.M.	534,000	2-1978	4-1978	2-1979	1-1980	4-1980	3-1981
19	STOUGHTON EXT. S.	1,080,000	1-1979	2-1979	4-1979	2-1980	1-1981	4-1981
20	WALPOLE EXT. S.	11,834,000	1-1979	3-1979	1-1980	4-1980	3-1981	2-1983
21	NO. CHARLES METRO. S.	1,271,000	4-1979	1-1980	3-1980	4-1980	3-1981	2-1982
22	MILLBROOK VALLEY S.	3,771,000	4-1979	2-1980	4-1980	3-1981	2-1982	1-1983
23	QUINCY P.S. AND F.M.	2,220,000	4-1979	3-1980	1-1981	4-1981	3-1982	3-1983
24	NORTH METRO S.	1,165,000	4-1980	2-1981	2-1981	3-1982	2-1983	3-1984
25	CHELSEA BRANCH S.	145,000	4-1980	2-1981	4-1981	3-1982	2-1983	1-1984
26	STONEHAM EXT. S	348,000	3-1981	1-1982	3-1982	2-1983	1-1984	4-1984
27	STONEHAM TRUNK S.	145,000	3-1981	1-1982	3-1982	2-1983	1-1984	4-1984
28	EAST BOSTON STEAM P.S.	1,460,000	2-1982	1-1983	3-1983	2-1984	1-1985	4-1985
29	CHARLESTOWN P.S.	6,000,000	2-1982	1-1983	3-1983	2-1984	1-1985	2-1986
30	ALEWIFE BROOK P.S.	712,000	2-1982	1-1983	3-1983	2-1984	1-1985	4-1985
31	EAST BOSTON ELECTRIC P.S.	365,000	2-1982	1-1983	3-1983	2-1984	1-1985	4-1985
32	HOUGHS NECK P.S.	203,000	2-1982	1-1983	3-1983	2-1984	1-1985	4-1985
33	SOMERVILLE-MEDFORD BRANCH S.	4,500,000	3-1983	2-1984	4-1984	3-1985	2-1986	1-1988
34	SOUTH CHARLES REL. S.	2,679,000	1-1984	4-1984	4-1985	3-1986	2-1987	1-1989
35	WAKEFIELD BRANCH S.	538,000	1-1984	2-1984	4-1984	3-1985	2-1986	1-1987
36	SOUTH CHARLES RIVER S.	5,428,000	3-1984	2-1985	4-1985	3-1986	2-1987	1-1989
37	CUMMINGSVILLE BRANCH S.	1,012,000	2-1986	1-1987	3-1987	2-1988	1-1989	4-1989

EXHIBIT VII-5 (CONT.)

38	HINGHAM P. S.	890,000	2-1987	1-1988	3-1988	2-1989	1-1990	4-1990
39	REVERE EXT. S.	3,413,000	2-1988	1-1989	3-1989	2-1990	1-1991	4-1992
40	LYNNFIELD EXT. S.	367,000	4-1988	2-1989	4-1989	3-1990	2-1991	1-1992
41	ASHLAND-HOPKINTON EXT. S.	4,459,000	4-1988	3-1989	1-1990	4-1990	3-1991	2-1993
42	WESTON-LINCOLN EXT. S.	3,832,000	4-1989	3-1990	1-1991	4-1991	3-1992	2-1994
43	SOUTHBORO EXT. S.	2,421,000	4-1989	3-1991	1-1992	4-1992	3-1993	4-1994
44	SHARON EXT. S.	1,218,000	4-1991	2-1992	4-1992	2-1993	1-1994	4-1994
45	STOUGHTON EXT. S.	827,000	3-1992	1-1993	3-1993	2-1994	1-1995	4-1995
46	WILMINGTON EXT. S.	2,464,000	4-1992	3-1993	1-1994	2-1995	1-1996	4-1997
47	NORTH METRO S.	475,000	4-1992	2-1993	4-1993	3-1994	2-1995	3-1996
48	WESTWOOD EXT. S.	2,350,000	1-1993	4-1993	2-1994	1-1995	4-1995	1-1997
49	WAKEFIELD TRUNK S.	4,754,000	2-1993	3-1994	1-1995	2-1996	1-1997	4-1998
50	WAKEFIELD BRANCH S.	177,000	1-1994	2-1994	4-1994	2-1995	1-1996	4-1996
51	SO. CHARLES RELIEF S.	2,011,000	4-1994	3-1995	1-1996	2-1997	1-1998	4-1999
52	SOUTH CHARLES RIVER S.	4,250,000	4-1995	3-1996	1-1997	2-1998	1-1999	4-2000
	TOTAL COST OF ALL PROJECTS COMBINED:	313,443,000						

Source: Metcalf & Eddy, Inc. Data for projects 0.1, 0.2, 0.3, 0.4, 2.1, 3.1 were provided by MDC. Cost estimates are in 1975 dollars without consideration for inflationary factors. See section E for additional information on data sources and study assumptions.

*Dates are shown as quarter-calendar year.

Using assumptions previously discussed and summarized in Appendix VII-1, PMM&Co. applied the selected cost allocation methods to determine, on a pro forma basis, the relative cash flows and deficits to be financed by the local communities. The results of these allocations are presented in Exhibit VII-6.

Exhibit VII-6 reflects the cash flow and deficits resulting from these assumptions to be financed for each year, and cumulatively through the duration of the construction schedule. Since the last year selected for analysis is 1990, details of the years following 1990 are shown cumulatively as "1991 onward." The Exhibit indicates that $92,874,000 (10.1619% of the scheduled construction costs) unadjusted for inflation will have to be raised as the local portion of capital requirements. Most of those capital requirements arise in the years 1981 and 1982, when $39.4 million and $41.5 million are required respectively. Cumulative capital requirements through 1982 are $111.9 million, after which they decline to $104.9 million in the following year. The fluctuation of cumulative deficits to be financed during this period results from the intensity of construction activity and the lag in federal and state project reimbursements. The estimated net capital requirements resulting from the selected assumptions were converted into the bond sale schedule presented in Exhibit VII-7. Refer to Section C for a discussion of financing alternatives and to the related assumptions in Appendix VII-1.

Based on the bond issue schedule, assumed debt service costs in 1980 and 1990 increased by $3,635,263 and $7,683,625, respectively. These additional costs must be related to volume and strength characteristics.

As an initial requirement for relating new debt service costs to flow and strength characteristics, the costs of the various projects in the proposed construction schedule were allocated, by percentage, to flow, BOD and SS. This analysis was prepared by M&E and is presented in Exhibit VII-8.

METROPOLITAN DISTRICT COMMISSION

EXHIBIT VII-6 - ANALYSIS OF CASH FLOW ON ACCOUNT OF PLANNED CONSTRUCTION PROJECTS

$(000)

DATE	CONSTRUCTION DISBURSEMENTS	FEDERAL REIMBURSEMENTS	STATE REIMBURSEMENTS	CASH FLOW (DEFICITS) TO BE FINANCED	CUMULATIVE TOTALS: CONSTRUCTION DISBURSEMENTS	CUMULATIVE TOTALS: FEDERAL REIMBURSEMENTS	CUMULATIVE TOTALS: STATE REIMBURSEMENTS	CUMULATIVE TOTALS: CASH FLOW (DEFICITS) TO BE FINANCED
1-ST QTR 1975	0	0	0	0	0	0	0	0
2-ND QTR 1975	0	0	0	0	0	0	0	0
3-RD QTR 1975	0	0	0	0	0	0	0	0
4-TH QTR 1975	3,538	0	3,000	(538)	3,538	0	3,000	(538)
1-ST QTR 1976	3,923	2,653	0	(1,269)	7,460	2,653	3,000	(1,807)
2-ND QTR 1976	4,745	2,942	740	(1,063)	12,205	5,595	3,740	(2,870)
3-RD QTR 1976	4,433	3,394	0	(1,039)	16,639	8,990	3,740	(3,909)
4-TH QTR 1976	4,753	3,160	136	(1,456)	21,391	12,150	3,876	(5,365)
1-ST QTR 1977	7,002	3,406	205	(3,398)	28,394	15,550	4,081	(8,763)
2-ND QTR 1977	8,013	5,087	354	(2,571)	36,407	20,638	4,435	(11,334)
3-RD QTR 1977	8,013	5,845	429	(1,739)	44,420	26,483	4,864	(13,073)
4-TH QTR 1977	13,273	5,845	4,150	(3,278)	57,693	32,328	9,015	(16,350)
1-ST QTR 1978	11,205	9,730	225	(1,190)	68,898	42,119	9,239	(17,540)
2-ND QTR 1978	15,267	8,239	916	(6,111)	84,165	50,358	10,155	(23,652)
3-RD QTR 1978	11,830	11,286	2,489	1,944	95,996	61,644	12,644	(21,747)
4-TH QTR 1978	10,932	8,873	1,958	(101)	106,928	70,517	14,563	(21,949)
1979	61,915	43,913	14,260	(3,740)	168,843	114,430	28,824	(25,590)
1980	99,931	52,560	41,925	(5,446)	268,775	166,990	70,749	(31,036)
1981	202,169	148,011	14,756	(39,401)	470,944	315,001	85,504	(70,439)
1982	183,098	139,597	1,983	(41,517)	654,042	454,598	87,487	(111,956)
1983	128,524	112,758	22,727	6,960	782,567	567,357	110,215	(104,996)
1984	44,910	46,684	13,471	15,246	827,477	614,041	123,687	(88,750)
1985	32,779	23,484	878	(8,415)	860,256	637,525	124,566	(98,165)
1986	4,526	9,050	5,340	9,864	864,781	646,575	129,905	(88,301)
1987	6,079	3,743	965	(1,372)	870,860	650,318	130,870	(89,673)
1988	5,708	4,638	241	(828)	876,568	654,957	131,112	(90,500)
1989	2,449	2,590	673	815	879,017	657,546	131,785	(89,686)
1990	1,331	1,015	235	(80)	880,347	658,561	132,021	(89,766)
1991 ONWARD	33,587	25,411	5,068	(3,108)	913,935	683,971	137,090	(92,874)*
					100%	75%	15%	10%

*Total cash flow deficits are 10.1619% due to project number 2.1 which is subject to only 55% federal reimbursement.

Note: See Section E for additional information on data sources and study assumptions.

EXHIBIT VII-7

BOND SALE SCHEDULE

Date of Issue	Amount ($)	Interest Rate	Term	Type
January 1, 1975	$10,000,000	7.250%	30 years	General Obligation Bonds
January 1, 1977	$12,000,000	7.250%	30 years	General Obligation Bonds
January 1, 1979	$22,000,000	7.250%	30 years	General Obligation Bonds
January 1, 1981	$25,000,000	7.250%	30 years	General Obligation Bonds
January 1, 1982	$24,000,000	7.250%	30 years	General Obligation Bonds

Note: See Section E for data sources and underlying assumptions.

EXHIBIT VII-8

SCHEDULE OF PROJECT COST BREAKDOWN BY WASTEWATER CHARACTERISTICS

Project Descriptions	Flow	BOD	Suspended Solids
D.I. Primary Exp.	69.2%	13.5%	17.3%
D.I. Secondary Ext.	9.1	68.8	22.1
N.I. Primary Exp.	77.5	5.7	16.8
N.I. Secondary Ext.	21.7	58.8	19.5
N.I. Outfall Ext.	100.0	0.0	0.0
Middle Charles ATP	38.2	37.0	24.8
Upper Neponset ATP	37.0	37.6	25.4
Sludge Mgmt. Primary	0.0	0.0	100.0
Sludge Mgmt. Secondary	0.0	33.3	66.7
Pump Stas., Interceptors, Comb. Sewers, and II Anal.	100.0	0.0	0.0

Source: Metcalf and Eddy, Inc.

PMM&Co. classified the projects in Exhibit VII-6 into one of ten project types to meet automated processing requirements. Based upon the project type and associated cost percentages, construction costs were allocated to flow, BOD, and SS, as shown in Exhibit VII-9.

The resulting percentages of 63.529%, 22.167% and 14.304% relate to flow, BOD, and SS respectively and are applied to the new debt service costs for 1980 and 1990. This procedure yielded a uniform allocation of debt service costs throughout the construction period.

Based on the developed percentages, new debt service is allocated to flow, BOD and SS. Exhibit VII-10 presents a summary of the old and new debt service requirements, allocated to wastewater characteristics for the selected study years.

These same percentages are used to apportion grant amounts to be recovered through the proposed ICR program. The calculation of ICR portions to be recovered is best shown by the example shown below, using year 1980 data.

By the end of 1980, seven projects of the construction schedule will have been completed and federal reimbursement will have been received. Total federal reimbursements assumed and the subsequent determination of ICR amounts are shown in Exhibit VII-11. ICR calculations for the years 1980 and 1990 are shown in summary form in Exhibit VII-12.

METROPOLITAN DISTRICT COMMISSION

EXHIBIT VII-9 - DEVELOPMENT OF PERCENTAGES TO ALLOCATE NEW DEBT SERVICE COSTS

PROJECT TYPE	PROJECT SEQUENCE NUMBER	NAME OF PROJECT	COMMUNITIES' SHARE OF CONSTRUCTION COSTS($)	COSTS RELATED TO PROCESSING OF: FLOW($)	B.O.D.($)	SUSPENDED SOLIDS($)
10	0.1	SQUANTUM P.S.	135,000	135,000	0	0
10	0.2	READING EXT. S. AND P.S.	423,700	423,700	0	0
10	0.3	BRAINTREE-WEYMOUTH EXT. S.	644,300	644,300	0	0
10	0.4	UPPER NEPONSET VALLEY S.	915,400	915,400	0	0
X	1	SLUDGE MANAGEMENT (PRIMARY)	2,557,300	0	0	2,557,300
10	2	I/I ANALYSIS (SOUTH SYSTEM)	98,300	98,300	0	0
10	2.1	CHARLES RIVER MARGINAL CONDUIT	3,000,000	3,000,000	0	0
10	3	DORCHESTER BAY COMB. S. OVERFLOWS	7,700,000	7,700,000	0	0
10	3.1	NORTH CHARLES RIVER RELIEF SEWER	2,220,000	2,220,000	0	0
10	4	I/I ANALYSIS (NORTH SYSTEM)	101,200	101,200	0	0
X	5	N.I. PRIMARY EXP. (INCL. OUTFALL)	5,053,600	3,916,540	288,955	849,005
1	6	D.I. PRIMARY EXP.	4,193,000	2,889,480	565,650	724,870
4	7	N.I. SECONDARY EXT.	8,070,600	1,381,390	5,097,960	1,690,650
2	8	D.I. SECONDARY EXT.	15,000,000	1,365,000	10,320,000	3,315,000
X	9	SLUDGE MANAGEMENT (SECONDARY)	2,809,400	0	935,530	1,873,870
6	10	MIDDLE CHARLES R. W.W.T.P.	4,960,000	1,594,720	1,835,200	1,530,080
7	11	UPPER NEPONSET R. W.W.T.P.	4,119,000	1,520,700	1,545,360	1,052,940
10	12	CHARLES R. COMB. S. OVERFLOWS	8,400,000	8,400,000	0	0
10	13	NEPONSET R. COMB. S. OVERFLOWS	2,300,000	2,300,000	0	0
10	14	FRAMINGHAM EXT. S.	2,246,100	2,246,100	0	0
10	15	INNER HARBOR COMB. S. OVERFLOWS	8,600,000	8,600,000	0	0
10	16	LOWER BRAINTREE CONN. S.	40,000	40,000	0	0
10	17	BRAINTREE-WEYMOUTH P.S.	292,000	292,000	0	0
10	18	HINGHAM P.S.	53,400	53,400	0	0
10	19	STOUGHTON EXT. S.	109,000	109,000	0	0
10	20	MALDEN EXT. S.	1,138,400	1,138,400	0	0
10	21	NO. CHARLES METRO. S.	127,100	127,100	0	0
10	22	MILLBROOK VALLEY S.	377,100	377,100	0	0
10	23	QUINCY P.S. AND F.M.	223,000	223,000	0	0
10	24	NORTH METRO S.	116,500	116,500	0	0
10	25	CHELSEA BRANCH S.	14,500	14,500	0	0
10	26	STONEHAM EXT. S	34,900	34,900	0	0
10	27	STONEHAM TRUNK S.	14,500	14,500	0	0
10	28	EAST BOSTON STEAM P.S.	146,000	146,000	0	0
10	29	CHARLESTOWN P.S.	600,000	600,000	0	0
10	30	MERRIMAC BROOK P.S.	71,200	71,200	0	0
10	31	EAST BOSTON ELECTRIC P.S.	36,500	36,500	0	0
10	32	HOUGHS NECK P.S.	20,300	20,300	0	0
10	33	SOMERVILLE-MEDFORD BRANCH S.	450,000	450,000	0	0
10	34	SOUTH CHARLES REL. S.	267,000	267,000	0	0
10	35	WAKEFIELD BRANCH S.	83,800	83,800	0	0
10	36	SOUTH CHARLES RIVER S.	842,800	842,800	0	0
10	37	CUMINGSVILLE BRANCH S.	101,200	101,200	0	0
10	38	HINGHAM P. S.	89,000	89,000	0	0
10	39	REVERE EXT. S.	341,300	341,300	0	0
10	40	LYNNFIELD EXT. S.	36,700	36,700	0	0
10	41	ASHLAND-HOPKINTON EXT. S.	445,900	445,900	0	0
10	42	WESTON-LINCOLN EXT. S.	383,200	383,200	0	0
10	43	SOUTHBORO EXT. S.	242,100	242,100	0	0

EXHIBIT VII-9 (CONT.)

10	44	SHARON EXT. S.	121,800	121,800	0	0
10	45	STOUGHTON EXT. S.	82,700	82,700	0	0
10	46	WILMINGTON EXT. S.	296,400	296,400	0	0
10	47	NORTH METRO S.	47,500	47,500	0	0
10	48	WESTWOOD EXT. S.	235,000	235,000	0	0
10	49	WAKEFIELD TRUNK S.	475,400	475,400	0	0
10	50	WAKEFIELD BRANCH S.	17,700	17,700	0	0
10	51	SO. CHARLES RELIEF S.	291,100	291,100	0	0
10	52	SOUTH CHARLES RIVER S.	425,000	425,000	0	0
		TOTALS:	92,874,300	59,001,830	20,587,755	13,284,715
			100.000%	63.529%	22.167%	14.304%

Note: See Section E for data sources and study assumptions.

EXHIBIT VII-10

ALLOCATION OF DEBT SERVICE FOR SELECTED YEARS
TO WASTEWATER CHARACTERISTICS

Year	Old Debt* Service	New Debt** Service	Allocation		
			Flow	BOD	Suspended Solids
1974	$6,787,619		$6,787,619		
1980	6,777,949	$3,635,263	9,087,384	$805,841	$519,987
1990	3,851,957	7,683,625	8,733,263	1,703,255	1,099,064

* 100% flow related.
** 63.529% flow; 22.16% BOD; 14.304% SS related

Note: See Section E for additional information on data sources and study assumptions.

EXHIBIT VII-11

FEDERAL REIMBURSEMENTS AND INDUSTRIAL COST RECOVERY*

Project Number	Project	Federal Reimbursement	Collection Period	Annual Amount	Allocation		
					Flow	BOD	SS
0.1	Squantum P.S.	$ 1,012,500	30 years	$ 33,750	$ 33,750		
0.2	Reading Ext.S.	3,177,750	30 years	105,925	105,925		
0.3	Braintree-Wey. Ext. S.	4,832,250	30 years	161,075	161,075		
0.4	Upper Nepon. Valley St.	6,865,500	30 years	228,850	228,850		
1	Sludge Mgmt. (Primary)	19,179,750	30 years	639,325			$639,325
3.1	North Charles Relief S.**	4,070,000	30 years	135,667	135,667		
2.1	Charles River Marginal Conduit	22,500,000	30 years	750,000	750,000		
	Totals	$61,637,750		$2,054,592	$1,415,267	$-0-	$639,325

* Since this table was prepared, two projects (Projects 3.1 and 2.1) have been reported by EPA to be exempt from ICR. This would reduce the total annual flow related costs subject to ICR by $885,667, and estimated annual recoverable costs by $78,293 (885,667 X 8.84%).

**Federal Share for this project is 55%.

Note: See Section E for additional information on data sources and study assumptions.

METROPOLITAN DISTRICT COMMISSION

EXHIBIT VII-12 - INDUSTRIAL COST RECOVERY OF FEDERAL SHARE OF CONSTRUCTION COSTS FOR SELECTED YEARS

YEAR	TOTAL FEDERAL SHARE	ALLOCATION			INDUSTRIAL SHARE OF WASTEWATER			INDUSTRIAL COSTS TO BE RECOVERED
		FLOW	B.O.D.	SUSPENDED SOLIDS	FLOW	B.O.D.	SUSPENDED SOLIDS	
1974	$0	$0	$0	$0	5.84%	0.00%	0.00%	$0
1980	$2,054,592	$1,415,267	$0	$639,325	8.84%	26.66%	20.25%	$254,579
1990	$15,166,542	$6,698,424	$5,146,939	$3,321,179	8.24%	23.45%	18.11%	$2,366,727

Note: See Section E for additional information on data sources and study assumptions.

Calculations of ICR

Flow Related Costs X % Ind'l Flow Contribution = ICR Flow Related Share

$1,415,267 X 8.84% = $125,110 Flow Related

SS Related Costs X % Ind'l SS Contribution = ICR SS Related Share

$639,325 X 20.25% = $129,463

BOD Related Costs X % Industrial BOD Contribution = ICR BOD Related Share

$0.00 X 26.66% = 0

Summary

ICR Related to Flow:	$125,110
ICR Related to SS:	129,463
ICR Related to BOD:	-0-
	$254,573*

COMMUNITY DATA

For study purposes, community discharge data prepared for the EMMA Study by Metcalf and Eddy, Inc. were used to apportion costs among participating communities. The percent contribution of volume and strength by community was prepared by M&E and forwarded to PMM&Co. According to M&E, because no major changes in community sewerage needs are expected before 1980, the cost distribution percentages for flow related costs for 1980 were used to distribute the 1974 cost data.

Other community information used in the study was the percent of each community's discharge by volume and strength attributed to large industrial users. These data, prepared by M&E, were to be used by PMM&Co. to allocate costs to the two user classes selected for the study. Community and industrial data are presented in Exhibits VII-13 and VII-14 respectively.

*Difference of $7.00 (Appendix VII-2) is due to rounding calculations.

METROPOLITAN DISTRICT COMMISSION

EXHIBIT VII-13 - COMMUNITIES' CONTRIBUTION TO TOTAL WASTEWATER (%)

COMMUNITY	FOR THE YEAR 1974			FOR THE YEAR 1980			FOR THE YEAR 1990		
	FLOW	B.O.D.	SUSPENDED SOLIDS	FLOW	B.O.D.	SUSPENDED SOLIDS	FLOW	B.O.D.	SUSPENDED SOLIDS
ASHLAND	0.3	0.0	0.0	0.3	0.3	0.4	0.4	0.5	0.6
ARLINGTON	2.0	0.0	0.0	2.0	1.7	1.8	2.0	1.7	1.9
BEDFORD	0.4	0.0	0.0	0.4	0.7	0.7	0.6	0.7	0.7
BELMONT	0.9	0.0	0.0	0.9	0.6	0.7	0.9	0.7	0.7
BRAINTREE	1.1	0.0	0.0	1.1	1.1	1.2	1.2	1.2	1.3
BROOKLINE	2.5	0.0	0.0	2.5	1.7	1.9	2.5	1.8	2.0
BURLINGTON	0.5	0.0	0.0	0.5	0.6	0.6	0.7	0.8	0.9
CAMBRIDGE	6.1	0.0	0.0	6.1	5.1	5.2	6.0	3.6	3.5
CANTON	0.8	0.0	0.0	0.8	1.0	1.0	1.0	1.3	1.2
CHELSEA	1.2	0.0	0.0	1.2	0.7	0.8	1.0	0.7	0.7
DEDHAM	0.9	0.0	0.0	0.9	0.8	0.8	1.0	0.9	1.0
DOVER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EVERETT	2.2	0.0	0.0	2.2	2.6	1.7	2.0	2.4	1.6
FRAMINGHAM	2.4	0.0	0.0	2.4	3.8	3.2	2.6	4.0	3.4
HINGHAM	0.2	0.0	0.0	0.2	0.3	0.3	0.4	0.4	0.5
HOLBROOK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HOPKINTON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LEXINGTON	0.9	0.0	0.0	0.9	1.0	1.1	1.0	1.2	1.2
LINCOLN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LYNNFIELD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MALDEN	2.4	0.0	0.0	2.4	2.0	2.1	2.2	1.9	2.0
MEDFORD	2.8	0.0	0.0	2.8	2.5	2.6	2.7	2.4	2.6
MELROSE	1.3	0.0	0.0	1.3	0.9	1.0	1.3	1.0	1.1
MILTON	0.9	0.0	0.0	0.9	1.1	1.0	0.9	1.1	1.1
NATICK	1.3	0.0	0.0	1.3	2.4	1.7	1.4	2.4	1.8
NEEDHAM	1.0	0.0	0.0	1.0	1.1	1.2	1.2	1.2	1.3
NEWTON	3.7	0.0	0.0	3.7	3.0	3.3	3.6	3.0	3.3
NORWOOD	1.2	0.0	0.0	1.2	1.1	1.2	1.3	1.2	1.3
QUINCY	4.4	0.0	0.0	4.4	3.3	3.6	4.4	3.4	3.6
RANDOLPH	0.6	0.0	0.0	0.6	0.7	0.7	0.7	0.8	0.9
READING	0.5	0.0	0.0	0.5	0.5	0.6	0.6	0.7	0.7
REVERE	1.7	0.0	0.0	1.7	1.2	1.3	1.7	1.3	1.3
SHARON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SHERBORN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SOMERVILLE	3.7	0.0	0.0	3.7	2.6	2.7	3.3	2.4	2.5
SOUTHBORO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
STONEHAM	0.7	0.0	0.0	0.7	0.6	0.6	0.7	0.6	0.6
STOUGHTON	0.6	0.0	0.0	0.6	0.6	0.7	0.8	0.9	0.9
WAKEFIELD	1.2	0.0	0.0	1.2	1.1	1.0	1.1	1.2	1.2
WALPOLE	1.4	0.0	0.0	1.4	2.5	2.0	1.5	2.5	2.1
WALTHAM	3.5	0.0	0.0	3.5	4.3	3.7	3.6	4.3	3.8
WATERTOWN	1.5	0.0	0.0	1.5	1.3	1.4	1.3	1.1	1.2
WELLESLEY	1.0	0.0	0.0	1.0	0.8	0.9	1.0	0.9	1.0
WESTON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WESTWOOD	0.3	0.0	0.0	0.3	0.3	0.4	0.5	0.5	0.6

EXHIBIT VII-13 (CONT.)

WEYMOUTH	1.0	0.0	0.0	1.0	1.1	1.1	1.3	1.4	1.5
WILMINGTON	0.4	0.0	0.0	0.4	0.5	0.5	0.7	0.9	1.0
WINCHESTER	1.0	0.0	0.0	1.0	1.1	1.0	0.9	1.0	0.9
WINTHROP	0.6	0.0	0.0	0.6	0.4	0.4	0.5	0.4	0.4
WOBURN	1.7	0.0	0.0	1.7	5.6	3.1	1.9	5.5	3.3
BOSTON	37.2	0.0	0.6	37.2	35.4	38.8	35.4	34.0	36.8

Source: Metcalf and Eddy, Inc.

METROPOLITAN DISTRICT COMMISSION

EXHIBIT VII-14 - MAJOR INDUSTRY SHARE OF COMMUNITIES' WASTEWATER (%)

COMMUNITY	FOR THE YEAR 1974			FOR THE YEAR 1980			FOR THE YEAR 1990		
	FLOW	B.O.D.	SUSPENDED SOLIDS	FLOW	B.O.D.	SUSPENDED SOLIDS	FLOW	B.O.D.	SUSPENDED SOLIDS
ASHLAND	56.4	0.0	0.0	56.4	55.9	58.6	34.1	33.4	35.9
ARLINGTON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BEDFORD	14.0	0.0	0.0	14.0	34.5	30.0	10.5	32.1	27.8
BELMONT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BRAINTREE	1.1	0.0	0.0	1.1	1.5	1.2	1.0	1.3	1.0
BROOKLINE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BURLINGTON	10.5	0.0	0.0	10.5	8.8	5.9	7.0	5.7	3.8
CAMBRIDGE	5.0	0.0	0.0	5.0	15.5	9.1	4.8	20.5	12.4
CANTON	8.4	0.0	0.0	8.4	16.7	5.9	6.3	12.6	4.3
CHELSEA	5.9	0.0	0.0	5.9	12.0	12.0	6.4	12.5	12.5
DEDHAM	6.4	0.0	0.0	6.4	4.9	4.6	5.5	4.0	3.7
DOVER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EVERETT	22.2	0.0	0.0	22.2	62.2	37.3	22.9	61.8	36.8
FRAMINGHAM	6.8	0.0	0.0	6.8	35.8	15.6	5.9	5.8	5.3
HINGHAM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HOLBROOK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HOPKINTON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LEXINGTON	2.3	0.0	0.0	2.3	2.2	1.5	1.9	1.7	1.2
LINCOLN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LYNNFIELD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MALDEN	1.7	0.0	0.0	1.7	1.0	2.3	1.7	1.0	2.3
MEDFORD	1.4	0.0	0.0	1.4	11.0	10.9	1.4	11.0	10.1
MELROSE	2.5	0.0	0.0	2.5	4.6	4.6	2.4	4.0	4.0
MILTON	1.9	0.0	0.0	1.9	27.7	15.5	1.7	24.2	13.1
NATICK	24.3	0.0	0.0	24.3	53.7	31.3	21.4	48.8	27.2
NEEDHAM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NEWTON	2.9	0.0	0.0	2.9	7.1	7.8	2.7	6.5	7.2
NORWOOD	13.8	0.0	0.0	13.8	16.0	16.1	12.5	14.1	14.2
QUINCY	2.6	0.0	0.0	2.6	2.5	1.3	2.5	2.2	1.2
RANDOLPH	3.8	0.0	0.0	3.8	1.7	1.0	2.9	1.2	0.8
READING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
REVERE	1.6	0.0	0.0	1.6	12.2	9.4	1.5	10.8	8.3
SHARON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SHERBORN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SOMERVILLE	3.4	0.0	0.0	3.4	7.3	4.7	3.5	7.3	4.7
SOUTHBORO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
STONEHAM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
STOUGHTON	5.6	0.0	0.0	5.6	6.6	6.6	3.7	4.3	4.1
WAKEFIELD	24.7	0.0	0.0	24.7	18.5	8.3	21.1	15.1	6.6
WALPOLE	68.4	0.0	0.0	68.4	89.6	73.3	66.3	74.0	65.4
WALTHAM	27.4	0.0	0.0	27.4	46.9	33.2	24.7	42.9	29.7
WATERTOWN	5.0	0.0	0.0	5.0	4.7	4.6	5.4	4.2	4.9
WELLESLEY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WESTON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WESTWOOD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

EXHIBIT VII-14 (CONT.)

WEYMOUTH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WILMINGTON	24.4	0.0	0.0	22.4	21.2	15.5	11.9	11.6	7.8
WINCHESTER	13.8	0.0	0.0	13.8	14.2	20.6	13.9	33.2	19.9
WINTHROP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WOBURN	34.5	0.0	0.0	34.5	73.8	60.3	28.4	73.9	54.2
BOSTON	8.7	0.0	0.0	8.7	28.4	28.6	8.5	27.2	27.5

Source: Metcalf and Eddy, Inc.

APPORTIONMENT AND ALLOCATION

Using the data presented in the preceding exhibits, wastewater treatment costs and Industrial Cost Recovery amounts were apportioned to all participating communities and allocated to the two user classes. As an example, the 1980 costs apportioned and allocated to Ashland are shown below.

APPORTIONMENT TO ASHLAND

Apportionment of O&M Cost

Flow %	X	Flow Costs	=	Flow $ Share
.3	X	$10,606,600	=	$31,820

BOD %	X	BOD Costs	=	BOD $ Share
.3	X	$346,100	=	$1,038

SS %	X	SS Costs	=	SS $ Share
.4	X	$2,450,000	=	$9,804

Total Share of O&M Costs: $42,662

Allocation of O&M Costs to Industry (Major)

Ind'l. Flow %	X	Ashland's Flow $ Share	=	Ind'l. Flow $ Share
56.4	X	$31,820	=	$17,946

Ind'l. BOD %	X	Ashland's BOD $ Share	=	Ind'l BOD $ Share
55.9	X	$1,038	=	$ 580

Ind'l. SS %	X	Ashland's SS $ Share	=	Ind'l. SS $ Share
58.6	X	$9,804	=	$5,745

Total O&M Costs Allocated to Industry: $24,271

Apportionment of Debt Service Costs

Flow $ X Flow Costs = Flow $ Share
.3 X $9,087,384 = $27,262

BOD % X BOD Costs = BOD $ Share
.3 X $805,841 = $2,418

SS % X SS Costs = SS $ Share
.4 X $519,987 = $2,080

Total Share of Debt Service Costs: $31,760

Allocation of Debt Service Costs to Industry

Ind'l. Flow % X Ashland's Flow $ Share = Ind'l. Flow $ Share

56.4 X $27,262 = $15,376

Ind'l. BOD % X Ashland's BOD $ Share = Ind'l. BOD $ Share

55.9 X $2,418 = $1,352

Ind'l. SS % X Ashland's SS $ Share = Ind'l. SS $ Share

58.6 X $2,080 = $1,219

Total Debt Service Costs Allocated to Industry: $17,947

Apportionment of ICR Amounts to Ashland

% of Total Ind'l. Flow X Flow ICR = Flow $ Share
.1692% X $1,415,267 = $2,395

% of Total Ind'l. SS X SS ICR = SS $ Share
.2344% X $639,325 = $1,499

Total ICR to be recovered from Ashland's Industries: $3,894

Summary of Cost and ICR Apportioned and Allocated to Ashland in 1980.

	O&M	Debt Service	ICR	Total
Large Industrial	$24,271	$17,947	$3,894	$46,112
All Other Sources	18,391	13,813		32,204
Total	$42,662	$31,760	$3,894	$78,316

A summary of all apportioned and allocated costs to MSD communities is presented in Appendix VII-2.

C. HIGHLIGHT OF THE APPORTIONMENT AND ALLOCATION STUDY

The Apportionment and Allocation Study provides a detailed schedule of results as to how the present and future wastewater treatment costs would be divided among communities and user classes (under selected assumptions) if the selected formula for apportioning and allocating costs and assumption (Appendix VII-1) is adopted. Total costs and the percentage burden to each user class is summarized below. A cost comparison using year 1974 as 100 is also presented. The effect of inflation has not been considered.

	Actual Costs		Estimated Costs (Excluding Inflationary Impact) (1975 $)			
	1974	%	1980	%	1990	%
O&M Costs	$ 9,660,836	58.7%	$13,403,700	56.3%	$27,543,006	70.5%
Debt Service Costs	6,787,619	41.3%	10,413,218	43.7%	11,535,580	29.5%
Total	$16,448,455	100.0%	$23,816,918	100.0%	$39,078,586	100.0%
Allocation of O&M and Debt Service Costs						
Industrial Users	$ 1,454,157	08.8%	$ 2,649,819	11.1%	$ 4,835,14-	12.4%
All Other Users	14,994,298	91.2%	21,167,099	88.9%	34,243,441	87.6%
Total	$16,448,455	100.0%	$23,816,918	100.0%	$39,078,586	100.0%
Industrial Cost Recovery	-0-		$ 254,580		$ 2,366,727	

Cost Comparison (excluding inflationary impact)

(1974 as 100)	1974	1980	1990
O&M Costs	100	139	285
Debt Service Costs	100	153	170
Total Costs	100	145	238

Per Capita Costs
(excluding inflationary impact)

	1974	1980	1990
Per Capita Costs - MSD	7.69	10.18	16.70

The projected per capita costs for 1974 were calculated using population data reported in PD 92, Commonwealth of Massachusetts, 1974 Assessments for Interest, Serial Bonds, and Maintenance of the Metropolitan Districts. The M&E population forecast for 1990 was used to determine per capita costs for 1980 and 1990.

RATE DETERMINATION

A strength surcharge would be assessed to those users who discharge BOD and SS in excess of domestic amounts. It is recognized that any rates recommended by MDC to the communities consists solely of MDC related costs. Thus, MDC recommended rates would require adjustments to reflect local collection cost reimbursements as well.

In determining rates for the selected alternative all of the procedures described in the cost apportionment and allocation study are necessary. In addition, unit costs must be developed for Normal Volume, BOD and SS, and estimates of normal strength characteristic must be developed.

Unit costs have been calculated using 1980 cost and discharge data and presented below.

Calculation of Unit Cost for Normal Volume:

$$\frac{\text{Total Costs Apportioned to "All Other" Category}}{\text{Estimated Annual Volume from "All Others"}} = \frac{\$21,167,099}{153,300 \text{ million gallons}} = \$138.08 \text{ million gallons or } .138/\text{thousand gallons}$$

Calculation of Unit BOD Costs:

$$\frac{\text{Total BOD Related Costs}}{\text{Estimated Annual BOD Discharge in Million Pounds}} = \frac{\$1,151,941}{192 \text{ Million Pounds}} = \$4,799/\text{Million Pounds or } \$4.80/\text{per } 1,000 \text{ Pounds}$$

Calculation of Unit SS Costs

$$\frac{\text{Total SS Related Costs}}{\text{Estimated Annual SS Discharged}} = \frac{\$2,970,987}{160 \text{ million pounds}} = \$11,883 \text{ per Million Pounds or } \$11.88 \text{ per Thousand Pounds}$$

Based on the above rate calculations and assumed strength characteristics for "normal" wastewater the following rate structure was developed.

Basis of Charge	Rate	User Class Affected
Volume (Flow)	$0.138/thousand gallons	Residential Commercial Industrial
Strength - BOD	$4.80/thousand pounds for all pounds of BOD in excess of 300 PPM equivalent	Industrial
Strength - SS	$11.88/thousand pounds for all pounds of SS in excess of 250 PPM equivalent	Industrial

D. FINANCIAL CONSIDERATIONS

Implementation of the proposed construction program will necessitate raising an estimated $93 million (1975 dollars, unadjusted for inflation) to finance the portion of capital costs assumed not to be reimbursed by federal and state granting sources. Planning for long-term capital requirements includes consideration of organizational structure and its legislation, amount and frequency of capital requirements, credit and security arrangements, interest rates and maturities, and financial market conditions.

Recognizing that specialized knowledge and experience was needed for recommending appropriate funding assumptions, PMM&Co. reviewed and discussed the projected capital requirements with the First Boston Corporation, an underwriting firm experienced in municipal financing and familiar with current conditions in the municipal bond market. Five alternatives for providing access to the capital markets were identified:

1. Commonwealth of Massachusetts general obligation bonds pledging the full faith and credit of the Commonwealth.

2. MDC issuing its own bonds secured by assessments back to local communities and a guarantee of the Commonwealth.

3. Local communities authorizing and issuing their own general obligation bonds which would be purchased by MDC. Simultaneously, MDC would issue its own bonds in order to purchase such bonds. MDC's bonds would be secured by principal and interest payments made by the local communities on the bonds held by MDC. MDC's bonds would be additionally secured by a "moral obligation" pledge of the Commonwealth.

4. Local communities authorizing and publicly issuing their own general obligation bonds.

5. Local communities authorizing and publicly issuing their own revenue bonds.

Interest rates in today's market for each of these alternatives were estimated assuming Moody's Investor Service "A-1" rating, and 30-year maturities:

Alternative	1	: 7.25%
"	2	: 7.40%
"	3	: 7.60%
"	4	: 8.00%
"	5	: 8.00%

Due to uncertainties in the bond market, actual interest rates can not be determined until the time that the bonds are actually sold. For the cost allocation study, a 30-year serial maturity was selected to conform with average maturities of previous MDC bond issues and industry practices as determined in Chapter I, and FBC's recommendations.

A bond sales schedule was developed that would hopefully avoid offerings either too frequent or of too large an amount. Based on an originally projected $88 million dollar capital outlay requirement, the following schedule was developed:

Year	Amount (000)	Cumulative (000)
1975	$10,000	$10,000
1976	-0-	10,000
1977	12,000	22,000
1978	-0-	22,000
1979	22,000	44,000
1980	-0-	44,000
1981	22,000	66,000
1982	22,000	88,000

Following discussions with the First Boston Corporation, two new projects were added to the construction program. These additions, judged not material to the overall program, increased net capital requirements by approximately $5 million to a total of $93 million. Accordingly, PMM&Co. revised the proposed bond sale schedule, increasing the 1981 and 1982 schedule requirements by $3 million and $2 million, respectively; this approach was subsequently confirmed by FBC.

The bonds sold will finance MDC's total share of the estimated construction costs over the construction period (2000). However, due to construction schedules and the timing of federal and state reimbursements, MDC will face temporary capital deficiencies in certain years after 1981. It has been assumed that MDC will finance such deficiencies with a revolving line-of-credit with local commercial banks, to be repaid from reimbursements.

RECOMMENDED CAPITAL FUNDING APPROACH

Presently, capital requirements for constructing MDC/MSD facilities are generated through the sale of General Obligation bonds by the State Treasurer. The bonds are secured by the full faith and credit of MSD communities and the state's authority to assess each community for amounts required for their repayments. The state's current A-1 rating has also been applied to such bonds.

The present method of funding capital requirements closely parallels Alternative I, recommended by the First Boston Corporation. Alternative I specifies General Obligation bonds pledging the full faith and credit of the Commonwealth, and carrying the lowest estimated interest cost (7.25%) from among all proposed alternatives. On the basis of cost alone, the present methods should be maintained for the short-term.

E. SUMMARY OF MAJOR DATA SOURCES, LIMITATIONS AND STUDY ASSUMPTIONS

The relative cost impact on communities and users resulting from the application of that methodology was developed from basic records and schedule data provided by the staff of the Metropolitan District Commission, public documents from the Commonwealth of Massachusetts, construction cost estimates and community discharge data developed by Metcalf and Eddy, Inc. (M&E), bonding advice assembled from the First Boston Corporation (FBC), and debt service assumptions and cost distribution models and calculations performed by Peat, Marwick, Mitchell & Co. (PMM&Co.). It was not within PMM&Co.'s scope of work to review the reasonableness of the engineering data and cost estimates provided by other study consultants.

Certain detailed study assumptions are included as Appendix VII-1. Important data sources and selected explanatory notes are listed below for assistance to the user in order to ensure proper understanding of data and study limitations.

- Operations and maintenance (O&M), and debt service costs were obtained from Commonwealth of Massachusetts Public Document 92, 1974 Assessments of the Metropolitan Districts, and were utilized without further audit or independent tests. These costs represent fiscal year 1974 expenditures;

- Operations and Maintenance costs (as noted in Exhibit VII-3), construction expenditure requirements and timing of project construction (as noted in Exhibit VII-5) were provided by Metcalf and Eddy, Inc.

- For study purposes, MDC and PMM&Co. agreed to project net capital costs on the assumption that federal and state grant reimbursements would continue at the levels of 75% and 15% respectively except for one project as noted in Exhibit VII-6.

- Bonding structure, interest, maturity, size, and timing information was based on advice of the First Boston Corporation;

- Debt service and overall financial allocation calculations and schedules were prepared by PMM&Co.; and

- Inflation factors were not applied to construction or operations and maintenance cost estimates.

The data and schedules in this report supercede all previous preliminary schedules prepared by PMM&Co. on cost apportionment and allocation. These results represent future events that are subject to uncertainties and accordingly, these projections are not represented as specific results which will be actually achieved. This is not a financial forecast or a feasibility study.

APPENDIX I-1

DETAILED PROFILES OF 12 METROPOLITAN SEWERAGE AGENCIES

GUIDE TO PROFILE

Identity	Governing Body Selection	Powers	Community Control	Contracts	Operating Features	Finance	Service Charges	Billing Methods	Industrial Surcharges	Monitoring Control	Other Unique Services
Municipality of Metropolitan Seattle	XX	XX					XX	XX			XX
Pollution Control Department Kansas City, Missouri					XX	XX	XX		XX		
Detroit Metropolitan Water Department				XX		XX	XX				
Metropolitan Sewer District of Greater Cincinnati		XX			XX			XX	XX	XX	XX
Allegheny County Sanitary Authority		XX				XX	XX	XX	XX	XX	
Louisville and Jefferson City Metropolitan Sewer District	XX		XX				XX	XX			
East Bay Municipal Utility District, Special District No. 1	XX	XX	XX			XX	XX	XX	XX		
Hampton Roads Sanitation District					XX	XX	XX	XX			
Metropolitan Sanitary District of Greater Chicago	XX								XX		
Washington Suburban Sanitary Commission	XX				XX		XX	XX			XX
Sanitation District of Los Angeles County		XX			XX				XX		
Metropolitan Denver Sewage Disposal, District No. 1	XX	XX			XX		XX				

INTRODUCTION

The following are the profiles of the 12 metropolitan sewerage agencies surveyed. The contents of each profile conform to the following format to the extent possible based on the information available.

- Identity
- Service Area
  - Population served
  - Geographic average
  - Number of participating municipalities
- Treatment Characteristics
  - Number of treatment plants
  - Wastewater processing (in MGD)
  - Level of treatment
- Legal Entity
  - Size and composition of governing body
  - Powers
  - Territorial authority
  - Authority to perform other services
- Operational Features
  - Wholesaler/retailer
  - Contracts
  - Other significant features
- Finance
  - Method of financing capital needs
  - Revenues, service charges, and industrial wastewater surcharges
- New Developments

The sewerage agencies in the profile study were selected on the basis of their unique characteristics (e.g., The Detroit Metropolitan Water Department maintains unique contractual arrangements with other governmental entities). The matrix on the facing page has been prepared to serve as a guide to the reader in locating unique characteristics relatint to specific wastewater practices of the 12 agencies profiled. The profiles were developed in 1973. Since that time, it is conceivable that some of the agencies have adopted new methodologies due to recent federal requirements.

Identity:	Municipality of Metropolitan Seattle Seattle, Washington
Service Area:	The Municipality of Metropolitan Seattle (Metro) services 29 municipalities having a population of 1,100,000. Metro's boundaries are coterminous with those of King County, an area of approximately 300 square miles.
Treatment Characteristics:	Metro collects and transports sewage to one of five treatment plants. Four are primary treatment plants discharging through ocean outfalls, and one is a secondary treatment plant discharging to the Duwamish River. In 1972 approximately 160 million gallons of wastewater were processed each day.

LEGAL ENTITY

On September 9, 1958 Metropolitan Seattle area citizens voted to create a municipal corporation to perform the sewage disposal function. This action followed the passage of a state law entitling two or more cities to establish a metropolitan municipal corporation, governed by a metropolitan council, which could be granted the power to perform one or more of six metropolitan functions: sewage disposal, public transportation, comprehensive planning, water supply, garbage disposal, and park administration. Accordingly, in 1972, the voters authorized Metro to perform the function of public transportation.

The Metro council was expanded from 29 to 36 members in 1971 when its geographic boundaries were extended to coincide with those of King County. A formula to determine the composition of the council recognizes the interests of all areas within Metro's boundaries. The formula as stated in Metro's enabling act is as follows:

> (1) One member (a) who shall be the elected county executive of the central county, or (b) if there shall be no elected county executive, one member who shall be selected by, and from, the board of commissioners of the central county;
>
> (2) One additional member selected by the board of commissioners of each component county for each county commissioner district containing ten thousand or more persons residing in the unincorporated portion of such commissioner district lying within the metropolitan municipal corporation who shall be either the county commissioner from such district or a resident of such unincorporated portion;
>
> (3) One member from each of the six largest component cities who shall be the mayor of such city, if such city shall have the mayor-council form of government, and in other cities shall be selected by, and from, the mayor and city council of each of such cities;
>
> (4) One member representing all component cities other than the six largest cities to be selected by and from the mayors of such smaller cities in the following manner: The mayors of all such cities shall meet on the second Tuesday following the establishment of a metropolitan municipal corporation and thereafter on the third Tuesday in June of each even-numbered year at two o'clock p.m. at the office of the board of county commissioners of the central county. The chairman of such

board shall preside. After nominations are made, successive ballots shall be taken until one candidate receives a majority of all votes cast.

(5) One additional member selected by the city council of each component city containing a population of ten thousand or more for each sixty thousand population over and above the first ten thousand, such members to be selected from such city council until all councilmen are members and thereafter to be selected from other elected officers of such city.

(6) One member, who shall be chairman of the metropolitan council, selected by the other members of the council. He shall not hold any public office of or be an employee of any component city or component county of the metropolitan municipal corporation. [1969 1st ex.s. c 135 § 1; 1967 c105 § 3; 1965 c 7 § 35.58.120. Prior: 157 c 213 § 12.]

Except for the chairman and one representative appointed by the King County Council, Metro's membership consists of officials elected by participating cities and districts. The following is a detailed summary of the composition of the council and shows how the interests of all participants are represented.

PARTICIPANTS	NUMBER OF COUNCIL REPRESENTATIVES
City of Seattle	11
City of Auburn	1
City of Bellevue	1
City of Kent	1
City of Kirkland	1
City of Penton	1
Other Small Cities	2
King County	10
Unincorporated Areas and Sewer Districts	7
TOTAL	35
Chairman	1
	36

As a metropolitan municipal corporation, Metro has been granted a broad range of powers necessary to accomplish its objectives.

General Powers

Metro may contract with the United States or any agency thereof, any other municipal corporation or governmental agency, and may sue and be sued.

Specific Powers Relating to Sewage Disposal

(1) To prepare a comprehensive sewage disposal and storm water drainage plan for the metropolitan area.

(2) To acquire by purchase, condemnation, gift, or grant and to lease, construct, add to , improve, replace, repair, maintain, operate and regulate the use of metropolitan facilities for sewage disposal and storm water drainage within or without the metropolitan area, including trunk, interceptor and outfall sewers, whether used to carry sanitary waste, storm water, or combined storm and sanitary sewage, lift and pumping stations, sewage treatment plants, together with all lands, properties, equipment and accessories necessary for such facilities. Sewer facilities which are owned by a city or special district may be acquired or used by the metropolitan municipal corporation only with the consent of the legislative body of the city or special districts owning such facilities. Cities and special districts are hereby authorized to convey or lease such facilities to metropolitan municipal corporations or to contract for their joint use on such terms as may be fixed by agreement between the legislative body of such city or special district and the metropolitan council, without submitting the matters to the voters of such city or district.

(3) To require counties, cities, special districts and other political subdivisions to discharge sewage collected by such entities from any portion of the metropolitan area into such metropolitan facilities as may be provided to serve such areas when the metropolitan council shall declare by resolution that the health, safety, or welfare of the people within the metropolitan area require such action.

(4) To fix rates and charges for the use of metropolitan sewage disposal and storm water drainage facilities.

(5) To establish minimum standards for the construction of local sewer facilities and to approve plans for construction of such facilities by component counties or cities or by special districts wholly or partly within the metropolitan area. No such county, city, or special district shall construct such facilities without first securing such approval.

(6) To acquire by purchase, condemnation, gift, or grant, to lease, construct, add to, improve, replace, repair, maintain, operate and regulate the use of facilities for the local collection of sewage or storm water in portions of the metropolitan area not contained within any city or sewer district and, with the consent of the legislative body of any city or sewer district, to exercise such powers within such city or sewer district and for such purpose to have all the powers conferred by law upon such city or sewer district with respect to such local collection facilities. All costs of such local collection facilities shall be paid for by the area served thereby. [1965 c87 35.58.200. Prior: 1957c213§].

(7) To annex territory with a majority vote of the qualified electors in the area to be annexed.

Financial Powers

(1) To assess taxes on property values.

(2) To issue General Obligation bonds with 60% voter approval in an election where more than 40% of those voting also voted in the last general election.

(3) To issue Revenue Bonds.

(4) To borrow money from any corporate city or county.

(5) To obtain "supplemental income" from each component based on its share of the total assessed valuation of Metro for the purpose of offsetting any deficiency in the Metro annual budget.

(6) To issue funding or refunding bonds.

Other Powers

Largely as a result of its broad range of powers, Metro was able to achieve all its goals of curbing the discharge of raw sewage into its lakes, streams, and bays in less than nine years. This included construction of four new treatment plants and over 100 miles of large trunklines.

Metro does not enforce or regulate the quality of effluent discharged into its system. Furthermore, it does not have the power to enforce specific methods of charging for sewerage collected at the community level. Metro officials recognize these problems and are aware that they must be addressed if Metro is to qualify for federal grants under the new Federal Law, P.L. 92-500.

Metro's political boundaries are coterminous with those of King County and include several major drainage basins, a few of which are part of other political boundaries. New state and federal laws required river basins planning resulted in Metro's participation in inter-governmental planning efforts. The map of the comprehensive plan reveals that it was developed without consideration of political boundaries, but that its implementation will require inter-governmental cooperation.

OPERATIONAL FEATURES

Metro is a service agency which provides sewer treatment services for the participants within its boundaries. Operating as a wholesaler, Metro forms an agreement with individual participants to accept sewage collected from various locations within the participant's boundaries. The sewage is transported via a system of interceptor sewers to one of four large treatment plants. Long term agreements executed with each participant identify each party's responsibility as follows.

> Delivery and Acceptance of Sewage. The City agrees to deliver to the Metropolitan Sewerage System all of the sewage and industrial wastes collected by it and Metro agrees to accept such sewage and wastes for treatment subject to such reasonable rules and regulations as may be adopted from time to time by the Metropolitan Council. Metro shall not directly accept sewage or wastes from any person, firm, corporation or governmental agency which is located within the boundaries of or is delivering its sewage into the Local Sewage Facilities of any Participant without the written consent of such Participant.
>
> Construction of Facilities. Metro shall construct, acquire or otherwise secure the right to use all facilities required for the disposal of sewage delivered to Metro pursuant to this Agreement and shall perform all services required for the maintenance, operation, repair, replacement or improvement of the Metropolitan Sewerage System, including any additions and betterments thereto.

Connection of Local Sewerage Facilities to the Metropolitan Sewerage System. Local Sewerage Facilities of the City shall be connected to the Metropolitan Sewerage System at such time as any portion of the Metropolitan Sewerage System shall be available to receive sewage collected by such facilities. Metro shall, at its sole expense, connect those Local Sewerage Facilities of the City which are now in existence or which shall be constructed in accordance with the rules and regulations of Metro prior to the availability of the Metropolitan Sewerage System. Local Sewerage Facilities constructed after the Metropolitan Sewerage System shall have been made available to the area served by such Local Sewerage Facilities shall be connected to the Metropolitan Sewerage System at the expense of the Participant in accordance with the rules and regulations of Metro.

Payment for Sewage Disposal. For the disposal of sewage collected by the City and delivered to Metro, the City shall pay to Metro on or before the last day of each month during the term of this agreement.

The monthly sewage disposal charge paid by each Participant to Metro is determined by multiplying the monthly rate by the number of Residential Customers and Residential Customer equivalents of the Participants. Additional charges may be levied for sewage of unusual quality or composition which requires special treatment (Metro may require pretreatment of such sewage) and for excess storm or ground waters entering local sewerage facilities in excess of the minimum standard established by Metro's general rules and regulations.

Interest at the rate of 6% is charged for unpaid bills 15 days after the due date. Metro may enforce payment by means of any remedy available at law or equity.

The City is bound to establish, maintain and collect City sewerage charges sufficient to cover all city maintenance and operating expenses, including the sewage disposal charge payable to Metro. The City has the right to fix its own schedule of sewerage rates and charges, provided that the charges are sufficient to meet the covenant of its agreement with Metro.

Responsibility of Participants. Each Participant is responsible for the delivery to the Metropolitan Sewerage System of sewage collected by the Participant, for the construction, maintenance and operation of local sewerage facilities, and for the payment of all costs related to the collection and delivery of such sewage to the Metropolitan Sewerage System.

Asssignment. Neither party has the right to assign the agreement or any of its rights and obligations nor to terminate its obligations without securing written consent of the other party.

Term of Contract. The agreement is for a period of fifty (50) years.

Other services performed In 1971 the voters of King County authorized Metro to perform public transportation services. Metro thus developed a comprehensive transit plan for the metropolitan area which was approved by the Metropolitan Council on July 20, 1972.

FINANCE

Ninety-six percent of Metro's capital requirements have been financed through the issuance of Municipal Revenue Bonds. State and federal grants contributed 4% of Metro's total financing. Revenue Bonds were selected for issuance primarily for two reasons:

- A Revenue Bond does not affect the debt capacity of the municipality, as does a General Obligation Bond. In consideration of Metro's composition and the substantial amount of funds required to implement the comprehensive plan, Revenue Bonds were selected as the more efficient method of raising the necessary capital.

- As required in Metro's enabling legislation, General Obligation Bonds must receive 60% voter approval. As Metro had already received voter approval to develop and implement a comprehensive plan, it was determined that Revenue Bonds would expedite the start of the first phases of the plan. Such issues require approval of the Metro Council.

Bond Covenants are requirements which bond issuers agree to meet. Covenants are usually stipulated to protect the investment of the bond buyer and to achieve a lower interest cost to the issuer. The following is a summary of the significant covenants of a Metro Revenue Bond Issue:

Creation of Funds and Accounts. Metro must establish separate accounts in the Office of the Treasurer of King County, and allocate the proceeds of the revenues generated by sewage charges according to a specified formula.

Priorities of Payments from the Revenue Fund. Revenues must be used and applied in the following order:

- to pay operating and maintenance expenses;
- to pay required principal and interest;
- to make required deposits for bond;
- to maintain Bond Reserve Account;
- to maintain Operating Reserve Account; and
- to maintain Contingency Reserve Account.

Rate Covenant. Rates and charges for sewage disposal service after operating and maintenance expenses have been paid must equal 1.15 times the amounts required to pay:

- annual interest and principal due each year; and
- amounts required for the amortization of term bonds as they are due to be retired.

Maintenance and Operation. The system must at all times be maintained in effective working order.

Revenues

Revenue to operate and maintain the system and to cover interest and debt service requirements of the Revenue Bonds is generated by service charges. The basis for the charge is the amount of water consumed by each household or equivalent unit. The formula used to determine the charge, which is outlined in each standard long term agreement with participants is as follows:

> 1. For the quarterly periods ending March 31, June 30, September 30, and December 31, of each year every Participant shall submit a written report to Metro setting forth (a) the number of Residential Customers billed by such Participant for local sewerage charges as of the last day of the quarter, (b) the total number of all customers billed by such Participant as of such day and (c) the total water consumption during such quarter for all customers billed by such Participant other than Residential Customers. The quarterly water consumption report shall be taken from water meter records and may be adjusted to exclude water which does not enter the sanitary facilities of a customer. Where actual sewage flow from an individual customer is metered, the metered sewage flows shall be reported in lieu of adjusted water consumption. The total quarterly water consumption report in cubic feet shall be divided by 2,700 to determine the number of Residential Customer equivalents represented by each Participant's customers other

than single family residences. Reports shall be made for each quarterly period and shall be submitted within thirty (30) days following the end of the quarter. Metro shall maintain a permanent record of the quarterly customer reports from each Participant.

2. To form a basis for determining the monthly sewage disposal charge to be paid by each Participant during any particular quarterly period Metro shall ascertain the number of Residential Customers and Residential Customer equivalents of each Participant for each such quarterly period. This determination shall be made by taking the sum of the actual number of Residential Customers reported as of the last day of the next to the last preceding quarter and the average number of Residential Customer equivalents per quarter reported for the four quarters ending with said next to the last preceding quarter, adjusted to eliminate any Residential Customer or Residential Customer equivalents whose sewage is delivered to a governmental agency other than Metro or other than a Participant for disposal outside of the Metropolitan Area.

3. The monthly rate for each Residential Customer and Residential Customer equivalent of the City shall be Two dollars and seventy-five cents ($2.75) and the monthly sewage disposal charge to be paid by each Participant to Metro shall be obtained by multiplying the number of Residential Customers and Residential Customer equivalents of the Participant as determined in subparagraph 2 of this section by the monthly rate of $2.75.

4. For each calendar year, the monthly sewage disposal charge payable to Metro shall be determined as follows:

(a) Prior to July 1st of each year Metro shall determine its total monetary requirements for the disposal of sewage during the next succeeding calendar year. Such requirements shall include the cost of administration, operation, maintenance, repair and replacement of the Metropolitan Sewerage System, establishment and maintenance of necessary working capital and reserves, the requirements of any resolution providing for the issuance of Revenue Bonds of Metro to finance the acquisition, construction or use of sewerage facilities, plus not to exceed 1% of the foregoing requirements for general administrative overhead costs.

(b) To determine the monthly rate per Residential Customer or Residential Customer equivalent to be used during said next succeeding calendar year, the total monetary requirements for disposal of sewage as determined in subparagraph 4(a) of this section shall be divided by twelve and the resulting quotient shall be divided by the total number of Residential Customers and Residential Customer equivalents of all Participants ascertained in accordance with subparagraph 2 of this section for the October-December quarter preceding said July 1st; provided, however, that the monthly rate shall not be less than Two dollars and seventy-five cents ($2.75) per month per Residential Customer or Residential Customer equivalent at any time during the period ending July 31, 1972.

(c) The monthly sewage disposal charge paid by each Participant to Metro shall be obtained by multiplying the monthly rate by the number of Residential Customers and Residential Customer equivalents of the Participant determined as provided in Paragraph 2 of this section. An additional charge may be made for sewage or wastes of unusual quality or composition requiring special treatment, or Metro may require pretreatment of such sewage or wastes. An additional charge may be made for quantities of storm or ground waters entering those Local Sewerage Facilities which are constructed after January 1, 1961 in excess of the minimum standard established by the general rules and regulations of Metro.

Although Metro has the power to levy additional charges to users who contribute sewage of high strength characteristics, the agency has chosen not to do so. At the time of the study, however, Metro officials were beginning to address this problem in light of recent federal legislation.

NEW DEVELOPMENTS

Phase II of the comprehensive plan, which involves the construction of new interceptor sewers to collect sewage from outlying cities and districts within the present Metro boundaries (see Map), is currently under way.

Metro's leadership as an environmental service agency was further demonstrated in the assistance it provided in developing a $4.5 million water and waste management planning program. Plans for water pollution control and abatement, water resources management, solid waste management, urban runoff and storm drainage, and land use allocation are scheduled to be completed in 1974. The study includes partial funding from the Ford Foundation for an extensive community involvement program.

Identity: Pollution Control Department
Kansas City, Missouri

Areas Serviced: The Pollution Control Department provides wastewater services to 1.3 million residents of the Kansas City Metropolitan area. The Department contracts with 17 villages and districts surrounding the city limits of Kansas City which share a watershed. The total land area serviced includes all or part of four counties in an area of over 700 square miles.

Treatment Characteristics: The Department operates two major primary treatment plants and 16 temporary secondary plants. As suburban growth extends to areas serviced by these smaller secondary plants, they will be replaced by larger plants connecting several communities.

The two major treatment plants process a combined average of 70 million gallons of wastewater per day and discharge to the Missouri River. The smaller plants each have a treatment capacity of .5 to 1 million gallons per day and discharge to local streams.

LEGAL ENTITY

The Pollution Control Department is a department of the City of Kansas City, Missouri. Its Director, appointed by the city manager and approved by the city council, is also responsible for directing the activities of the Water Department of Kansas City.

Operating as a city department, the Pollution Control Department shares all the legal powers of the city. However, these powers can only be exercised within the city's territorial limits, leaving the agency no powers to deal with outlying communities whose sewage it treats. An inter-municipal agreement between the city and participating municipalities provides the Department the necessary enforcement powers.

Revenue Bonds, which the City uses to finance construction of treatment facilities, must receive assent of four-sevenths of the qualified voters.

OPERATIONAL FEATURES

The Department markets its services in one of three ways, depending upon each municipality's location and whether or not it receives its water supply from the Department.

The Department is responsible for planning and constructing all sewers and treatment facilities within the city limits of Kansas City. This area receives its water services from the City Water Department. Water meters measure the flow of water entering the premises, and these measurements serve as the basis for determining a commodity charge and a sewage service charge. Billing services are performed by the Water Department, and billing costs are transferred to the Pollution Control Department.

Some municipalities in the Kansas City Metropolitan Area receive both water and sewage services from Kansas City, and some receive only one. For those receiving both, the billing for sewage service is included on the water bill and sent to individual users. However, the responsibility of the Pollution Control Department is only to intercept the sewage collected by the municipalities' own collection systems, and not to plan, build, and maintain those systems.

It is the responsibility of areas not supplied with water by Kansas City to reimburse the city according to agreed upon formulae. The Water Pollution Department thus performs wholesale functions by dealing with the municipality intercepting sewage only at connecting points and by collecting charges for its services.

The inter-municipal agreements formed between Kansas City and the municipalities serviced define the responsibilities of each party. While modifications are made to agreements with municipalities not receiving both water and sewage services from Kansas City, all agreements contain the same basic provisions, as follows:

- Each party will maintain its own sewerage system.
- Each party will police and control its own sanitary system to preclude:
  - the entrance of storm water, and
  - the discharge of industrial wastes not consistent with the Sewer Ordinance of Kansas City.
- The city has the right to terminate the agreement upon sixty (60) days written notice in the event that:
  - enforcement restrictions are not observed, or
  - compensation is not received within a reasonable time.
- Service charges are established.
- The agreement is in force until otherwise altered.

The city maintains the additional right to enter into the premises of any user to monitor the sewage discharged to the system.

FINANCE

Kansas City regards its Pollution Control Department as a self-sustaining agency and believes that the services provided can be directly apportioned to individual recipients. Revenue Bonds support the institution of treatment facilities, pumping stations, and interceptor and trunk sewers. General Obligation Bonds finance the construction of lateral services.

Although it is an unusual practice for a city to use Revenue Bonds, since they are normally issued at a higher interest cost, the Revenue Bonds of Kansas City are favorably received by the investment community; consequently, the cost of issue approximates the cost of General Obligation Bond issues.

The Revenue Bonds are payable only from revenues derived by the City from the operation of its sewerage system. To provide additional security for the bonds, it is mandatory that the city comply with the following rules:

1. All sewerage service charges and revenues derived by the City from the operation and use of its sewerage system are deposited in a Sewer Fund and kept separate from other revenue and funds of the City.

2. The City must maintain the following separate accounts:

    a) Principal and Interest accounts for each issue of revenue bonds.

    b) Reserve accounts for each issue of revenue bonds.

    c) Sewage System Depreciation and Replacement Account.

    d) Sewage System Extension and Bond Retirement Account.

3. Money deposited in the Sewer Fund is administered and disposed of each month as follows:

    a) Provide sufficient funds for operation and maintenance of the sewerage system.

    b) Distribute funds to the Principal and Interest accounts of each bond series.

    c) Distribute funds to the Reserve Accounts for each bond series.

    d) Distribute funds to the Depreciation and Replacement Account.

    e) Distribute remaining monies to the Sewerage System Extension and Bond Retirement Account.

4. The City of Kansas City, Missouri covenants with each of the purchasers and owners of the Revenue Bonds that:

    a) Proceeds from the sale of the bonds shall be used for making extensions and improvements to the sewerage system.

    b) Fix and maintain rates and collect charges sufficient to pay all maintenance and operation costs as well as pay the principal of and interest on its Revenue Bonds.

c) No facilities or services of the sewerage system will be furnished with any user without reasonable charge.

d) Employ an independent consulting engineer of national reputation to make an examination and report on the condition and operation of the system at least every three years.

e) The City will not mortgage, pledge, or otherwise encumber the sewerage system or any substantial part of the system.

f) Carry or maintain reasonable insurance on the properties of the sewerage system.

g) Maintain and keep a proper system of accounts showing the revenues received and applied.

h) The holders of not less than 10% in aggregate principal and amount have the right of inspection.

5. As long as any of the principal amount of the Sewerage System Revenue Bonds now being sold remains outstanding, no additional bonds shall be issued unless the following conditions exist:

   a) The City is not in default in making payments to the appropriate accounts.

   b) The net revenues for the fiscal year preceding the issuance of additional bonds is equal to at least one hundred thirty percent (130%) of the maximum amount required to pay principal and interest on all sewerage system revenue bonds in any subsequent fiscal year.

6. The principal amount received from the sale of the Bonds must be deposited in a separate fund to be used solely for system extensions and improvements.

The City also utilizes state and federal grants to support the institution of its sewage treatment facilities.

Revenue

All costs of operation and maintenance and debt service requirements are paid for by sewerage collection charges: a monthly service charge and a commodity charge. These charges are based on the quantity of water used in the premises, as measured by water meters. The service charge for all metered family residences is $1.00 per month, and the commodity charge is $0.25 per 100 cubic feet of water. Unmetered one and two family residences pay an estimated monthly average residential charge of $2.88.

In municipalities where the City of Kansas City does not supply water services, the average residential charge of $2.88 is applied to all one and two family dwellings. Multiple family dwellings and commercial and industrial establishments are subject to a sewer service charge and a commodity charge. It is the responsibility of the community to advise the City of Kansas City of the number and addresses of residential, commercial, and industrial customers for which sewage service and treatment is available through the sewerage system of the City.

A surcharge is imposed upon commercial and industrial users when permissible concentrations (not containing over 400 parts per million of BOD by weight) of suspended solids or BOD are exceeded. Sample monitoring is conducted periodically to determine sewage quality.

The surcharge is computed using the following formulae, outlined in the Code of General Ordinances:

S(ss) = .0000625 x Va x $.014 x (SS-400), which shall signify that the amount of the surcharge on the suspended solids basis shall equal the factor of .0000625 for converting parts per million by weight to pounds per cubic foot multiplied by the volume of sewage in cubic feet multiplied by $.014, the estimated cost for treatment of one pound of suspended solids in raw sewage, multiplied by the concentration of suspended solids in the waste in parts per million by weight minus 400 with the minimum charge to be $1.00; or

S(B.O.D.) = .0000625 x Va x $.0075 x (B.O.D.-300), which shall signify that the amount of the surcharge on the B.O.D. basis shall equal the factor of .0000625 for converting parts per million by weight to pounds per cubic foot, multiplied by the volume of sewage in cubic feet, multiplied by $.0075, the estimated cost for treatment of one pound of B.O.D. in the raw sewage multiplied by the concentration of B.O.D. (biochemical oxygen demand of the waste) in parts per million by weight minus 300 with the minimum charge to be $1.00.

The symbols, letters or figures employed in the aforesaid formulae signify the following:

Va = volume of sewage in cubic feet.
S(ss) = amount of surcharge, suspended solids basis.
S (B.O.D.) = amount of surcharge, biochemical oxygen demand basis.
.0000625 = factor for converting parts per million by weight to pounds per cubic foot.
SS = concentration of suspended solids in the waste in parts per million by weight.
B.O.D. = biochemical oxygen demand of the waste, as defined in section 29.44 of this article.

Determination of the suspended solids and B.O.D. concentrations shall be made in accordance with standard laboratory methods.

The municipalities are responsible for monitoring commercial and industrial connections outside the city limits.

NEW DEVELOPMENTS

A $200 million construction program is under way to upgrade primary treatment plants to secondary, to construct additional interceptors to handle increased flows resulting from population increases, and to connect new areas not presently served by the Pollution Control Department.

Identity: Detroit Metropolitan Water Department
Detroit, Michigan

Service Area: The Detroit Metropolitan Water Department (DMWD) provides water and sewage treatment and disposal services to 72 communities in the Southeastern Michigan region. The present service area includes 488 square miles and a population of over 3.2 million.

Treatment Characteristics: A single treatment plant processes approximately 800 million gallons of sewage per day. Beginning on November 15, 1973, approximately 400 million gallons will receive secondary treatment, and it is estimated that the remainder will by 1976. The effluent is discharged to the Detroit River.

LEGAL ENTITY

As a Department within the City of Detroit, DMWD shares the City's powers and authority.

DMWD's service area includes portions of Wayne, Macomb, and Oakland Counties. Its territorial boundaries are not fixed and are subject to continuous expansion resulting from the growth of the suburban areas and the consequent need for improved sewage treatment services. The areas presently included all share a watershed.

A seven member Board of Commissioners appointed to four-year terms by the Mayor of Detroit governs DMWD. All Board representatives are required to reside in the area serviced and at least four must reside within the city limits of Detroit.

The Department delegates the enforcement of its sewage regulations to each municipality it services. New facilities constructed by suburban areas are subject to DMWD approval. To control industrial wastes, the Department issues standards for all industries within the service area, and enforcement is accomplished through the cooperative efforts of all participants. The general and specific conditions to which discharges must adhere are as follows:

General Conditions

(a) Chemical reaction, either directly or indirectly, with the materials of construction to impair the strength or durability of sewer structures.

(b) Mechanical action that will destroy or damage the sewer structures.

(c) Restriction of the hydraulic capacity of sewer structures.

(d) Restriction of the normal inspection or maintenance of the sewer structures.

(e) Placing of unusual demands on the sewage treatment equipment or process.

(f) Limitation of the effectiveness of the sewage treatment process.

(g) Danger to public health and safety.

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(h) Obnoxious conditions inimical to the public interest.

Specific Conditions:

(a) Acidity or alkalinity must be neutralized to a pH of 7.0 as a daily average on a volumetric basis, with a maximum temporary variation of pH 5.0 to 10.0.

(b) Must not contain more than 10 p.p.m. of the following gases: hydrogen sulfide, sulfur dioxide, oxides of nitrogen, or any of the halogens.

(c) Must not contain any explosive substance.

(d) Must not contain any flammable substance with a flash point lower than 187°F.

(e) Must have a temperature within the range of 32° to 150°F.

(f) Must not contain grease or oil or other substance that will solidify or become viscous at temperatures between 32° and 150°F.

(g) Must not contain insoluble substance in excess of 10,000 p.p.m. or exceeding a daily average of 500 p.p.m.

(h) Must not contain total solids (soluble and insoluble substance) in excess of 20,000 p.p.m. or exceeding a daily average of 2,000 p.p.m.

(i) Must not contain soluble substance in concentrations that would increase the viscosity to greater than 1.1 specific viscosity.

(j) Must not contain insoluble substance having a specific gravity greater than 2.65.

(k) Must not contain insoluble substance that will fail to pass a No. 8 Standard sieve, or having any dimension greater than 1/2 inch.

(l) Must not contain gases or vapors either free or occluded, in concentrations toxic or dangerous to humans or animals.

(m) Must not have a chlorine demand greater than 15 p.p.m.

(n) Must not contain more than 100 p.p.m. or any antiseptic substance.

(o) Must not contain phenols in excess of 0.005 p.p.m.

(p) Must not contain any toxic or irritating substance which will create conditions hazardous to public health and safety.

(q) Must not contain in excess of 100 p.p.m. or exceed a daily average of 25 p.p.m. of any grease or oil or any oily substance.

OPERATING FEATURES

DMWD is a regional agency of the City of Detroit with two separate self-supporting systems: water and sewer. It services 94 communities with water and 72 communities with wastewater treatment and interception service. DMWD does not provide any other regional services.

The Department is responsible for constructing, operating, and maintaining the sewer collection, drainage, and water distribution systems within the city limits of Detroit. The suburban communities served by DMWD are responsible for operating and maintaining their own sewer connection and water distribution systems.

Long-term, 35 year contracts formed with each municipality are the basis upon which sewerage interception and treatment services are provided. The terms of the agreement are fundamental elements needed to finance the construction of DMWD's large regional sewerage system. Additionally, various provisions in the agreements serve to enhance the DMWD's powers of control and enforcement over the large regional area. The following is a summary of key provisions.

(a) The BOARD shall collect or intercept wastewater at the point or points designated herein, or to be designated in the future by mutual agreement of the parties hereto, through interceptors of the capacity needed to meet all reasonable requirements of the municipality's customers.

(b) The BOARD will provide such wastewater intercepting facilities and treatment as may be necessary to meet the terms of this agreement with the understanding that the municipality shall provide the collection system of laterals and trunks required to deliver the wastewater to the points of interception.

(c) The DISTRICT or the collection system of the DISTRICT shall not extend beyond the limits as herein defined except by mutual agreement of the parties hereto.

(d) It is understood and agreed that communities outside the DISTRICT may be served by the BOARD through the interceptor system to be constructed within the DISTRICT.

(e) The municipality shall pay the BOARD for wastewater disposal service at such rates as the BOARD may establish from time to time, it being mutually understood that such rates for treatment shall be uniform throughout the entire Detroit Wastewater Disposal system and such rates shall always be reasonable in relation to the costs incurred by the BOARD for providing this service. The BOARD shall give 30 days written notice of any change in rates. All money collected by the BOARD for providing this service under the terms of this agreement, shall be used for the construction, financing, operation, maintenance, renovation, repair, replacement and improvements of the Detroit Regional Wastewater Disposal System.

(f) The charge, except as hereinafter provided for, for such wastewater disposal services shall be on the basis of the aggregate quantity of wastewater entering the DETROIT SYSTEM per year from the District. The minimum charge for service for the DISTRICT for each calendar year shall be for an amount not less than that which is obtained by applying the effective rates to the quantities set forth in Exhibit "A" attached hereto and made a part hereof.

(g) All wastewater flow entering the DETROIT SYSTEM from the District shall be measured by meters installed at each point of interception. All required wastewater meters and meter pits shall be furnished and installed by the BOARD and billed as a separate expense to the municipality, to be included in the monthly billing amortized over a 10-year period with interest at 5% per annum on the unpaid balance. The BOARD agrees to make such repairs, replacements and/or adjustments of meters as may from time to time be necessary at no additional cost to the

municipality. The municipality agrees to accept the BOARD's estimates of quantities of wastewater flow during all periods in which the meters fail to measure the wastewater flow correctly, provided there is reasonable basis for such estimates.

(h) The disposal charges as herein provided for shall be billed on a monthly basis by the BOARD to the municipality. Such billings shall be subject to 5 per cent penalty if not paid within 30 days of the billing date, except that for the first 2 years of this contract, 60 days shall be allowed without penalty. All delinquent balances remaining unpaid for one year or more shall be subject to an additional charge of 6 per cent per annum until paid.

(i) All wastewater disposal charges herein provided for shall commence at the time services are made available for the acceptance of wastewater from the DISTRICT into the DETROIT SYSTEM.

(j) The municipality agrees to conform to generally acceptable standards and specifications established by good engineering practices in the installation of wastewater collection, pumping, and transportation facilities which the municipality and/or its municipal subdivisions will cause to have constructed in the DISTRICT, and further agrees that plans and specifications for such facilities shall be submitted to the BOARD for approval prior to installation in the DISTRICT's wastewater collection system. The municipality further agrees to provide the BOARD with a copy of the location records of existing wastewater collection facilities located in the DISTRICT.

(k) The municipality shall take such steps as may be required to insure the accuracy of any measuring devices other than those maintained by the BOARD, used in computing the charges to be paid by the COUNTY under the terms of this Agreement. The BOARD shall have the right, at its election, to inspect and check for proper installation and operation any wastewater collection facility, measuring device, regulator, diversion chamber, pumping station, and any other wastewater handling facility within the DISTRICT. This right shall include the inspection of records of the municipality wastewater disposal system, the Drainage System of the municipality, the Water System of the municipality, and the pertinent records of any municipality within the DISTRICT. Nothing in this Agreement shall be construed to deprive the municipality of jurisdiction over the DISTRICT's wastewater collection system.

(l) In cases where the character of wastewater from the DISTRICT or any portions thereof or from any commercial, manufacturing or industrial plant, building or premises within the DISTRICT is such that it imposes an additional burden upon the services to be provided by the BOARD and the facilities of the DETROIT SYSTEM above that which would be imposed through adherence to standard limitations, as established from time to time by the BOARD or agencies of the State of Michigan for the entire service area of the City of Detroit Wastewater Disposal System for wastewater permitted to enter the DETROIT SYSTEM, any additional costs necessitated thereby shall be an additional charge over the rates herein provided. The municipality shall refuse any person, firm, or corporation the right to discharge its wastewater into the DISTRICT's wastewater system if such wastewater violates the standard limitations established or to be established.

(m) The municipality agrees to comply with all laws, ordinances, rules, regulations and orders of the BOARD and the State of Michigan applicable to the entire service area of the City of Detroit Wastewater Disposal System with reference to wastewater characteristics, collection and disposal, and water pollution control; and the municipality further agrees to ascertain the party or parties at fault and require same to pay the reasonable cost for repair of any damage resulting to the DETROIT SYSTEM for the violation of any of the aforesaid laws, ordinances, orders, rules and regulations.

The municipality agrees to limit the maximum rate of discharge through each interceptor connection to the DETROIT SYSTEM to 0.4 cubic feet per second per 1,000 population served through such connection or such other limit as may be mutually agreed upon to accommodate exceptional circumstances.

(n) No failure or delay in performance of the executed wastewater disposal agreement by either party shall be deemed to be a breach thereof when such failure or delay is occasioned by or due to any Act of God, strikes, lockouts, wars, riots, epidemics, explosions, sabotage, breakage or accident to machinery or lines of pipe, the binding order of any court or governmental authority, or any other cause, whether of the kind herein enumerated, or otherwise, not within the control of the party claiming suspension; provided that no cause or contingency shall relieve the municipality of its obligation to make payment for wastewater entering the

DETROIT SYSTEM, and provided further that the BOARD shall assume full responsibility for maintaining service in the absence of the above happening and to maintain standard of treatment as established by the State of Michigan.

(o) In the event proper operation of the system requires the BOARD to discontinue temporarily all or part of the service to the DISTRICT, no claims for damages for such discontinuance shall be made by the municipality against the City of Detroit, Board of Water Commissioners.

(p) The municipality shall assist the BOARD to obtain permission to use streets, highways, alleys, and/or easements in the municipalities within the DISTRICT for the purpose of constructing, maintaining, and operating wastewater disposal facilities to adequately service the DISTRICT and other areas.

(q) The terms of this agreement shall be for at least 35 years from the date hereof, provided, however, that this agreement shall be renewed without further action by the parties hereto for successive terms of 10 years thereafter, unless either party hereto shall elect to terminate the same by written notice to the other party given one year prior to the date of termination of the original term or any renewal thereof. In the event of the willful cessation by either of the parties hereto of performance of and/or of compliance with the terms of this agreement, the other party hereto may elect to terminate this agreement at any time upon 90 days written notice. In the event of termination of this agreement the BOARD shall have the right by any employable means at its command to prevent continued introduction of wastewater into the DETROIT SYSTEM from the area contemplated to be served hereby.

(r) This agreement shall inure to the benefit of and be binding upon the respective parties hereto, their successors and assigns.

EXHIBIT "A"

WASTEWATER FLOWS

Year	Million Cubic Feet	Year	Million Cubic Feet
1970	340	1986	1,130
1971	380	1987	1,160
1972	450	1988	1,200
1973	500	1989	1,240
1974	560	1990	1,270
1975	630	1991	1,300
1976	700	1992	1,330
1977	750	1993	1,360
1978	820	1994	1,390
1979	880	1995	1,420
1980	930	1996	1,460
1981	960	1997	1,480
1982	990	1998	1,510
1983	1,030	1999	1,530
1984	1,070	2000	1,570
1985	1,110		

The above quantities represent approximately 50% of the estimated aggregate annual flow from the initial service area.

FINANCE

To finance major construction projects DMWD uses Revenue Bonds supported solely by net revenues of the sewerage disposal system (not an indebtedness of the City). Bonds are authorized by an Ordinance of the Common Council of the City of Detroit.

Recent bond issues have received favorable acceptance by the financial community and are presently rated the same as the City of Detroit's General Obligation Bonds. Key factors accounting for this favorable rating are:

- Estimated net revenues must be equal to at least one and one-half the largest amount of combined principal and interest to fall due in any future operating year.

- Revenues of the Sewage Disposal System are deposited in the Sewage Disposal System Receiving Fund as they are collected. The funds are apportioned in the following manner:

  Current expenses for operation and maintenance are first set aside monthly in the Operation and Maintenance Fund. An amount is next set aside for monthly payments to the Bond and Interest Redemption Fund equivalent to one-sixth (1/6) of the next maturing interest and one-twelfth (1/12) of the next maturing principal payment. The moneys are deposited in the separate account and invested in short term Federal Securities until required for payment to bond holders. In addition a monthly amount is also set aside equal to one-twelfth (1/12) of 10% of the total interest and principal to be paid during the year and set aside in the Bond Reserve account. Such payments will be made until such time as the Reserve account has accumulated an amount sufficient to pay the largest amount of principal and interest payable from the Bond and Interest Redemption Fund due in any future year.

  Payments will continue until the total yearly requirement of the Operation and Maintenance Fund and the Bond and Interest Redemption Fund including the reserve account have been transferred. Out of the revenues remaining after the satisfaction of the above mentioned requirements there may be set aside in an account designated Capital Equipment Replacement Fund such sums as the Board of Water Commissioners may deem advisable to be used solely for the purpose of making major repairs and replacements to the system.

After meeting the requirements of the above funds there may be set aside out of the remaining revenues of the system during the year into an account designated Improvement and Extension Fund such sums as the Board of Water Commissioners may deem advisable, to be used only for making improvements, enlargements and extensions to the system.

Revenues

The sewage disposal system is supported entirely by revenues charged to recipients of sewage services. Residents within the city limits of Detroit are charged according to water consumption, as measured by a meter. Sewage charges to these customers are billed and collected as part of the water bill from DMWD, at the current rate of $0.65 per 1,000 cubic feet. The combined waste from each suburban community is measured by a meter or meters installed at each point of interception. Suburban communities are expected to pay the costs of meters and interceptors used to service their requirements. Costs of these facilities are amortized over a long-term period and paid for by the community. These amortized costs are built into the commodity charge and paid according to flow as measured by meters.

NEW DEVELOPMENTS

Progress is continuing toward the expansion of services in the Detroit Watershed Region. New interceptors and pumping stations are being constructed to service distant communities within the watershed. In addition, improvements and additions to the treatment plant will provide secondary treatment to the remaining 400 million gallons per day by 1976. The expenditure planned for plant and system investment through the year 2000 totals $922 million.

The rate structure is currently being revised to charge commercial and industrial users according to flow and quality of the sewage contributed to the system. A permit program will implement and enforce the new requirements.

Identity: Metropolitan Sewer District of Greater Cincinnati, Cincinnati, Ohio

Service Area: The Metropolitan Sewer District (MSD) provides sewage services to Greater Cincinnati and Hamilton County, an area of 414 square miles. The service area includes 35 cities and townships having a population of 900,000.

Treatment Characteristics: MSD maintains three permanent primary treatment plants, two permanent secondary plants, and 30 secondary and tertiary temporary plants to process 170 million gallons of wastewater per day. Effluent is discharged to the Ohio River.

LEGAL ENTITY

Chapter 6117 of the Ohio Revised Code authorizes the County Commissioners to form a sewer district to join one or several incorporated and unincorporated areas for the purposes of planning, constructing, and operating sewage collection and treatment faciltiies. Since 1924, the Board of County Commissioners of Hamilton County has established several sewer districts accordingly and in 1955, all the previously established sewer districts were consolidated into a single county district, the "Hamilton County Sewer District No. 1." In 1963, the Board of County Commissioners expanded the boundaries of the District to include all other unincorporated areas of the County and to be co-terminous with the boundaries of Hamilton County. On April 10, 1968, the official name of the district became "The Metropolitan Sewer District of Greater Cincinnati."

While no mandatory requirements exist for cities or unincorporated areas to participate in the District, when an area decides to join the system, it forms a 35 year agreement with the MSD and agrees to adopt its rules and regulations. The District may be expanded to include additional areas within the County or beyond County limits.

The powers of the District are vested in its Board, which consists of the three elected Commissioners of Hamilton County. The Board's major responsibilities are to fix service charges, adopt rules and regulations, and approve capital improvement programs. The Board has delegated other powers and responsibilities to the City of Cincinnati, which is the agency assigned by the Board of County Commissioners to operate and manage the Metropolitan Sewer District.

The enforcement powers of MSD, published in its "Rules and Regulations," are comprehensive, covering the following areas:

- control of public and private sewers;
- construction of combined sewers;
- use of sewers;
- connection to main sewers and treatment facilities;
- approval of sewer plans;
- design of sanitary sewers;
- sewage treatment plants;
- construction materials and procedures;
- building sewers and connections;
- private sewage disposal;
- disposal of septic tank wastes; and
- industrial wastes.

MSD is a special purpose sewage district whose activity is directed by the County Commissioners of Hamilton County. As such, MSD does not perform other regional services. However, its agent, the Department of Sewers of the City of Cincinnati, does perform other areawide, pollution-related services.

OPERATIONAL FEATURES

On April 10, 1968, an agreement between the City of Cincinnati and the Board of County Commissioners of Hamilton County was executed whereby the Department of Sewers of Cincinnati was designated as the management agency for the operation and maintenance of the sewer system. The Board delegated the following powers and responsibilities to the City of Cincinnati:

- plan, design, contract for, and supervise the construction of all sewage facilities;
- recommend the method of financing the sewerage facilities;
- maintain and operate all sanitary and combined sewers, pumping stations, and sewage treatment facilities of MSD;
- review and approve the design and construction of all sewerage facilities which connect directly or indirectly into the sewerage facilities of MSD;
- issue tap permits for connections to all sanitary or combined sewers;
- bill and collect sewerage service charges;
- receive and account for all monies; and
- obtain all easements required for the purposes of the sewer system.

To comply with its portion of the agreement with MSD, the City of Cincinnati on April 10, 1968 adopted an ordinance establishing the Department of Sewers, to be administered by a Director of Sewers and subject to the supervision and control of the City Manager.

In addition to providing sewerage services for the Metropolitan Sewer District of Greater Cincinnati, the Department of Sewers is responsible for three other environmental programs:

- Flood Control Program of the City of Cincinnati;
- Air Pollution Control Program for Cincinnati and Butler, Clermont, Hamilton, and Warren Counties; and

. Storm Sewer Maintenance Program for the City of Cincinnati.

To perform its functions, the Department of Sewers avails itself of the services and facilities of other city departments (e.g., Public Works, Finance, Personnel, and Law). The City of Cincinnati is reimbursed by the Department of Sewers at cost plus established overhead.

MSD follows a retail approach in performing the functions of sewage collection and disposal. MSD is thus actively involved within each community to ensure its compliance with published rules and regulations governing the design, construction, maintenance, operation and use of sanitary and combined sewers.

The Technical Services Division is responsible for providing engineering services required to meet the demands of the retail approach. The Division has four major sections: Design; Heavy Construction; Field; Sampling and Gauging. Briefly, the functions of each section are as follows.

Design - responsible for the design and preparation of plans, estimates, and specifications for local, trunk, and interceptor sewers. In addition, the section handles sewer tap records, issuing permits, and licenses.

Heavy Construction - reviews and approves consulting engineers' plans for sewer improvements and treatment plants, and architects' plans for proposed MSD construction. Additionally, the section coordinates all heavy construction programs within the District.

Field - inspects and monitors existing sewers and those under construction. This section consists of three units, Construction Inspection, Investigation and Inspections, and Sewer Inspection (by television cameras).

Sampling and Gauging - samples and guages wastes generated at industrial plants by subjecting the wastes to laboratory analysis to determine the sewerage surcharge. The section also serves as a policing agency and maintains constant checks on waste discharges from industry entering sewers and surface waters.

The Division of Sewer Maintenance is responsible for inspecting, cleaning, and repairing all publicly owned sanitary and combined sewers in MSD. The Division is subdivided into three geographical sections (East, Central, and West) which clean and repair the sewer system, and one Investigations section which performs special and routine inspections and maintains the interceptors and regulator chamber devices in the entire MSD.

FINANCE

Through fiscal year June 30, 1973, the MSD financed its projects through grants from the Ohio Water Development Authority (OWDA). The Local Governmental

Agency Program of OWDA was designed to expedite treatment plant construction and to provide for expansion and additional treatment needs through 1974. Through a combination of $100 million in state funds, revenue bonds sold by the Authority, and available federal funds from the Federal Grant Program, OWDA finance 100% of the project cost, guaranteeing a portion of its advances through a grant. The remaining portion was repaid over a 10 to 40 year period. In fiscal years 1970 and 1971, the OWDA guaranteed a 30% minimum grant. If sufficient federal funds became available, these grants became eligible to a 50% level.

As a result of the increased federal grants of 75% of costs for eligible projects, the MSD will attempt to qualify for direct grants from the federal EPA. The remaining 25% will be generated by General Obligation bonds issued by Hamilton County.

Revenues

Although revenues are generated from a variety of sources, sewerage service charges accounted for 82% in fiscal year 1973. The service charge consists of a minimum charge and a commodity charge.

Minimum Charge

The minimum charge is based on the size of the water meter used to serve the premises or the size of the premises served as determined by the number of family units therein, whichever results in the larger minimum charge. Such minimum charges include the charge for the first 1,000 cubic feet of water used in the case of monthly bills and the first 2,000 cubic feet of water used in the case of quarterly bills.

Schedule of Minimum Charge Rates

METER METER SIZE	NUMBER OF FAMILY UNITS	MONTHLY BILLS	QUARTERLY BILLS
5/8 Inch	1	$ 3.00	$ 6.50
3/4 Inch	2 or 3	4.00	8.00
1 Inch	4 or 5	4.50	11.00
1-1/2 Inch	6 thru 12	6.50	16.00
2 Inch	13 thru 20	10.00	27.00
3 Inch	21 thru 50	20.00	54.00
4 Inch	51 thru 115	32.00	95.00
6 Inch	116 thru 250	65.00	190.00
8 Inch	over 250	90.00	270.00
10 Inch		90.00	270.00
12 Inch		90.00	270.00

For trailer parks the number of family units shall be 75% of the available occupancy.

For hotels and motels the number of family units shall be 50% of the available occupancy.

For Commercial establishments each two sets, or part thereof, of sanitary facilities shall be counted as one family unit. A set of sanitary facilities shall be any grouping of water using plumbing fixtures whose total instant demand is not greater than the total instant demand of five, one-half inch, water faucets. Where commercial or manufacturing facilities require more water than required for sanitary purposes, the minimum charge shall be not less than the minimum charge for a meter one size smaller than the branch serving the premises.

Commodity Charge

The commodity charge is based on the quantity of water used on the premises served, as measured by water meters acceptable to the City of Cincinnati.

Commodity Rate Schedule

MONTHLY BILLS	QUARTERLY BILLS
For each 100 cubic feet consumed per month in excess of 1,000 cubic feet but not in excess of 500,000 cubic feet - 20¢ per 100 cubic feet	For each 100 cubic feet consumed per quarter in excess of 2,000 cubic feet but not in excess of 1,500,000 cubic feet - 20¢ per 100 cubic feet.
For each 100 cubic feet consumed per month in excess of 500,000 cubic feet - 14¢ per 100 cubic feet.	For each 100 cubic feet consumed per quarter in excess of 1,500,000 cubic feet - 14¢ per 100 cubic feet.

Sewerage service charges apply to every premise discharging "normal sewage" into the sewerage system. As defined in MSD's "Rules and Regulations," normal sewage, when analyzed, shows by weight a daily average not more than 2,500 pounds (240 parts per million) of B.O.D. and not more than 833 pounds (100 parts per million) of ether soluble matter (grease and oil), per million gallons of daily flow.

When a premise is supplied with water from wells or any other source other than a public water supply, such wells or sources must be registered with the District on the District's form. The owner of the premise must install and maintain a meter acceptable to the District at his expense.

Sewerage Surcharge

When the sewage discharged from a premise is other than "normal" as described in the Rules and Regulations, the owner is charged a sewerage surcharge determined based on either or both of the constituents of total suspended solids and B.O.D. The formula detailed in the Rules and Regulations is shown below. The comprehensive rules for administering the sewerage surcharge, extracted from the Rules and Regulations, are presented below.

ARTICLE XVIII

APPLICATION OF THE SEWERAGE SURCHARGE

Section 1801

Every person, firm or corporation whose premises are served by a sewer connection which discharges sanitary sewage, industrial wastes, water or other liquids--other than "normal sewage"--either directly or indirectly into the sewerage system under the jurisdiction of the District shall be charged and shall pay a Sewerage Surcharge in addition to the Sewerage Service Charge for "normal sewage".

The basis of the surcharge shall be determined on either or both, of two constituents of the water or wastes:

(a) Total suspended solids, and

(b) B.O.D., 5 days at 20 degrees Centigrade and as herein provided.

When either or both the total suspended solids and B.O.D. of a water or waste accepted for admission to the city sewage works exceeds the values of these constituents for "normal sewage", the excess concentration in either or both, as the case may be, shall be evaluated volumetrically in terms of "normal sewage" and be subject to surcharge on the volume derived in accordance with the following formula:

$$Sv = \frac{(Sw-2500) \times 0.65}{2500} \times F \times 133{,}690 +$$

$$\frac{(Bw - 2000) \times 0.65}{2000} \times F \times 133{,}690$$

which reduced to its simplest form is:

$$Sv = F\ [\ (Sw-2500)\ 35 + (Bw-2000)\ 43]$$

where SV is the derived volume of wastes in cubic feet subject to surcharge.

Sw - the pounds per million gallons of suspended solids in the wastes as discharged.

2,500 - the pounds per million gallons of suspended solids in the "normal sewage".

Bw - the pounds per million gallons of B.O.D. in the wastes as discharged.

2,000 - the pounds per million gallons of B.O.D. in "normal sewage".

0.65 - Factor allowance for 65% degree of purification.

F - the flow expressed in million gallons of wastes as discharged.

133,690 - Factor to convert million gallons to cubic feet.

The equivalent volume of "normal sewage" as derived from the excess above the normal strength of any water and wastes shall be subject to a surcharge for the volume of equivalent "normal sewage" as computed from the formula.

Section 1802

Each such person, firm or corporation shall complete and file with the District an industrial waste questionnaire containing pertinent information of the quantity of flow and a chemical analysis of the wastes to be discharged before said discharge begins.

Section 1803

When required by the Director, the owner of any property discharging such wastes shall install a suitable chamber or chambers in the building sewer to permit observation, sampling and measurement of the combined wastes from his premise. Such chamber shall

be constructed in accordance with approved plans, shall be installed by the owner at his expense and shall be maintained by him so as to be safe and accessible at all times.

Section 1804

All measurements, tests and analyses of the characteristics of such wastes shall be determined in accordance with the latest edition of "Standard Methods for the Examination of Water and Sewage", as prepared, approved and published jointly by the American Public Health Association, the American Water Works Association, and the Water Pollution Control Federation.

Section 1805

The strength of the wastes shall be determined from samples taken at the aforementioned chamber at any period or time and of such duration and in such manner as the District may elect, or, at any place mutually agreed upon between the owner and the District. The results of routine sampling and analysis by the owner may also be used, in determining the amount of the surcharge after verification by the District.

The strength so found by analysis shall be used in determining the amount of the Surcharge. The Surcharge shall be applied to the total water consumption, less that portion exempted by order of the Director and shall be based on the average strength of all wastes discharged to the sewerage system.

Section 1806

The District will asume the cost of operation of not more than two (2) gauging and sampling manholes or points of discharge and the necessary analytical work involved. The work time of the District personnel engaged in the field operations and laboratory work shall not exceed a five (5) day, forty (40) per week.

In the event more than two (2) gauging and sampling manholes or points of discharge are necessary, the additional costs of the installation of measurement devices to be used and the costs of the personnel

required for operation of the manholes or sampling points and the subsequent laboratory work involved, shall be borne by the owners of the property.

Where a plant or premise discharges its effluent to a manhole or manholes, used as gauging and sampling points, and the effluent is of such volume and duration that installation of hydraulic equipment cannot be made until the plant or premise ceases its operations, by week-end closedown, the costs of making the installations, involving overtime pay, shall be borne by the plant or premise. If the plant or premise elects to make the hydraulic installations with their own personnel, the installations shall be made in a manner approved by the Director.

In the event that a period in excess of a standard five (5) day, forty (40) hour week is required for District personnel to properly gauge, sample and analyze the discharged effluent, the extra costs shall be borne by the owner of the property.

Section 1807

The District shall have the right to enter and set up, on company property, such devices as are necessary to conduct a gauging and sampling operation and to begin such operation without advance notice to the company. While performing the work, the District will observe all Safety Rules applicable to the premises, established by the Company.

Where a company or premise has security measures in force which require proper identification and clearance before entry into said company or premise is granted, such company or premise shall either make the necessary arrangements with their security guards that upon showing proper identification personnel from the District will be permitted to enter, without delays, for the purpose of obtaining grab samples of wastes being discharged at the various sampling points; or the company or premise shall install suitable gauging and sampling manholes outside the security limits which manholes will at all times be immediately accessible to District personnel.

Section 1808

If a person, firm or corporation disagrees with the analysis on which the sewerage surcharge is based, he or it may request, in writing, an additional sampling and analysis which shall be conducted in a manner acceptable to the Director. The cost of such sampling and analysis shall be borne in full by the requestor.

Section 1809

In the event an analysis of the wastes is not furnished to the District when requested, the sewerage surcharge shall be based on the chemical analysis of a similar process or other data acceptable to the Director and shall continue in effect until such time as an analysis of the wastes is submitted by the company and confirmed by the District.

Section 1810

Where certain types of business and industrial users discharge clear water, not contaminated as the usual sewage entering the system, if such users shall install and have in operation equipment to dispose of or divert said water from entering the system, they shall be exempt from payment of sewerage service charges for the water so disposed of or diverted. When the equipment is installed and in operation, the owner shall install a meter or meters at his expense to measure the amount of water so disposed of, or diverted.

Section 1811

If the Director finds that it is not practicable to measure such waste by meters, he shall determine the waste in any manner or method as he may find practicable, in order to arrive at the precentage of metered water entering the sewerage system and the quantity of water used to determine the sewerage service charge be that percentage so determined.

Section 1812

In cases where the character of sewage or industrial waste from any manufacturing or industrial plant, building, or premises is such that it will damage the sewerage system, or cannot be treated satisfactorily

in this sewerage system, the Director has, and shall use, the authority to compel such users to dispose of such waste and prevent it from entering the system.

In cases where the character of the sewage or industrial waste from any manufacturing or industrial plant, building, or premises is such that it imposes an unreasonable burden upon said sewerage system greater than that imposed by the normal sewage entering said sewerage system, the Director may, if he deems advisable, compel such manufacturing or industrial plant, building, or premises, to pretreat such sewage in such manner as he shall specify before discharging such sewage into the sewerage system.

If such pretreatment is not so ordered or accomplished, the Director shall recommend to the Board the levying of a surcharge which shall be in addition to the regular charge; the Board thereupon by resolution may fix the amount of the surcharge.

Section 1813

If the findings, order, or decision of the Director made in pursuance of the provisions or of these Rules and Regulations, are not acceptable to any industry, such industry shall have the right to appeal as follows. Two Professional Engineers shall be chosen, one by the industry and the other by the Board, neither of whom shall be a regular employee of either principal. Such persons shall act as referees. As soon as such referees are chosen, the Director shall file with them a certified copy of the complaint and the decision of the Director, and it shall be the duty of such referees to investigate the complaint and to agree either to affirm or reject the findings of the Director and file a report with the Board within a reasonable time, setting down their decision. If the referees so chosen are unable to agree, they shall choose a third Professional Engineer, and the decision or recommendation of the majority shall be reported to the Board. The decision or ruling of the Board shall be final and shall be reported to the industry and to the Director.

The fees and expenses of the referee appointed by the industry shall be paid by the industry and the fees and expenses of the referee appointed by the Board shall be paid from funds appropriated by the Board for

such purposes, from the surcharge collections. The fees and expenses of the third referee shall be equally divided between the industry and the Board.

Billing Procedures

Billing calculations are performed in several ways, depending upon the type of account and whether a surcharge is required. For the majority of customers, who are subject only to a service charge, the billing calculations are performed by the Water Department on the Water Department's computer and mailed from the Water Department.

Exceptions from the above normal routine are as follows:

- Consolidated Accounts - customers with more than one water meter. Meter reading must be manually combined and subsequently keypunched and entered into the Water Works Computer for bill preparation.

- Exception Accounts - accounts where water introduced on the premises does not all enter the sewer collection system. These accounts are calculated manually and subsequently billed through the computer.

- Industrial Surcharge Accounts - charged an additional amount due to the quality characteristics of their discharge. The surcharges are calculated manually by the Sewer Department and forwarded to the Water Department for customer billing

NEW DEVELOPMENTS

The District is engaged in a $400 million areawide improvement program, of which $100 million will be used for upgrading primary treatment plants to secondary. The remaining funds will be used to construct collecting sewers, interceptors, and pumping stations. In addition, cost accounting techniques will be developed to determine the costs of operating and maintaining the individual components in the system. This will enable the District to comply with federal EPA regulations concerning the proper allocation of costs to industry.

Identity:	Allegheny County Sanitary Authority Pittsburgh, Pennsylvania
Area Serviced:	The Allegheny County Sanitary Authority (Alcosan) intercepts, transports, and treats the combined sewage of the City of Pittsburgh and 74 surrounding municipalities (20 in part). The service area includes approximately 225 square miles and a population of 1,200,000.
Treatment Characteristics:	One secondary plant processes approximately 150 million gallons of sewage each day and discharges to the Ohio River.

LEGAL ENTITY

Alcosan was formed in 1946 following passage of the Clean Streams Act by the Pennsylvania Legislature in 1945. The Act ordered local communities to cease the discharge of untreated wastes to the streams of the Commonwealth. Under the Municipality Authorities Act of 1946 Alcosan was established in response to formal resolutions of surrounding municipalities for the establishment of a county-wide agency to investigate stream pollution abatement.

Despite numerous delays, as a result of encouragement and financial assistance from the City of Pittsburgh, a suitable plan was developed to serve Pittsburgh and as many surrounding municipalities (at least 43) as could be included economically. The plan was soon expanded to include 59 and additional fringe-area municipalities have since been added, for a present total of 75.

Alcosan is a quasi public agency managed by a Board of five directors. It does not have the power to tax. Alcosan's boundaries cannot be expanded beyond the boundaries of Allegheny County, which contains 102 municipalities, 74 serviced by Alcosan.

Alcosan was originally organized as a County Agency, with all five Board members appointed by the County Commissioners. In return for its assistance in developing the final plan, the City of Pittsburgh insisted on the reorganization of Alcosan into a joint City of Pittsburgh-County of Allegheny Authority. The method of appointing Board members was thus changed in 1955 to entitle Pittsburgh to appoint three members and the county, two.

Enforcement of effluent entering Alcosan's system is accomplished by requiring the adoption of a waste control ordinance by each municipality as a prerequisite to forming a service agreement. Violation of the ordinance by any person, firm, association, or corporation is punishable by a fine not to exceed one hundred dollars ($100.00) for each offense. Each day that the violation continues constitutes a separate offense.

OPERATIONAL FEATURES

A standard Municipal Agreement is formed with all connecting municipalities. Additionally, agreements have been formed with 28 waterfront industrial corporations whose wastes enter the system's intercepting sewers directly. Alcosan does not provide any other regional services.

Prior to the formation of an agreement, it must be shown that the participation of a new member in the program will not increase Pittsburgh's sewage rates. To ensure that the Authority will not be required to build branch intecepting sewers, which would result in an overall rate increase, every Municipal Agreement requires the participating municipality to extend its own collection

facilities to specific points of connection with the Authority's interceptors. Unable to construct the needed facilities, some communities requested that Alcosan do so for them. The municipalities agreed to pay the cost of construction in one of the following ways:

- advancing the entire additional cost in cash;
- advancing periodically the semi-annual amortization requirements (principal, interest, and reserves) of the Authority's revenue bonds issued to finance the extension; or
- paying the amortization requirements in the form of higher sewage charges.

Participating municipalities are responsible for providing their own local collection network. Each municipality further guarantees payment for any customer who defaults payment on his sewer service bill. When the Authority was created, each municipality was offered the option of paying all the bills of its residents aggregately, with the right to fix its own sewage rates or charges to be paid by its residents; 20 municipalities chose this method.

FINANCE

Revenue Bonds are issued to pay the cost of constructing major capital requirements. The revenues of the system are pledged to the repayment of the bonds. In addition, Alcosan has in the past applied for and received grants from federal and state programs.

The municipal agreements provide that the sewage charges will be uniform throughout the service area unless (by exception) additional facilities are required to intercept and transport the sewage to the treatment plant. Bills are sent to sewered premises within the entire service area and are determined as follows:

(a) Metered Water Users

The charges for sewage service to users of metered water are based upon the quantity of water delivered to each water user, as measured by a water meter.

Water used per quarter year	Sewage charge
For first 100,000	$0.375 per 1,000 gal.
For next 1,000,000	0.3125 per 1,000 gal.
For next 2,500,000	0.25 per 1,000 gal.
For excess over 3,600,000 gal.	0.1875 per 1,000 gal.

Minimum charge is $3.00 per quarter year.

(b) Flat Rate Water Users

The charges for sewage service to water users whose water bills are based on a flat rate are determined as follows.

1. For City of Pittsburgh water users, 80% of flat rate water bill.

2. For suburban water users, such percentage of the flat rate water bill as will produce substantially the same sewage charge as is levied on a similar flat rate water user of the City of Pittsburgh.

(c) Other Water Users

The water consumption is estimated by the Authority and calculated by applying the schedule of rates in (a) above to the estimated quantity.

(d) Commercial and Industrial Surcharges

In any case where any commercial or industrial contributor's wastes contain an unusually high concentration of suspended solids, biochemical oxygen demand (BOD), or high chlorine demand, the sewage charges are increased according to the following formulae:

Suspended Solids and BOD

$$F = 1 + .50\left(\frac{.44(SS - 275)}{275} + \frac{0.27\ (BOD - 300)}{300}\right)$$

Where:

F = Factor to be applied to basic rate
SS = Suspended solids in parts per million
BOD = BOD of particular wastes in parts per million.

Chlorine Demand

$$Rc = 0.00835\ Pc\ (C-5)$$

Where:

Rc = Surcharge rate for chlorine demand in cents per thousand gallons of wastes.
Pc = Contract price of chlorine in cents per pound.
C = Chlorine demand of particular wastes in parts per million.

A monitoring section samples sewage entering the system and reports changes in the sewage concentration.

(e) Additional Charges for Garbage Grinders

For each household garbage grinder in a private dwelling unit, the charge is $1.88 per quarter year. For other than household garbage grinders, the charge is $31.25 per quarter year per grinder of one horsepower capacity, and a proportionately lower or higher charge per grinder of lesser or greater horsepower capacity.

The information concerning water meter readings required to determine the sewage service charge is provided by one of 23 independent water service agencies. A law requiring that such water supply agencies provide the Sanitary Authority copies of their own water meter readings was passed in the 1949 session of the State Legislature. The law also obligates them to shut off water to delinquent sewage customers.

Local banks act as collection agencies for the Authority.

NEW DEVELOPMENTS

Alcosan has recently completed upgrading its treatment level to secondary. Currently, no additions to the system are planned. As fringe municipalities surrounding the present territorial boundaries of the Authority are planning their own facilities, it is not anticipated that Alcosan will be required to expand its present boundaries in the foreseeable future.

Identity:	Louisville and Jefferson County Metropolitan Sewer District Louisville, Kentucky
Service Area:	The Louisville and Jefferson County Metropolitan Sewer District (MSD) services the wastewater needs of the Metropolitan Louisville area. The land area of Jefferson County is 375 square miles and contains a population of over 380,000 persons living in 33 separate communities.
Treatment Characteristics:	Approximately 86 MGD are processed by nine treatment plants. A single large primary treatment plant processes over 97% of the wastewater. The eight smaller plants provide treatment for 1.6 MGD at secondary and tertiary levels. Effluent is discharged to the Ohio River and several tributary creeks.

LEGAL ENTITY

The MSD was formed in 1946 as a public body, a corporate and political subdivision with the power to use a corporate seal, sue and be sued, contract and be contracted with, and in other ways act as a natural person.

General Powers

- To have jurisdiction, control, possession, and supervision of sewers and drainage systems.
- To prepare or cause to be prepared comprehensive wastewater plans.
- To construct, according to its plans, the necessary sewerage facilities after receiving approval from designated authorities of the affected city.
- To acquire and hold personal property and to dispose of property when the district has no further need for the property.
- To acquire by purchase, gift, lease, or by condemnation, real property or any interest, right, or easement as the board determines necessary.
- To formulate by-laws and agreements for the management and regulation of its affairs.
- To borrow money and to issue negotiable bonds.
- To fix and collect sewer rates, rentals, and other charges, subject to the approval, supervision, and control of the legislative body of the city being provided services.
- To enter on any lands, waters, and premises for the purpose of conducting surveys and examinations.
- To approve or revise the plans and designs of all sewerage facilities constructed in the entire County.

The MSD does not have the power to levy ad valorem taxes upon any property.

The directing body of the MSD consists of a Board of five members, three appointed by the Mayor of the City of Louisville subject to confirmation by the Board of Aldermen, and two appointed by the County Judge subject to the approval of the County Commissioners.

Many of the MSD's enforcement powers lie within the scope of its General Powers. In addition, it has the power to curtail service to delinquent users, and to establish and promulgate all rules and regulations necessary to regulate the use, operation, and maintenance of property and facilities under its control. Its jurisdiction extends beyond the district area for regulation of sewers and drains which by natural flow empty into or flow through any part of the district area. The MSD has the power to extend its boundaries to be co-terminous with those of Jefferson County.

The Board of Directors must secure approval of the participating municipalities for construction plans and new rate schedules. Bonds issued for purposes of construction directly affecting a city must be approved by an ordinance of the legislative body of the affected city and approved at a public election.

OPERATIONAL FEATURES

The MSD provides sewage services to individual users within the boundaries of the District and constructs or supervises the construction of all collecting facilities within the District.

The Louisville Water Department provides the District with water services. Through a cooperative arrangement with the MSD, the water department includes a sewer service charge on its monthly and bi-monthly bills. All but a small percentage of the residents are billed for sewer services in this manner. Approximately 40 industrial accounts are billed directly by the MSD, based on special meter readings by MSD personnel.

FINANCE

The MSD is not empowered to issue General Obligation Bonds since it is prohibited from levying an ad valorem tax. It is, however, authorized to issue Revenue Bonds, and has done so in the past. In addition, the MSD has secured financing for capital improvement projects from the federal Environmental Protection Agency and the Department of Housing and Urban Development.

Revenues accrue from sewer service charges (including a minimum charge and a commodity charge) based upon water consumed. A schedule of the Sewer Service Rates appears below.

LOUISVILLE AND JEFFERSON COUNTY
METROPOLITAN SEWER DISTRICT

Schedule of Sewer Service Rates
Based on Water Consumed
Effective for Bills Issued on or
After March 1, 1972

MINIMUM CHARGES

Water Meter Size	Bi-Monthly 1,000 Gals.	Bi-Monthly Sewer Charge	Monthly 1,000 Gals.	Monthly Sewer Charge
Residential				
5/8"	2	$ 3.60	1	$ 1.80
3/4"	2	3.60	1	1.80
Industrial, Commercial, Etc.				
1"	10	11.28	5	5.64
1-1/2"	20	20.30	10	10.15
2"	30	33.82	15	16.91
3"	70	67.68	35	33.84
4"	130	135.32	65	67.66
6"	300	248.26	150	124.13
8"	500	429.00	250	214.50
10"	800	700.50	400	350.25
12"	1,200	1,130.00	600	565.00
16"	2,000	1,584.00	1,000	792.00
20"	3,200	2,263.00	1,600	1,131.50

PLUS THE FOLLOWING CHARGE FOR EACH 1,000 GALS. OF WATER USED IN EXCESS OF THE ABOVE MINIMUM ALLOWANCES:

52¢ - Up to 400,000 Bi-Monthly or
200,000 Monthly
41¢ - From 400,000 to 3,000,000 Bi-Monthly or
200,000 to 1,500,000 Monthly
22¢ - Over 3,000,000 Bi-Monthly or
1,500,000 Monthly

PLUS APPLICABLE KY. SALES TAX. A 10% PENALTY IS ADDED FOR BILLS NOT PAID BY DUE DATES.

Additional revenues are collected from connection fees, which finance the cost of lateral sewers. The fee is based upon the size of the water meter(s) serving the premise, in accordance with the following schedule:

Water Meter Size	Connection Fee
5/8" - 3/4"	$ 1,000
1"	$ 2,000
1-1/2"	$ 4,000
2"	$ 7,000
3"	$ 15,000
4"	$ 25,000
6"	$ 50,000
8"	$ 80,000
10"	$120,000
12"	$170,000
16"	$300,000
20"	$440,000

Charges for installation of property service connections are based upon the size of the connection as follows:

LOUISVILLE AND JEFFERSON COUNTY
METROPOLITAN SEWER DISTRICT

SCHEDULE OF CHARGES FOR INSTALLATION
OF PROPERTY SERVICE CONNECTIONS
BY DISTRICT FORCES
EFFECTIVE JULY 1, 1972

Total Right-Of-Way Width Of Street, Alley Or Easement	6-Inch	8-10-12-Inch	15-Inch +
10'	$100	$ 300	$ 500
20'	150	450	750
30'	200	600	1,000
40'	250	750	1,250
50'	300	900	1,500
60'	350	1,050	1,750
70'	400	1,200	2,000
80'	450	1,350	2,250
90'	500	1,500	2,500
100'	550	1,650	2,750
110'	600	1,800	3,000
120'	650	1,950	3,250

Plus the following charge for each foot of depth in excess of 5 feet at the property line:

6-inch - 50¢ for each foot of the total right-of-way width of the street, alley or easement

8-10-12-inch - $1.50 for each foot of the total right-of-way width of the street, alley or easement

15-inch + - $2.50 for each foot of the total right-of-way width of the street, alley or easement

The MSD has established industrial waste surcharge rates for wastewaters containing excessive concentrations of suspended solids and grease. However, due to manpower limitations and EPA regulations, MSD has not imposed these surcharge rates upon industrial users.

"Normal" sewage is sewage which, when analyzed, shows by weight a daily average of not more than 500 mg/L of suspended solids, initially, and not more than 100 mg/L of grease. When either exceeds the "normal" amount, a surcharge may be charged in accordance with the following formulae:

$W_1 = V \times 8.34 (SS - 500)$

$W_2 = V \times 8.34 (G - 100)$

W_1 = Weight in pounds of suspended solids over the limit for "normal" sewage.

W_2 = Weight in pounds of grease over the limit for "normal" sewage.

SS = Suspended solids in terms of mg/liter

G = Grease in terms of mg/liter

V = Millions of gallons of water or waste

The surcharge will be based on the following formulae:

$$S = \frac{W_1}{100} \times \$1.09 + \frac{W_2}{100} \times \$ .48$$

S = Total surcharge in dollars.

Industrial waste surcharges are being thoroughly reviewed in light of EPA regulations and will undoubtedly become effective prior to the commencement of secondary treatment operations.

NEW DEVELOPMENTS

MSD's increments for major capital improvements are developed in five year programs. Secondary treatment facilities are currently under construction at a cost of $58 million. In addition, MSD is currently participating in the development of a Water Quality Management Plan for the metropolitan region to comply with EPA's planning requirements.

Identity: East Bay Municipal Utility District,
Special District No. 1
Alameda and Contra Costa Counties, California

Area Serviced: The East Bay Municipal Utility District (EBMUD), Special District No. 1 serves the City of Oakland and eight smaller municipalities. The service area encompasses approximately 100 square miles and includes a population of over 600,000.

Treatment Characteristics: One primary treatment plant processes approximately 85 million gallons of sewage per day. Effluent is discharged to San Francisco Bay.

LEGAL ENTITY

EBMUD was organized in 1923 pursuant to the Municipal Utility District Act of 1921 as a taxpayer-owned public agency with a broad range of powers, including the power to levy taxes without limitations on rate or amount on all taxable property within its boundaries. EBMUD is authorized to issue General Obligation Bonds, subject to two-thirds approval of the voters in the District, and Revenue Bonds, subject to majority approval of the voters in the District.

EBMUD has sole authority to establish rates and charges for all utilities it owns. The Act of 1921 permits it to supply light, water, power, heat, transportation, telephone service or other means of communication, garbage disposal, sewage, and public recreation facilities appurtenant to its reservoirs.

EBMUD received additional authorization from the State Legislature in 1971 to regulate the quality of wastes discharged into its sewers. An Ordinance was drafted and adopted in 1972 which enables EBMUD to limit or prohibit the discharge of toxic materials into its system. The Ordinance requires monitoring by some dischargers. Furthermore, EBMUD has the authority to make spot checks. Penalties for violations include fines of up to $6,000 per day by the courts. Termination of EBMUD services can result in extreme cases.

EBMUD is governed by a board of five directors who are elected at large for alternating four-year terms.

OPERATIONAL FEATURES

EBMUD currently functions in the areas of water supply, recreation, and sewage treatment and disposal.

Prior to 1944 EBMUD performed the single function of water supply to most of the urban and suburban development in Alameda and Contra Costa Counties. In 1944, Special District No. 1 was formed as a subdivision of EBMUD to perform the functions of sewage interception, treatment, and disposal for the most highly developed areas in EBMUD. Since its formation, the Special District has expanded its boundaries to include other municipalities.

Participating municipalities are responsible for constructing, managing, and operating their own local collection networks. EBMUD maintains separate accounting and financial data for its water and wastewater activities. The individual boundaries of the areas receiving water supply and sewage services are not coterminous.

EBMUD owns 54,000 acres of open space land needed to protect large reservoirs from contamination. Four of these reservoirs have been opened for fishing, hiking, picnicking, and boating. In 1970 a master plan was developed to open additional areas for recreation. Included in the master plan is a program to set aside areas of land for environmental education, nature areas, and open space preserves.

FINANCE

General Obligation Bonds are issued to finance the cost of constructing sewerage facilities. The bonds constitute a general obligation of the Special District and are payable from ad valorem tax revenues unless funds are otherwise provided.

EBMUD has the authority to issue Revenue Bonds, subject to majority approval of the voters. However, it has never used this vehicle to finance any of its projects, but instead utilizes state and federal grants to finance portions of projects which are eligible for assistance.

Revenues

EBMUD utilizes a combination of ad valorem taxes and service charges to pay the costs incurred in financing, maintaining, and operating its facilities. These revenues are proportioned as follows.

- Ad Valorem Taxes - used to pay for the extra capacity provided by newly constructed facilities.
- Service Charges - established to compensate for various classes of users as follows:
  - Homeowners: $0.75 per month
  - Commercial and Industrial (for firms not requiring permits): The following were developed based on volume and strength of sewage discharged by each of 15 industrial classifications.

Business Description	Rate per 100 Cu. Ft.
Canning and Packing	$ .15
Commercial Laundries	.15
Pulp and Paper Products Manufacturers	.15
Miscellaneous Food Manufacturers	.15
Fats & Oils Manufacturing and Processing	.15
Dairy Product Processors	.15
Bakeries	.20
Grain Mills	.25
Paint Manufactures	.25
Drums & Barrels Cleaning	.25
Meat Products Packaging	.25
Eating Places	.25
Slaughterhouses	.30
Leather Tanning	.30
Industrial Laundries	.40

- Commercial and Industrial (for firms not requiring permits): Firms discharging sewage of unusually high volumes or strength require permits. Rates for these customers are established accordingly.

The sewage service charge is incorporated into the water bill, a service also performed by EBMUD. These new rates meet state and federal requirements for grant eligibility, thus enabling EBMUD to qualify for construction funds to improve treatment facilities.

NEW DEVELOPMENTS

As a result of new water quality standards set forth by the state and federal governments, EBMUD has embarked upon a new construction program to upgrade existing treatment processes to include secondary treatment. The project is expected to cost $55 million and is scheduled for completion in 1975.

A new schedule of service charges has been adopted to comply with new regulations. These rates reflect the actual cost of treating sewage from various sources.

Identity:	Hampton Roads Sanitation District Norfolk, Virginia
Service Area:	The Hampton Roads Sanitation District provides sewage services to the Norfolk, Virginia area, which includes six cities, the County of James City, the County of York, and portions of the Isle of Wight County and Nansemond County. The service area includes approximately 1,400 square miles and a population of 900,000.
Treatment Characteristics:	Three secondary treatment plants and six primary treatment plants process approximately 68.5 million gallons of sewage each day. The major bodies of water discharged to are the Elizabeth River, James River, and Chesapeake Bay.

LEGAL ENTITY

"Hampton Roads" is a geographic term which refers to the water channel in east Virginia through which the James River, Elizabeth River, and Nansemond River flow into Chesapeake Bay. The District's territorial authority includes areas on both the north and south shores of Hampton Roads. Its boundaries are flexible and over the years have expanded to accommodate suburban growth.

The Hampton Roads Sanitation District is a political subdivision of the Commonwealth of Virginia. The Hampton Roads Sanitation District Commission is the governing body of the District. Both the Distirct and the Commission were created by the legislature of the Commonwealth of Virginia in 1940 to provide public health and welfare services.

The Commission consists of five members appointed by the Governor of Virginia for four-year terms. Appointments are made and set so that no more than two of the Commissioners' terms expire in any one year. The composition of the Commission must meet the legal requirements that two members be residents of the City of Norfolk or the City of Virginia Beach, one member a resident of the City of Newport News, one member a resident of the City of Hampton, and the fifth member a resident of the City of Chesapeake or the counties of Isle of Wight or Nansemond.

Powers

The enabling act authorizes and empowers the Commission to:

- construct, improve, extend, enlarge, reconstruct, maintain equip, repair, and operate a sewage disposal system;
- issue at one time or from time to time, revenue bonds, notes or other obligations of the District, payable solely from the revenues of the District;
- fix, revise, charge, and collect rates, fees, and other charges for furnishing wastewater services; and
- exercise eminent domain.

The issuance of Revenue Bonds does not require the assent of the voters of the District.

OPERATIONAL FEATURES

The function of the Commission is to provide interceptor systems to collect sewage from public and private systems within the District, transport the sewage

to one of nine treatment plants, and discharge in a manner that avoids pollution of any water in the District. The collection of sewage from individual homes, industries, apartments, institutions, and other users remains the responsibility of the various cities and counties. The District does not provide any other areawide services.

The Commission's unique operating feature is its combination of the characteristics of wholesale and retail organizations. For example, although the Commission is not involved in the local collection of sewage, it submits a bill to each premise its services. The usual practice for agencies which intercept sewage at central connection points is to measure the sewage at the point of interception according to flow and strength characteristics and submit a bill to the city or county for the combined charges of participants.

In areas where municipalities wished to join the District earlier than anticipated, lease-purchase agreements were formed. Facilities were constructed under the supervision and engineering specifications of the District, but financed by the municipality, subject to purchase at cost by the District in accordance with the Commission's normal financial program.

FINANCE

Revenue Bonds are used to finance the construction of all major treatment facilities. These bonds are payable solely from the revenues of the District's sewerage system. Covenants which provide additional security for the bonds are as follows.

Reserve Account

The Trust Agreement establishes a Reserve Account for the equal benefit of all Primary Pledge Sewer Revenue Bonds, which must be accumulated and maintained by the District, from the revenues of the Sewerage System on deposit with the Trustee, at a balance equal to the maximum amount of the Principal and Interest Requirements for any future fiscal year on account of each Series of Primary Pledge Bonds outstanding. The Reserve Account balance is presently at $920,432 for the Series 1962 Bonds and the Series 1967 Bonds and is to be increased to approximately $2,700,000 following delivery of the Series 1973 Bonds.

Rate Covenant

The Hampton Roads Sanitation District Commission covenants that, among other things, it will revise the sewage disposal charges as may be necessary or proper so that the monies deposited in the Revenue Fund in each fiscal year will be not less than the total of the following amounts:

(i) the Current Expenses of the Sewerage System for the current fiscal year as shown by the annual budget for such fiscal year, and

(ii) 130% of the maximum amount of the Principal and Interest Requirements for any fiscal year thereafter on account of the bonds of each Series of Primary Pledge Bonds then outstanding; provided, however, that such percentage shall be reduced to 120% from the time any Series of bonds is issued under the provisions of Section 210 of the Trust Agreement until the expiration of two complete fiscal years thereafter. The Series 1973 Bonds will be issued under this Section.

Additional Bond Covenant

Following the delivery of the $25,000,000 Series 1973 Bonds, additional Primary Pledge Bonds, ranking on a parity with the Series 1962, Series 1967 and Series 1973 Bonds, may be issued under the provisions of Section 210 of the Trust Agreement, provided that, among other things, the net revenues of the Sewerage System during the last complete fiscal year (as adjusted to reflect on an annual basis (a) any sewer customers connected to the Sewerage System at the end of the fiscal year, and (b) sewage disposal charges placed in effect not later than the delivery of the bonds) shall have been not less than 120% of the Principal and Interest Requirements for each fiscal year thereafter on account of the outstanding and proposed additional Primary Pledge Bonds.

Revenues

All operating and maintenance expenses as well as debt service requirements are paid for by service charges. The charges for sewage disposal are based on water consumed on the premises, as measured by a water meter. The schedule of charges is as follows.

	Per hundred Cubic Feet
1. For the first 9,000 cubic feet per quarter or 3,000 cubic feet per month	$ 0.38
For the next 90,000 cubic feet per quarter or 30,000 cubic feet per month	0.35

	Per hundred Cubic Feet
For the next 900,000 cubic feet per quarter or 300,000 cubic feet per month	0.33
For all over 999,000 cubic feet per quarter or 333,000 cubic feet per month	0.32

Minimum Charge Allowance	Per Quarter	Per Month
1,200 cubic feet per quarter or 400 cubic feet per month	$ 4.50	$ 1.50

2. Quarterly charges for unmetered water connections are based upon the number of flush toilets in use.

First toilet:	$4.50
Second toilet:	$3.00 additional
Each additional toilet:	$2.60

3. Advance charges of $9.00 are made for all quarterly new accounts and are refunded for any account which is not delinquent for eight (8) consecutive quarters.

4. Exemption status is awarded those premises which do not discharge the entire volume of water into the system. The owner must provide the necessary meters to measure the sewage discharged.

5. Some customers using private water supplies are required to provide and install meters at their own expense to determine the amount of sewage discharged.

6. Surcharges to dischargers of waste which add to the cost of treatment are:

   . Suspended Solids - For excess over 300 parts per million, $1.50 per hundred pounds. Based on total volume for billion period in million gallons x (average suspended solids concentration is parts per million--300) x 8.34 pounds/gallon.

   . Biochemical Oxygen Demand - For excess over 250 parts per million, $3.00 per hundred pounds. Based on total volume for billing period in million gallons x (average 5 day biochemical oxygen demand concentration at 20 Centigrade in parts per million--250) x 8.34 pounds/gallon.

. Unusual characteristics of wastes are surcharged in accordance with special rates adopted by the Commission.

The necessary information concerning water usage is supplied by the water authorities located in each municipality.

NEW DEVELOPMENTS

The District has established an eight-year construction program estimated to cost $180 million. A major portion of the program provides for the upgrading of existing treatment plants, including sludge incineration facilities, at three plants. Grants totaling over $100 million are anticipated to finance the construction costs.

Identity: Metropolitan Sanitary District of Greater Chicago
Chicago, Illinois

Area Serviced: The Metropolitan Sanitary District of Greater Chicago (District) provides wastewater services to the City of Chicago and 117 surrounding municipalities. The service area includes 860 square miles and a population of 5.5 million.

Treatment Characteristics: Three tertiary plants and four secondary plants process an average of 1.38 billion gallons of sewage per day. The District's West-South Treatment Plant at Stickney, Illinois is the largest such plant in the world, treating approximately one billion gallons of sewage per day. Effluent is discharged to several rivers and special canals constructed to divert the flow of polluted water from the area's water supply.

LEGAL ENTITY

The District was established by an Act of the State Legislature in 1889 to provide for the collection and disposal of sewage in the City of Chicago and the surrounding area. Under the statutes, the District is authorized to act as a separate municipal corporation with its own taxing powers and to issue General Obligation Bonds, subject to voter approval. As a municipal corporation, the District has a fixed boundary which can be extended to include all municipalities within Cook County. At present, only a few municipalities within the County are not serviced by the District and are therefore not included within its territorial authority. These municipalities may be incorporated into the District at a future date.

Nine members (trustees) elected at large for six-year terms form the District's governing body.

Other responsibilities of the District as established by the Illinois State Legislature are to prevent flooding by polluted water and to maintain navigation facilities on the waterways included within its territorial authority. Water quality standards set by the State of Illinois Environmental Protection Agency are enforced by the District. Discharge to both sewers and waterways is policed by the District.

The District also administers a Sewer Permit Ordinance to control the quality and quantity of wastewater received from local municipalities. The District maintains a permit program to control construction of new sewers which serve 25 or more family units or an industry or commercial establishment. The permit applications are submitted jointly by the users and the municipality.

OPERATIONAL FEATURES

The District operates a system of interceptor sewers for participating communities. The sewage is transported to one of seven treatment plants, where it is treated and discharged to receiving rivers or canals.

The highly innovative founders of the District devised a plan to construct a system of canals and waterways to reverse the flow of the Chicago and Calumet Rivers, which carried polluted water to Lake Michigan. This system was recognized by the American Society of Civil Engineers in 1955 as one of the seven modern engineering wonders in the United States. Today, the District is continuing its role of leadership by developing advanced treatment processes. Over $15 million has been spent on research for land fertilized applications of digested sludge.

The District constructed and operates a power generating station at the base of the Sanitary and Ship Canal where it joins the Illinois River. The generated energy is sold to local electric utilities for redistribution to consumers.

No contracts or inter-municipal agreements are formed when a municipality is annexed to the system. Participation is not mandatory.

FINANCE

The District finances its major construction projects through federal and state grants and the issuance of General Obligation Bonds. Ad valorem taxes are assessed uniformly throughout the District to pay for maintenance and operation and debt service requirements. The assessment is added to the county assessment and billed to each municipality by the County.

Each industrial premise is metered for water consumption. The meter readings are submitted to the District by the water utilities and serve as the basis for the sewage charge. All industries which contribute more than 10,000 gallons per day are billed separately by the District according to flow and constituency. A surcharge document is prepared by each industry identifying the type and quantity of waste discharged. Based on this information and periodic monitoring by District personnel, a sewage surcharge is computed and billed directly by the District to the industry.

NEW DEVELOPMENTS

A $3.3 billion dollar expansion program is under way which includes the construction of tunnels and reservoirs to control pollution from overflows and the upgrading of treatment capabilities to tertiary. The District anticipates that 75% of the costs will be funded by federal grants, 15% by the State of Illinois, and 10% by the District.

Identity:	**Washington Suburban Sanitary Commission** **Hyattsville, Maryland**
Service Area:	The Washington Suburban Sanitary Commission (WSSC) services over one million persons in a geographic area comprising 41 municipalities and covering over 1,000 square miles.
Treatment Characteristics:	The WSSC maintains and operates three treatment plants which presently treat 28 million gallons per day. Approximately 45% of the sewage receives tertiary treatment, with the remaining 55% receiving secondary processing. The WSSC also transports approximately 120 MGD to the Blue Plains Treatment Plant located in the District of Columbia, where it receives secondary processing before discharge to the Potomac River.

LEGAL ENTITY

The Washington Suburban Sanitary Commission (WSSC) is an agency of the State of Maryland. Since its inception in 1918, the District has been expanded by legislation enacted by the Maryland General Assembly to coincide with the boundaries of Montgomery and Prince Georges Counties. A study completed in 1967 investigated the feasibility of having a separate agency in each county perform the services then performed by the WSSC. It was concluded that innumerable problems would arise because the County line had historically been disregarded for housing and street layouts, and for the planning, design, and construction of sewerage and drainage systems.

Authority to issue bonds is subject to approval by the Maryland Legislature. Since other powers have been delegated to Montgomery and Prince Georges Counties, budget and rates are subject to County approval.

The WSSC is governed by a six member Commission whose members are appointed for four-year terms by the governments of the two constituent counties. Three members from each county are nominated by the County Executive and confirmed by the County Council. The Powers of the Commission are vested in the authority of the two counties it serves and the Maryland Legislature.

Public Hearings are held by the Commission and are required by law on the following matters:

(1) The Commission's annual budget. This hearing is normally held in March and includes consideration of WSSC rate schedules.

(2) Proposed revision of the Commission's Plumbing Code.

(3) Proposed Storm Drainage "General Benefit" projects, initiated on the request of the public or a municipality in Prince George's County only.

(4) Front Foot Benefit Assessments.

OPERATIONAL FEATURES

A unique feature of the WSSC is its agreement with the District of Columbia, which allows for the treatment of up to 120 MGD of sewage at the District's Blue Plains Plant for a charge based upon metered volume. The WSSC does not contribute to the management of the treatment plant, but does contribute its share of the capital improvements needed at the plant.

The WSSC also performs the function of water supply for the residents of Montgomery and Prince Georges Counties. In addition, it is responsible for issuing plumbing permits and licenses, and inspecting plumbing installations within the District.

FINANCE

The WSSC finances large capital programs with three types of bonds: Sewage Collection and Disposal Bonds, General Construction Bonds, and Storm Drainage and Flood Control Bonds. Sewage Collection and Disposal Bonds are supported by the Sewer Usage charges; General Construction Bonds are used to construct lateral sewers and are supported by Benefit Assessments; and Storm Drainage and Flood Control Bonds are financed from an ad valorem tax on property owners within areas benefiting from the drainage facilities.

Rates

The WSSC is required by law to establish rates and charges sufficient to cover all costs of providing services. If revenues prove insufficient to pay all costs, the deficiency becomes an obligation against the general taxing powers of the two constituent counties.

Rates are applied uniformly throughout the District except in three remote sub-districts, which involve higher servicing costs. Four methods of charging are used: front foot benefit rate; sewer connection cost; sewer use charge; and ad valorem tax.

Front Foot Benefit Assessment - The Front Foot Benefit assessment charge is made against property abutting and/or sewer line. The formula is derived on the basis of new water and sewer line construction during the year. Once the assessment has been made, it remains fixed for the life of the bonds issued (22 years in 1972). The rates are scaled downward according to property classifications. The current rates are:

Subdivision Classification

1st 150 feet -- full rate (currently $1.16)
2nd 150 feet -- 1/2 rate (currently 58¢)

Small Acreage Classification

1st 150 feet -- full rate (currently $1.16)
2nd 150 feet -- 1/2 rate (currently 58¢)
over 300 feet - 1/4 rate (currently 29¢)

Agriculatural Classification (actual farming)

No assessment until connection is made with system. After connection is made, the Commission may assess up to 300 feet per connection.

Business Classification

1st 200 feet -- full Business Rate ($1.55 per assessable foot)
over 200 feet - reduced Business Rate ($1.16)

Multi-Family Residential Classification

Assessed at Business Rate ($1.55) at the rate of 18 feet per living unit.

Sewer Connection Fees - Sewer Connection fees are paid when the customer is ready to hook up to the system. The current charge is $410 and can be paid in full or amortized over a 22-year annual payment period.

Sewer Use Charges - The Sewer Use Charge, currently $0.58 per 1,000 gallons of water consumed as measured by a water meter, is uniform throughout the District. Unmetered residences are charged $50 per year. Single non-graduated rates are used because the character of the region is predominantly residential, with little industrial consumption.

Ad Valorem (Sanitary) Tax - Most owners of real property pay a "sanitary tax" on their annual County Tax Bill. Revenue from this source is used to finance construction, maintenance, and planning of storm drainage facilities.

Billing Procedures

Revenues are collected by three methods:

- Semi-Annual Usage Bill;
- County Tax Bill (Front Foot Assessment and Ad Valorem Tax); and
- Direct Charges (House connections and Permit fees).

NEW DEVELOPMENTS

Plant capacity is presently being expanded at the WSSC's three treatment plant locations. In addition, the treatment capabilities will be expanded so that all sewage will receive tertiary treatment by 1978.

Identity: Sanitation Districts of Los Angeles County
Los Angeles, California

Area Serviced: The Sanitation Districts of Los Angeles County (Districts) provide sewerage services for 71 cities and 27 districts. The service area encompasses 729 square miles and includes a population of approximately four million.

Treatment Characteristics: District No. 2 serves as the central administrative body for all 27 districts. A single major primary treatment plant processes most of the effluent discharged to the combined system, treating approximately 350 million gallons per day. Discharge from the facility is made through a series of ocean outfalls. Ten smaller secondary treatment plants are also operated by the Districts to serve inland areas; these discharge to several receiving waters.

LEGAL ENTITY

The County Sanitation District Act, passed in 1923, authorizes the board of supervisors of any county to organize a sanitation district whose boundaries have no regard for existing political subdivisions. The Act was amended in 1949 to authorize districts to provide for the disposal of solid wastes.

A District has broad powers, including the power to issue General Obligation Bonds subject to two-thirds voter approval, to levy ad valorem taxes, to sue and be sued, and to construct, own, and operate collection and treatment works.

An Ordinance was passed in April 1972 to regulate sewer construction, sewer use, and industrial wastewater discharge; to provide for equitable distribution of the Districts' costs; and to establish compliance procedures for requirements placed upon the Districts by other regulatory agencies. The provisions of the Ordinance apply to direct and indirect discharge of liquid wastes to District facilities. The Ordinance also provides for the regulation of sewer construction in areas within the Districts, degree of waste pretreatment required, approval of plans for sewer construction, issuance of permits for industrial wastewater discharge and other miscellaneous activities, and establishment of penalties for violations of the Ordinance. (The major features of the Ordinance have been abstracted and reproduced in Exhibit I.)

A Board of Directors, which includes the presiding officer of the governing body of each participating city, administers the powers of the Districts. The chairman of the county board of supervisors represents the interests of any unincorporated area included in the Districts.

OPERATIONAL FEATURES

The function of the Districts is to intercept, treat, and discharge sewage which enters their system. The participating cities are responsible for the collection of sewage from local collection networks.

In addition to providing wastewater collection and treatment services, the Districts provide regional refuse disposal service for about 50% of the County through the operation of six sanitary landfills. House to house refuse collection is the responsibility of local authorities. Upon completion of a landfill operation, the areas are landscaped to provide recreation areas for the surrounding communities.

The success of the Sanitation Districts is attributed to their power to own, construct, maintain, and operate facilities jointly with other districts. This requires two key agreements: the Joint Administration Agreement and the Joint Outfall Agreement.

Joint Administrative Agreement

This agreement provides for a centralized administrative organization to perform the administrative functions of the 27 districts, all of which subscribe to the agreement. Expenses are apportioned to the member districts as follows:

- all expenses that can be directly traced to a district are the obligation of that district; and
- all other expenses are apportioned on the basis of the ratio of a district's bond sales or capital investment, whichever is greater, to the aggregate sum of all of the districts.

Joint Outfall Agreement

This agreement provides for the joint construction, operation, and maintenance of trunk sewers and treatment works to the mutual benefit of two or more districts. Each unit of the joint outfall system is stated in capacity in cubic feet per second and the agreement states how much capacity ownership each district has purchased. Maintenance and operation expenses are apportioned according to flow, as measured by meters.

FINANCE

General Obligation Bonds, which require two-third assent of the registered voters in an election, are issued to finance the construction of wastewater treatment facilities.

Revenues are collected by levying ad valorem taxes upon all the real property within a district to pay interest on outstanding bond issues and principal as well as the annual cost of operating the system.

Industrial wastewater surcharges are imposed upon all commercial and industrial establishments within the Districts. These surcharges are designed to compensate for the capital costs and the maintenance and operating costs incurred to treat industrial wastewaters. Tax assessments for the benefit of sewage treatment are deducted from these charges.

NEW DEVELOPMENTS

Four treatment plants are presently under construction to provide the highest form of processing. Water treated by these new plants will be recycled.

EXHIBIT I

AN ORDINANCE REGULATING SEWER CONSTRUCTION, SEWER USE AND INDUSTRIAL WASTEWATER DISCHARGES

Penalty for Violation and Civil Liability - Section 202

Every person violating any provision of this Ordinance, including the failure to pay any fees, charges or surcharges imposed hereby, or any condition or limitation of a permit or plan approval issued pursuant thereto, is guilty of a misdemeanor, and upon conviction is punishable by a fine of not to exceed one hundred dollars ($100), imprisonment not to exceed 30 days, or both.

Each day during which any violation continues shall constitute a separate offense punishable as provided above.

Any person, who intentionally or negligently violates any provision of this Ordinance pertaining to the subject matter of either subparagraphs (A) or (B) below or any condition or limitation of a permit or plan approval related thereto shall be civilly liable to the Districts in a sum of not to exceed six thousand dollars ($6,000) for each day in which such violation occurs.

(A) The pretreatment of any industrial wastewater which would otherwise be detrimental to the treatment works or its proper and efficient operation and maintenance.

(B) The prevention of the entry of such wastewater into the collecting system and treatment works.

Inspectors - Section 206

Adequate identification shall be provided by the Chief Engineer for all inspectors and other authorized personnel and these persons shall identify themselves when entering any property for inspection purposes or when inspecting the work of any contractor.

Inspection of every facility that is involved directly or indirectly with the discharge of wastewater to the Districts' sewerage systems may be made by the Chief Engineer as he deems necessary. These facilities shall include but not be limited to sewers; sewage pumping plants; pollution control plants; all industrial processes; industrial wastewater generation, conveyance and pretreatment facilities; devices and connection sewers; and all similar sewerage facilities. Inspections may be made to determine that such facilities are maintained and operated properly and are adequate to meet the provisions of this Ordinance.

Reconsideration and Appeal Procedures - Section 213

Any permit applicant, permit holder, authorized industrial wastewater discharger or other discharger adversely affected by any decision, action or determination made by or on behalf of the Districts in interpreting or implementing the provisions of this Ordinance or any permit issued hereto, may file with the Districts a written request for reconsideration.

The written appeal shall state all the pertinent aspects of the matter, and shall be accompanied by a fee of Two Hundred Dollars ($200.00) which shall be refunded if the appeal is sustained. Within 45 days after the written appeal is received, the Board of Directors of District No. 2 shall hold a hearing on this matter. At this hearing, the discharger may appear personally or through counsel, cross-examine witnesses, and present evidence in his own behalf. Notice of the hearing shall be given in accordance with Section 204 at least 15 days prior to the date of hearing. Within 45 days after the hearing is closed, said Board shall make a final ruling on the appeal.

Approval of Plans for Sewerage Construction - Section 301

No person, other than employees of the Districts, persons contracting to do work for the Districts, or maintenance workers of the local sewering agency, shall construct or cause to be constructed, or alter or cause to be altered, any public sewer, lateral sewer, house connection or industrial connection sewer over 6 inches in diameter, sewate pumping plant, pollution control plant, or other sewerage facility within the Districts where existing or proposed wastewater flows will discharge directly or indirectly to facilities of the Districts without first obtaining approval of sewerage construction plans from the Chief Engineer.

The applicant shall submit to the Chief Engineer for approval, construction plans and such specifications and other details as required to describe fully the proposed sewerage facility. The plans shall have been prepared under the supervision of and shall be signed by an engineer of suitable training registered in the State of California.

Approval of the plans by the City Engineer or the County Engineer having jurisdiction in the area in which the sewerage facility is located shall be obtained before approval of plans by the Chief Engineer. Plans for sewerage construction shall not be approved by the Chief Engineer for any facility which will convey industrial wastewater unless the discharger has first obtained a Districts' Permit for Industrial Wastewater Discharge.

Permit for Sewer Six Inches or Smaller in Diameter Connecting Directly to a Trunk Sewer of the Districts - Section 302

Any person desiring to connect a sewer six (6) inches or smaller in diameter directly to a trunk sewer of the Districts shall make written application to the Chief Engineer on a Districts' Trunk Sewer Connection Permit application form. The applicant shall complete the form and furnish such additional information as required by the Chief Engineer to substantiate that the proposed work or use will comply with the provisions of this Ordinance.

A Trunk Sewer Connection Permit will not be issued unless the applicant has first obtained approval from the City Engineer or the County Engineer who has jurisdiction in the area in which the property is located. A Trunk Sewer Connection Permit will not be issued for any sewer which will convey industrial wastewaters unless the discharger has first obtained a Districts' Permit for Industrial Wastewater Discharge.

Direct attachment of a sewer six inches or smaller in diameter to a trunk sewer will be permitted only if the Chief Engineer determines that a suitable local sewer is not available, that adequate trunk sewer capacity exists, that the connection will function properly and that the connection will not adversely affect existing or anticipated facilities or operations of the Districts.

Inspection of Construction - Section 303

All sewers to be attached directly to a trunk sewer shall be inspected by personnel of the Districts during construction. At least 48 hours prior to cutting into a Districts' sewer, the Districts shall be notified. In making a connection to a trunk sewer, no physical alteration of the Districts' facilities shall commence until an inspector is present.

Sewerage facilities which will not be directly connected to a Districts' sewer will not be inspected routinely by the Districts during construction. Upon completion of construction and prior to removal of the downstream bulkhead and upon receiving 48 hours notice, the Districts will inspect the work to determine if it has been constructed in a satisfactory manner and to determine if all facilities are cleaned of construction debris that could be flushed into the Districts' sewers.

No wastewater shall be discharged into any sewerage facility tributary to a Districts' facility prior to obtaining inspection and approval of sewerage construction by the Districts.

Following satisfactory completion of construction, the Districts will issue a construction inspection certificate upon request.

Improper Use of Connected Sewers - Section 308

The Districts hereby reserve the right to inspect any existing lateral or connecting sewers that discharge wastewater directly or indirectly to trunk sewers. If it is found that such lateral or collecting sewers are improperly used or improperly maintained, thereby causing discharge of septic wastewater, excessive groundwater, debris or any other objectionable substance to the Districts' sewers, the Chief Engineer will give notice of the unsatisfactory condition to the offending discharger and to the City Engineer or the County Engineer having jurisdiction and shall direct the condition be corrected.

In cases of continued noncompliance with the Districts' directive, the Districts may disconnect the offending sewer from the Districts' sewerage system.

Permit for Industrial Wastewater Discharge - Section 401

No person shall discharge or cause to be discharged any industrial wastewaters directly or indirectly to sewerage facilities owned by the Districts without first obtaining a Districts' Permit for Industrial Wastewater Discharge.

The permit for Industrial Wastewater Discharge may require pretreatment of industrial wastewaters before discharge, restriction of peak flow discharges, discharge of certain wastewaters only to specified sewers of the Districts, relocation of point of discharge, prohibition of discharge of certain wastewater components, restriction of discharge to certain hours of the day, payment of additional charges to defray increased costs of the Districts created by the wastewater discharge and such other conditions as may be required to effectuate the purpose of this Ordinance.

No Districts' Permit for Industrial Wastewater Discharge is transferable without the prior written consent of the Chief Engineer.

No person shall discharge industrial wastewaters in excess of the quantity or quality limitations set by the Permit for Industrial Wastewater Discharge. Any person desiring to discharge wastewaters or use facilities which are not in conformance with the Industrial Wastewater Permit should apply to the Districts for an amended Permit.

Suspension of Permit for Industrial Wastewater Discharge - Section 404

The Chief Engineer may suspend a Permit for Industrial Wastewater Discharge for a period of not to exceed 45 days when such suspension is necessary in order to stop a discharge which presents an imminent hazard to the public health, safety or welfare, to the local environment or to the Districts' sewerage system.

Any discharger notified of a suspension of his Industrial Wastewater Permit shall immediately cease and desist the discharge of all industrial wastewater to the sewerage system. In the event of a failure of the discharger to comply voluntarily with the suspension order, the Chief Engineer shall take such steps as are reasonably necessary to insure compliance.

Any suspended discharger may file with the Chief Engineer a request for Board hearing in which event the Board of Directors of District No. 2 shall meet within 14 days of the receipt by the Chief Engineer of such request. The Board shall hold a hearing on the suspension and shall either confirm or revoke the action of the Chief Engineer. Reasonable notice of the hearing shall be given to the suspended discharger in the manner provided for in Section 204. At this hearing the suspended discharger may appear personally or through counsel, cross-examine witnesses, and present evidence in his own behalf.

In the event that the Board fails to meet within the time set forth above or fails to make a determination within a reasonable time after the close of the hearing, the order of suspension shall be stayed until a determination is made either confirming or revoking the action of the Chief Engineer.

The Chief Engineer shall reinstate the Industrial Wastewater Permit upon proof of satisfactory compliance with all discharge requirements of the Districts.

Revocation of Industrial Wastewater Discharge - Section 405

The Board of Directors of District No. 2 may revoke a Permit for Industrial Wastewater Discharge upon a finding that the discharger has violated any provision of this Ordinance. No revocation shall be ordered until a hearing on the question has been held by the Board of Directors of District No. 2. At this hearing, the discharger may appear personally or through counsel, cross-examine witnesses and present evidence in his own behalf. Notice of the hearing shall be given to the discharger in accordance with Section 204 at least fifteen days prior to the date of hearing.

Any discharger whose Industrial Wastewater Permit has been revoked shall immediately stop all discharge of any liquid carried wastes covered by the Permit to any public sewer that is tributary to a sewer or sewerage system of the Districts. The Chief Engineer may disconnect or permanently block from such public sewer the industrial connection sewer of any discharger whose Permit has been revoked if such action is necessary to insure compliance with the order of revocation.

Before any further discharge of industrial wastewater may be made by the discharger, he must apply for a new Districts' Permit for Industrial Wastewater Discharge, pay all charges that would be required upon initial application together with all delinquent fees, charges and penalties and such other sums as the discharger may owe to the Districts. Costs incurred by the Districts in revoking the Permit and disconnecting the industrial connection sewer shall be paid for by the discharger before issuance of a new Permit for Industrial Wastewater Discharge.

Prohibited Waste Discharges - Section 406

In most cases, the concentration or amount of any particular constituent which will be judged to be excessive or unreasonable cannot be foreseen but will depend on the results of technical determinations and the actions of regulatory agencies. The list of constituents which may be regulated provides specific limits only where they are now reasonably well established.

The other constituents in the list are presented with the objective of enumerating the types of wastes which will be regulated from time to time.

Except as provided in Section 407, no person shall discharge or cause to be discharged to a public sewer, which directly or indirectly connects to the Districts' sewerage systems, the following wastes:

(A) Any gasoline, benzene, naphtha, solvent, fuel oil or any liquid, solid or gas that would cause or tend to cause flammable or explosive conditions to result in the sewerage system.

(B) Any waste containing toxic or poisonous solids, liquids or gases in such quantities that, alone or in combination with other waste substances, may create a hazard for humans, animals or the local environment, interfere detrimentally with wastewater treatment processes, cause a public nuisance, or cause any hazardous condition to occur in the sewerage system.

(C) Any waste having a pH lower than 6.0 or having any corrosive or detrimental characteristics that may cause injury to wastewater treatment or maintenance personnel or may cause damage to structures, equipment or other physical facilities of the sewerage system.

(D) Any solids or viscous substances of such size or in such quantity that they may cause obstruction to flow in the sewer or be detrimental to proper wastewater treatment plant operations. These objectionable substances include, but are not limited to, asphalt, dead animals, offal, ashes, sand, mud, straw, industrial process shavings, metal, glass, rags, feathers, tar, plastics, wood, whole blood, paunch manure, bones, hair and fleshings, entrails, paper dishes, paper cups, milk containers, or other similar paper products, either whole or ground.

(E) Any rainwater, storm water, groundwater, street drainage, subsurface drainage, roof drainage, yard drainage, water from yard fountains, ponds or lawn sprays or any other uncontaminated water.

(F) Any water added for the purpose of diluting wastes which would otherwise exceed applicable maximum concentration limitations.

(G) Any nonbiodegradable cutting oils, commonly called soluble oil, which form persistent water emulsions.

(H) Any excessive concentrations of nonbiodegradable oil, petroleum oil or refined petroleum products.

(I) Any dispersed biodegradable oils and fats, such as lard, tallow or vegetable oil in excessive concentrations that would tend to cause adverse effects on the sewerage system.

(J) Any waste with an excessively high concentration of cyanide.

(K) Any unreasonably large amounts of undissolved or dissolved solids.

(L) Any wastes with excessively high BOD, COD or decomposable organic content.

(M) Any strongly odorous waste or waste tending to create odors.

(N) Any wastes containing over 0.1 milligram/liter of dissolved sulfides.

(O) Any wastes with a pH high enough to cause alkaline incrustations on sewer walls.

(P) Any substance promoting or causing the promotion of toxic gases.

(Q) Any waste having a temperature of 120°F or higher.

(R) Any wastes requiring an excessive quantity of chlorine or other chemical compound used for disinfection purposes.

(S) Any excessive amounts of chlorinated hydrocarbon or organic phosphorous type compounds.

(T) Any excessive amounts of deionized water, steam condensate, or distilled water.

(U) Any waste containing substances that may precipitate, solidify or become viscous at temperatures between 50°F and 100°F.

(V) Any waste producing excessive discoloration of wastewater or treatment plant effluent.

(W) Any garbage or waste that is not ground sufficiently to pass through a 3/8-inch screen.

(X) Any wastes containing excessive quantities or iron, boron, chromium, phenols, plastic resins, copper, nickel, zinc, lead, mercury, cadmium, selenium, arsenic or any other objectionable materials toxic to humans, animals, the local environment or to biological or other wastewater treatment processes.

(Y) Any blow-down or bleed water from cooling towers or other evaporative coolers exceeding one-third of the makeup water.

(Z) Any single pass cooling water.

(AA) Any excessive quantities of radioactive material wastes.

(BB) Recognizable portions of the human anatomy.

No person shall discharge or cause to be discharged to any public sewer which directly or indirectly connects to the Districts' sewerage system any wastes, if in the opinion of the Chief Engineer such wastes may have an adverse or harmful effect on sewers, maintenance personnel, wastewater treatment plant personnel or equipment, treatment plant effluent quality, public or private property, or may otherwise endanger the public, the local environment or create a public nuisance. The Chief Engineer, in determining the acceptability of specific wastes, shall consider the nature of the waste and the adequacy and nature of the collection, treatment and disposal system available to accept the waste.

The Chief Engineer shall from time to time prepare a list of the maximum permissible quantities or concentrations of certain constituents in industrial wastewater flows and otherwise issue detailed directions for meeting the requirements of this Section.

Availability of Districts' Facilities - Section 408

If sewerage capacity is not available, the Districts may require the industrial wastewater discharger to restrict his discharge until sufficient capacity can be made available. When requested, the Districts will advise persons desiring to locate new facilities as to the areas where industrial wastewater of their proposed quantity and quality can be received by available sewerage facilities. The Districts may refuse service to persons locating facilities in areas where their proposed quantity or quality of industrial wastewater is unacceptable in the available treatment facility.

Industrial Wastewater Treatment Surcharge - Section 409

An industrial wastewater treatment surcharge shall be paid to the Districts annually, following the fiscal year in which charges accrue, by those industrial wastewater dischargers whose contribution of flow, chemical oxygen demand, suspended solids, or peak flow create costs in excess of the value of their ad valorem taxes. The treatment surcharge shall be based on the appropriate Districts' sewerage system's total maintenance, operation and capital expenditures for providing industrial wastewater collection, treatment and disposal services as described in Section 410.

The annual industrial wastewater treatment surcharge shall be computed by the following formula:

$$\text{Surcharge} = a(V) + b(COD) + c(SS) + dM(P) - TAX$$

Where:

Surcharge = Net annual industrial wastewater treatment surcharge in dollars. No refund will be made if a negative number results.

V = Total annual volume of flow, in millions of gallons.

COD = Total annual discharge of chemical oxygen demand, in thousands of pounds.

SS = Total annual discharge of suspended solids, in thousands of pounds.

P = Peak discharge rate over a 30-minute period, occurring between the hours of 8:00 a.m. and 10:00 p.m. and determined by averaging a maximum of 10 substantiated peak flow rate measurements of the accrual year in gallons per minute. Values of "P" less than 10 gallons per minute shall be considered equal to zero.

A = Average discharge rate, determined by dividing "V" by the total annual hours of operation or working time for the industrial discharger, converted to gallons per minute. (See M)

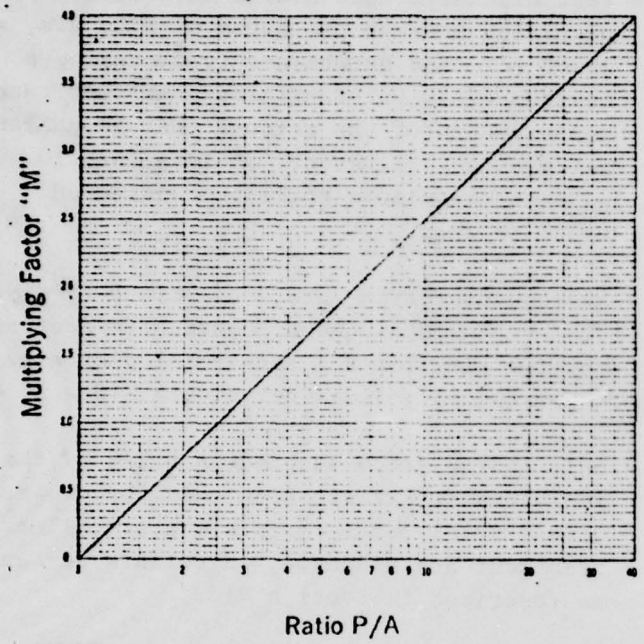
a,b,c & d = Unit charge rates adopted annually by the individual District based upon the projected annual total costs for wastewater collection, treatment and disposal, in dollars per unit, as described in Section 410.

M = A multiplying factor accounting for increased Districts' costs due to high ratios of industrial discharger peak to average flow rates (P/A). Factor "M" is obtained from Figure 1.

TAX = The annual ad valorem taxes paid to the Districts during the accrual year on the land or property utilized for the generation of industrial wastewater, in dollars. For the purpose of establishing this amount, only the land and property owned or hired by the discharger and which is contiguous to the source of the industrial discharge shall be considered. If requested to do so by the Chief Engineer, the industrial wastewater discharger shall submit a verified copy of the annual tax bill to substantiate the amount of the tax.

FIGURE 1

VALUES OF MULTIPLYING FACTOR "M"



NOTE:
Mathematical formula for "M" is: $M = 2.50 \log (P/A)$

The quantities for yearly total flows, COD, suspended solids and peak flow rates used in the above formula may be established by engineering estimation; short term sampling, analysis and flow measurement extrapolated to a yearly total; or by extensive sampling, analysis and flow measurement, all as approved by the Chief Engineer. The Chief Engineer shall set the minimum requirements for sampling, analysis and flow measurement by the discharger necessary to establish quantities to be used in the above formula.

If the industrial discharger elects or is required by the Districts to discharge the peak rates of industrial flow during the nighttime hours between 10:00 p.m. and 8:00 a.m., the flow discharge shall be made approximately uniform during these 10 nighttime hours. Certain industrial dischargers may be prohibited from discharging peak flows during the nighttime hours if these flows would adversely affect Districts' operations.

Establishment of Unit Charge Rates for Industrial Wastewater Treatment Surcharge - Section 410

Unit charge rates "a", "b", "c" and "d" in the industrial wastewater treatment surcharge shall be established annually for each sewerage system by the procedure described herein and shall be adopted by the individual Districts which utilize each system.

For each sewerage system, appropriate unit charge rate parameters for flow, chemical oxygen demand and suspended solids--respectively designated "a" (in dollars per million gallons), "b" (in dollars per 1000 pounds of COD) and "c" (in dollars per 1000 pounds of suspended solids)--shall be determined by the following methods.

(A) The total capital outlay for construction of sewerage facilities including debt principal and interest over the next five fiscal years less anticipated grant funds shall be estimated and distributed among the three parameters in accordance with the Chief Engineer's determination of the percentage of the total existing capital facilities of the sewerage system predominantly related to each parameter.

(B) The total operation and maintenance costs of the system shall be estimated for the next five fiscal years and distributed among the three parameters in accordance with the Chief Engineer's determination as to which charges are predominantly related to each parameter.

(C) The sum of the capital costs and operation and maintenance costs determined for each parameter in (A) and (B) above shall be divided by the projected five year total volume of wastewater and weight of COD and suspended solids to be treated by the sewerage system in order to obtain the unit charge rates "a," "b" and "c" for the system.

For each sewerage system in the Districts, the unit charge rate related to peak flow rate and designated "d" (in dollars per gallon per minute of peak flow) shall be determined by the following method:

(A) The total non-depreciated value of the historic capital investment in the system shall be divided by the total peak hydraulic capacity of all treatment facilities in the system to determine a unit cost per million gallons per day of peak flow capacity.

(B) The unit cost determined in (A) above shall be amortized over thirty (30) years at six (6) percent interest and converted to a gallon per minute basis to obtain the unit charge rate "d."

Annual Treatability Charge and Charges for Unusual Industrial Wastewaters - Section 411

An annual treatability charge ranging from a minimum of $25 to a maximum of $500 per year or a charge per unit of offending constituent as established by the Chief Engineer shall be paid by those industrial dischargers having wastes of such a character as to impose unusual operation and maintenance or capital costs upon the Districts which are unrelated to total flow volume, chemical oxygen demand, suspended solids, or peak flow rates. Such charges shall be reasonably calculated to defray costs attributable to such wastes.

Pretreatment of Industrial Wastewaters - Section 412

An industrial wastewater pretreatment system or device may be required by the Chief Engineer to treat industrial flows prior to discharge to the sewer when it is necessary to restrict or prevent the discharge to the sewer of certain waste constituents, to distribute more equally over a longer time period any peak discharges of industrial wastewaters or to accomplish any pretreatment result required by the Chief Engineer. All pretreatment systems or devices shall be approved by the Chief Engineer but such approval shall not absolve the industrial discharger of the responsibility of meeting any industrial effluent limitation required by the Districts. In special cases, the Chief Engineer may require construction of sewer lines by the discharger to convey certain industrial wastes to a specific Districts' trunk sewer. All pretreatment systems judged by the Chief Engineer to require engineering design shall have plans prepared and signed by an engineer of suitable discipline licensed in the State of California.

Normally a gravity separation interceptor, equalizing tank, neutralization chamber and control manhole will be required respectively to remove prohibited settleable and floatable solids, to equalize wastewater streams varying greatly in quantity and/or quality, to neutralize low or high pH flows and to facilitate inspection, flow measurement and sampling. Floor drains from commercial or manufacturing buildings, warehouses or multi-use structures shall not discharge directly to the sewer, but shall first discharge to a gravity separation interceptor.

Industrial Wastewater Sampling, Analysis and
Flow Measurements - Section 414

Periodic measurements of flow rates, flow volumes, COD and suspended solids for use in determining the annual industrial wastewater treatment surcharge and such measurements of other constituents believed necessary by the Chief Engineer shall be made by all industrial wastewater dischargers, unless specifically relieved of such obligation by the Chief Engineer. All sampling, analyses and flow measurements of industrial wastewaters shall be performed by a State certified independent laboratory, by a laboratory of an industrial discharger approved by the Chief Engineer or by personnel of the Districts. If performed by Districts' personnel, an appropriate charge shall be paid by the discharger requesting the tests. Prior to submittal to the Districts of data developed in the laboratory of an industrial discharger, the results shall be verified by a responsible administrative official of the industrial discharger under the penalty of perjury.

All dischargers making periodic measurements shall furnish and install at the control manhole or other appropriate location a calibrated flume, weir, flow meter or similar device approved by the Chief Engineer and suitable to measure the industrial wastewater flow rate and total volume. A flow indicating, recording and totalizing register may be required by the Chief Engineer. In lieu of wastewater flow measurement, the Chief Engineer may accept records of water usage and adjust the flow volumes by suitable factors to determine peak and average flow rates for the specific industrial wastewater discharge.

The sampling, analysis and flow measurement procedures, equipment and results shall be subject at any time to inspection by the Districts. Sampling and flow measurement facilities shall be such as to provide safe access to authorized personnel.

Those industrial wastewater dischargers required by the Chief Engineer to make periodic measurements of industrial wastewater flows and constituents shall annually make the minimum number of such measurements required. The minimum requirement for such periodic measurements shall be at least one 24-hour measurement per year. Representative samples of the industrial wastewater shall be obtained at least once per hour over the 24-hour period, properly refrigerated, composited according to measured flow rates during the 24 hours and analyzed for the specified wastewater constituents. Dischargers required to sample on only a few days per year shall sample during the periods of highest wastewater flow and wastewater constituent discharges. Industrial plants with large fluctuations in quantity or quality of wastewater may be required to provide continuous sampling and analyses for every working day. When required by the Chief Engineer, dischargers shall install and maintain in proper order automatic flow-proportional sampling equipment and/or automatic analysis and recording equipment.

Measurements to verify the quantities of waste flows and waste constituents reported by industrial dischargers will be conducted on a random basis by personnel of the Districts.

Distribution of Revenue - Section 212

All fees and charges payable under the provisions of this Ordinance shall be paid to the Sanitation Districts of Los Angeles County and any revenue derived pursuant to this Ordinance shall be allocated as follows:

(A) Any revenue derived from any source within an individual District other than a Joint Outfall District shall be credited to the operating fund of that District.

(B) Any revenue derived from any source within the Joint Outfall Districts shall be distributed as follows:

(1) Any revenue derived from a source other than the the Industrial Wastewater Treatment Surcharge shall be distributed fifty percent on the basis of the Joint Outfall Capital Distribution Schedule and fifty percent on the basis of the Joint Outfall Operation and Maintenance Schedule.

(2) Revenues derived from the Industrial Wastewater Treatment Surcharge shall be distributed as follows:

(a) The tax credit in the surcharge formula (Section 409), will be distributed between the first term (related to "a") and the remaining three terms (related to "b," "c" and "d") of the formula in the same percentage that each portion comprises of the total of the four terms.

(b) The portion of the revenue related to unit charge rate "a" (as determined in (B)(2)(a) above) shall be allocated to the individual District within which the discharge originates.

(c) The remainder of the revenue shall be distributed in accordance with paragraph (B)(1).

Revenues derived under the provisions of this Ordinance shall be used only for the acquisition, construction, reconstruction, maintenance and operation of sanitation or sewerage facilities, to repay principal and interest on bonds issued for the construction or reconstruction of such sanitation or sewerage facilities and to repay Federal or State loans or advances made to the Districts for construction or reconstruction of sewerage facilities; provided, however, that such revenue shall not be used for the acquisition or construction of new local street sewers or laterals as distinguished from main trunk, interceptor, and outfall sewers.

Identity: Metropolitan Denver Sewage Disposal
District No. 1
Commerce City, Colorado

Area Serviced: The Metropolitan Denver Sewage Disposal District No. 1 (Metro Denver) provides wastewater services to six cities, 15 districts, and one special industrial connection located in all or part of four counties. The service area includes approximately 100 square miles and a population of one million.

Treatment Characteristics: A single secondary treatment plant handles all the needs of Metro Denver, processing approximately 130 million gallons of waste per day. Effluent is discharged to the South Platte River.

LEGAL ENTITY

Metro Denver was formed in 1961 when the Metropolitan Sewage Disposal Districts Act was passed by the Colorado Legislature allowing municipalities to join together to form a political subdivision of the State to exercise public and essential governmental functions for public health, safety, and general welfare. The Act authorized a district to perform only the functions of sewage disposal. Originally, Metro Denver had 13 members. However, the metropolitan Denver area grew rapidly following passage of the Act, and the burdens of sewage disposal required the communities to join the district. The district now includes 21 communities in four counties.

Metro Denver is governed by a 54 member Board of Directors subject to change every two years. Each participating city or district is allowed one board representative per 25,000 population. However, the City of Denver is entitled to additional representation because its population is 50% or greater of the total population included in Metro Denver. For this reason, an agreement was made to allow the City of Denver 50% representation on the Board of Directors; 27 members of the current 54 thus represent the City of Denver, with the remaining 27 representing the surrounding cities and districts. Due to population shifts and the possibility of adding additional member areas, the City of Denver's population may not equal or exceed 50% of the total Metro Denver population. Denver's representation on the Board would then be apportioned like all other areas, one member per 25,000 population.

New members join Metro Denver on the same basis as the original members. No special cost allocations are made to new members and the same formula for determining service charges is applied to all participants. If, however, present interceptors have to be extended for the benefit of a new participant, that member must bear the cost of the interceptor. Each new member must also pay for its own meeting station, which monitors the flow of the sewage entering the system, at the connecting point. Results of the monitoring serve as the basis for determining each community's service charge.

As a public body politic and political subdivision of the State of Colorado, Metro Denver has the following powers:

- to fix and from time to time increase or decrease rates and other charges to the participating cities and districts;

- to levy taxes during the first five years of its existence on all taxable property within the District;

. to borrow money in anticipation of taxes or other revenues;

. to issue bonds and secure their payment by a pledge of taxes and other revenues of the District;

. to contract with any municipality or person; and

. to exercise eminent domain.

Metro Denver had taxing power only during the first five years of its existence.

Metro Denver controls the quality of sewage discharged to its system by stating its requirements and limitations in the service agreements it forms with all participants. The following are requirements and prohibitions abstracted from the service agreement with the City of Denver.

ARTICLE IV

DELETERIOUS WASTES

Section 401. Additional Definitions. As used in this Agreement, the following terms shall mean:

A. Biochemical Oxygen Demand ("BOD"). The laboratory determination of the quantity of oxygen utilized in the biochemical oxidation of organic matter in a given time and at a specified temperature, being expressed in parts per million (ppm) or (mg/liter) of oxygen used in a period of five (5) days at 20°C.

B. Suspended Solids ("SS"). The laboratory determination of dry weight expressed in parts per million (ppm) or (mg/liter) of solids that either float on the surface or are in suspension in sewage and can be removed from sewage by filtration.

C. pH. The logarithm of the reciprocal of the hydrogen ion concentration, indicating the intensity scale of acidity and alkalinity expressed in terms of a pH scale running from 0.0 to 14.0 with a pH value of 7.0, the midpoint of the scale, representing exact neutrality and with values above 7.0 indicating alkalinity and those below 7.0, acidity.

D. Tests for Quality. The measurements, tests, and analyses of the characteristics of waters and wastes in accordance with the methods contained in the latest edition (at the time of any such measurement, test, or analysis) of "Standard Methods for Examination of Water and Sewage," a joint publication of the American Waterworks Association and the Water Pollution Control Federation, or in accordance with any other method prescribed by the District by rules and regulations promulgated pursuant to this article.

Section 402. Compliance with Requirements. Each Municipality will cause all sewage at any time discharged directly or indirectly into the System by it or on its behalf to comply with any requirements of the District as permitted by law. In all cases where the application or the enforcement of said requirements and any amendments thereof involve technical or scientific analyses or determinations, the District shall have final authority as to methods, standards, criteria, significance, evaluation, and interpretation of such analyses and determinations. Each Municipality will permit no new connections and will discontinue existing public connections and will require the discontinuance of existing private connections to its Sewer System which allow entrance therein of such sewage as will cause the discharge at any time into the System from such Sewer System of sewage that does not comply with said requirements of the District. The District may from time to time make a determination of the respects in which sewage discharged into the System by any Municipality is not in compliance with said requirements and with the amendments thereof, if any, then in effect. A copy of said determination shall be mailed to the Municipality at its usual place of business and for all purposes of this Agreement shall be conclusively deemed to have been made in accordance with this article and to be correct at the expiration of thirty (30) days after such mailing unless within said period of thirty (30) days the Municipality shall have filed with the District an objection thereto stating that such determination is incorrect and stating the changes therein which should be made in order to correct such determination.

Section 403. Place of Compliance. Sewage discharged into the System by or on behalf of each Municipality shall at the point of connection of its Sewer System with the Sewage Disposal System comply with the requirements hereinabove designated.

Section 404. Modification of Deleterious Wastes Requirements. The District may from time to time make any amendments of said requirements concerning deleterious wastes which may be reasonably necessary to prohibit or to regulate properly the delivery or the discharge into the System of any substances which alone or in combination with other substances delivered and discharged into the System from the same source are or may be or may reasonably be expected to be

substantially injurious or deleterious to the System or to its efficient operation. Every such amendment shall take effect as to a Municipality sixty (60) days after a copy of such amendment shall have been mailed to such Municipality at its usual place of business; and for all purposes of this Agreement such amendment shall be conclusively deemed to have been made in accordance with this article and to be authorized fully thereby at the expiration of said period of sixty (60) days unless within said period of sixty (60) days the Municipality shall have filed with the District an objection thereto stating that such amendment would contravene this Agreement in a manner prejudicial to the Municipality and stating the manner in which such amendment would so contravene this Agreement. Any controversy or claim involving a Municipality which shall have so filed an objection to any such amendment and arising out of or relating to the making of such amendment or the breach of any requirement provided by such amendment shall be referred to the State Board of Health whose decision in the matter shall be binding on all parties.

Section 405. Determination of Quantity, Quality, and Characteristics of Sewage. The District will use meters for determining the quantity and will make tests and will use other means for determining the quality and other characteristics of all sewage which shall be delivered and discharged into the System by each of the Connecting Municipalities and in accordance with sound engineering practice shall determine such quantity, quality, and any other characteristics. A copy of each such determination made by the District with respect to each Fiscal Year shall be mailed to each Connecting Municipality at its usual place of business and for all purposes of this Agreement shall be conclusively deemed to have been made in accordance with this section and to be correct at the expiration of sixty (60) days after such mailing unless within said period of sixty (60) days a Municipality shall have filed with the District an objection thereto stating that such determination is incorrect and stating the changes therein which should be made in order to correct such determination. From and after the placing of the System in operation, the District will make and will keep permanent records of the quantity, quality, and other characteristics of sewage delivered and discharged into the System by each of the Connecting Municipalities. For the purpose of determining the quantity, quality, and other characteristics of any sewage which shall be or may be delivered and discharged into the System by a Municipality, the District shall have the right at all reasonable times to enter upon and to inspect the Sewer System of the Municipality or any industrial or commercial installations connected thereto or any other connections which contribute sewage or wastes to the local Sewer System and to take normal samples under ordinary operating conditions and to make tests, measurements, and analyses of sewage or other wastes in, entering, or to be discharged into such Sewer System. The District will make and will keep a record of tests, measurements, and analyses of such sewage or other wastes entering such Sewer Systems, and there shall be forwarded to each Municipality the results of such tests, measurements, and analyses appertaining thereto.

Section 406. Storm Waters. Subject to the provisions of section 301 hereof, no Municipality shall make or permit any new connection to or extension of its Sewer System which is so designed as to permit entrance directly or indirectly into the Sewage Disposal System of storm water drainage from ground surface, roof leaders, catch basins, or any other source; and each Municipality, before making any new connection to or extension of its Sewer System, will submit the plans therefor to the District and in making the same will permit the District to inspect the work and with respect thereto will comply with all requests of the District reasonably designed to assure exclusion from the System of any such storm water drainage.

Section 407. Requirements Regarding Deleterious Wastes. Sewage delivered into the facilities of the District shall not:

A. Be of such a nature and delivered at such a rate as to impair the hydraulic capacity of such facilities, normal and reasonable wear and usage excepted;

B. Be of such a quantity, quality, or other nature as to impair the strength or the durability of the sewer structures, equipment, or treatment works, either by chemical or by mechanical action;

C. Be of such a quantity, quality, or other nature as to create flammable or explosive conditions in such facilities.

D. Have a flash point lower than 187°F, as determined by the Tagliabue (Tag.) close cup method;

E. Have a pH value lower than 6.0 or greater than 10.0 or otherwise contain chemical properties which are hazardous or capable of causing damage to any part of the system or to personnel;

F. Include any radioactive substance, except as otherwise hereinafter set forth, unless the District shall have given written consent to its inclusion;

G. Include any garbage other than that received directly into the Sewer System of the Municipality from domestic and commercial garbage grinders in dwellings, restaurants, hotels, stores, and institutions, by which such garbage has been shredded to such a degree that all particles will be carried freely under flow conditions normally prevailing in public sewers with no particle greater than one-half (1/2) inch in any dimension; and

H. Include night soil or septic tank pumpage (except by special permission in writing from the District at such points and under such conditions as the District may stipulate in each permit).

Section 408. Prohibited Sewage and Wastes. None of the following-described sewage, water, substances, materials, or wastes shall be discharged into the District's System; and also each governing body of each Municipality shall prohibit and shall prevent any of such discharges from any outlet into its Sewer System, if such prohibited discharges occur at the point of its connection with the District's System:

A. Any solid or viscous material which could cause an obstruction to flow in the sewers or in any way could interfere with the treatment process, including as examples of such materials but without limiting the generality of the foregoing, significant proportions of ashes, wax, paraffin, cinders, sand, mud, straw, shavings, metal, glass, rags, lint, feathers, tars, plastics, wood and sawdust, paunch manure, hair and fleshings, entrails, lime slurries, beer and distillery slops, grain processing wastes, grinding compounds, acetylene generation sludge, chemical residues, acid residues, food processing bulk solids, snow, ice, and all other solid objects, material, refuse, and debris not normally contained in sanitary sewage.

B. Sludge or other material from sewage or industrial waste treatment plants or from water treatment plants, except sludge from the North Denver treatment plant, the discharge of which to the System shall be governed by the provisions of this Agreement herein set forth.

C. Water which has been used for cooling or heat transfer purposes without recirculation, discharged from any system of condensation, air conditioning, refrigeration, or similar use.

D. Water accumulated in excavations or accumulated as the result of grading, water taken from the ground by well points, or any other drainage associated with construction.

E. Any liquid or vapor having a temperature higher than 150°F. or exceeding any lower limit fixed by the District to prevent odor nuisance where the volume of discharge represents a significant portion of the flow through a particular sewer.

F. Any water or wastes containing grease or oil or other substances that will solidify or become discernibly viscous at temperatures between 32°F. and 150°F.

G. Any water or wastes containing emulsified oil or grease exceeding 75 parts per million of ether-soluble matter.

H. Any gasoline, benzine, naphtha, fuel oil, lubricating oil, or other flammable or explosive liquid, solid, or gas.

I. Any wastes with phenolic compounds over 10 ppm, expressed as phenol.

J. Any wastes with sulfides over 10 ppm. expressed as hydrogen sulfide.

K. Any cyanides or compounds capable of liberating hydrocyanic acid gas over 2 ppm, expressed as hydrogen cyanide from any individual outlet, the discharge of any cyanides in lesser amounts so to be permitted only upon evidence of satisfactory and continuous control of the concentration and the volume of the discharge.

L. Any wastes that contain a corrosive, noxious, or malodorous material or substance which (either singly or by reaction with other wastes) is capable of causing damage to the System or to any part thereof, of creating a public nuisance or hazard, or of preventing entry into the sewers for maintenance and repair.

M. Any wastes that contain concentrated dye wastes or other wastes that are either highly colored or could become highly colored by reacting with any other wastes.

N. Any water or wastes containing a toxic or poisonous substance in sufficient quantity to injure or to interfere with any sewage treatment process, to constitute a hazard to humans or to animals, or to create any hazard in the waters which receive the treated or untreated sewage, the twenty-four (24) hour average concentration of certain toxic substances in sewage as it arrives at the point of connection to the Sewer System of a Municipality or to the District's System not to exceed the following:

(1) Iron as Fe	15 parts per million
(2) Chromium as Cr (hexavalent)	5 parts per million
(3) Copper as Cu	3 parts per million
(4) Zinc as Zn	2 parts per million

and the concentration at any time not to exceed three (3) times the average concentration limits stated above.

O. Any water or wastes containing the discharge of acid iron pickling wastes or plating solutions unless satisfactorily pretreated to a condition conforming to the provisions of articles III and IV.

P. Any radioactive toxic isotopes of over 100 days' half life, the radioactive isotopes I^{131} and P^{32} as used at hospitals not being prohibited if properly diluted at the source.

Q. Any wastes which are unusual in composition, i.e., contain an extremely large amount of suspended solids or BOD; are high in dissolved solids such as sodium chloride, calcium chloride, or sodium sulfate; contain substances conducive to creating tastes or odors in drinking water supplied; otherwise make such waters unpalatable even after conventional water purification treatment; or are in any other way extremely unusual unless the District determines that such wastes may be admitted to the System or shall be modified or treated before being so admitted.

R. Any material or substance not specifically mentioned in this section which is in itself corrosive, irritating to human beings and animals, toxic, noxious, or which by interaction with other wastes, could produce undesirable effects, including deleterious action on the System or on any part thereof, could adversely affect any treatment process, could constitute a hazard to humans or to animals, or could have an adverse effect upon the receiving stream.

OPERATIONAL FEATURES

Metro Denver's responsibility is to construct, operate and maintain sewage treatment facilities within its territorial boundaries. Long term 45-year agreements are formed with each of its participants to receive, transport, treat, and discharge effluent collected by various local collection sewer networks.

An unusual operating feature permits the City of Denver to operate its own primary treatment plant but to discharge its effluent to a conductor which connects to the Metro Denver secondary treatment plant. The effluent received, approximately 80 MGD, is further treated to secondary stages and discharged to the South Platte River. Areas within the city's boundaries which are not connected to the primary treatment plant connect to the Metro Denver system for complete primary and secondary treatment. Although this arrangement has caused some problems in the past, the City and Metro Denver have recently reached effective levels of cooperation. Recent studies have shown that the City's treatment plant could be maintained and operated more economically if Metro Denver assumed all wastewater responsibilities.

The long term 45-year agreements specify the responsibilities of each party. In addition to the normal legal provisions and the loading parameters to the system, the agreements contain one unusual restriction regarding "competing systems." In essence, the Sewage Treatment and Disposal Agreement enables Metro Denver to limit the establishment of competing sewage treatment plants within its territorial authority, as follows:

Section 304. Competing System. So long as any bonds or other securities of the District are outstanding, the District shall not grant any franchise or license to a competing system, nor shall it permit during said period (except as it may legally be required so to do) the Acquisition or Improvement by any Municipality of sewage treatment or disposal facilities which shall increase the capacity thereof; provided, however, that the District may consent to such Acquisition or Improvement and may approve the plans and specifications therefor if the Board determines each of the following:

A. Not Economically Feasible. It is not economically feasible for the District to furnish the desired treatment or disposal.

B. Security Not Substantially Impaired. The Acquisition or Improvement of such facilities or system by the Municipality or by any other Person within its boundaries shall not substantially impair the security for the payment of the obligations of the District.

C. Approval Granted by Act. It is not inequitable or unreasonable for the District to grant such consent and approval, pursuant to sections 89-15-3, 89-15-10, 89-15-12 and 89-15-37 of the Act.

FINANCE

Metro Denver was granted five-year taxing powers upon its formation in 1961. This power enabled Metro Denver to borrow money in anticipation of future bond issues and to pledge the faith and credit of the district to guarantee repayment.

No longer possessing the power to tax, Metro Denver finances all major construction projects with Revenue Bond issues and state and federal grants. A resolution by the Board of Directors authorizes Metro Denver to issue Revenue Bonds.

Revenues

Metro Denver supports its costs of operations and debt service through service charges to its participating members. These service charges are determined by measuring the flow, BOD, and suspended solids at each connecting point. Tests are conducted on an unannounced basis for seven consecutive days per year. An additional one-day return visit is made to test the reliability of the seven-day test.

Total annual charges are apportioned so that 45.51% of the charges are made for flow considerations; 30.88% of the charges for BOD content; and 23.61% for suspended solids content. The following schedule outlines the methods used for allocating annual charges and determining rates.

METHODS FOR ALLOCATION OF ANNUAL CHARGES AND DETERMINATION OF RATES

The Annual Charges and the rates for their allocation shall be determined in the following manner:

1. The District's total Annual Charges for any year shall be derived to the extent of 45.51% from charges for volume of sewage contributed to the System by its Connecting Municipalities during said year; 30.88%, from charges for the BOD content; and 23.61%, from charges for the Suspended Solids content of such sewage.

2. Applying these percentages to the estimated total Annual Charges and using the estimated annual sewage volume, BOD, and SS, the District shall compute annually the unit charge per million gallons of sewage volume, the unit charge per ton of BOD content, and the unit charge per ton of Suspended Solids content, as follows:

(a) Unit Charge for Volume (Per MG) = $\frac{\text{Total Annual Volume Charge}}{\text{Total MG to System}}$

(b) Unit Charge for BOD (Per Ton) = $\frac{\text{Total Annual BOD Charge}}{\text{Total Tons BOD to System}}$

(c) Unit Charge for SS (Per Ton) = $\frac{\text{Total Annual SS Charge}}{\text{Total Tons SS to System}}$

3. Each Connecting Municipality shall pay annually a total sum obtained by multiplying the respective unit charges thus obtained by the estimated annual volume, BOD, and SS of the sewage to be contributed by the Municipality to the System.

4. Following each fiscal year the actual unit charges for volume, BOD, and SS will be computed by the District on the basis of actual volume, BOD, and SS contributed to the System. The annual payments by the Connecting Municipalities made on the basis of estimated unit charges shall thereafter be adjusted on the basis of the actual unit charges, and such adjustments shall be reflected in subsequent Annual Charges to be made to the Connecting Municipalities.

5. In any Fiscal Year in which the District collects any Annual Charges, each Connecting Municipality shall pay not less than $2,000.00 in that Fiscal Year to the District:

   (a) As an availability-of-service charge, if the Connecting Municipality makes no use of the System, or

   (b) As a minimum charge, if the Connecting Municipality makes use of the System. Any minimum charge to any Connecting Municipality shall be credited each Fiscal Year against the Annual Charge therefor levied against the Municipality without any carry over of any remaining balance to any other Fiscal Year.

NEW DEVELOPMENTS

A new sewer ordinance which will require the participating cities and towns to identify major industrial and commercial users is currently being developed. Metro Denver will thus be able to assess users for their proportionate share of treatment costs.

APPENDIX II-1

OTHER AGENCIES, PROGRAMS, AND POLICIES

AFFECTING WASTEWATER MANAGEMENT

OMB CIRCULAR A-95

Office of Management and Budget (OMB) Circular A-95 is a coordinative mechanism which provides for review and comment by interested areawide or state agencies of applications for federal financial assistance. The procedure was originally established under Section 204 of the Demonstration Cities and Metropolitan Development Act of 1966 to provide areawide agencies a mechanism for reviewing the development programs funded under their jurisdiction.

The A-95 review procedure is significant in relation not only to the funding of projects under P.L. 92-500, but to the structure through which wastewater treatment services are provided. All applications for funding under P.L. 92-500 are reviewed (by the state or areawide clearinghouses in an advisory capacity) under either Parts I or III of Circular A-95.

Decisions relating to treatment plant capacity and area coverage place an implicit responsibility on areawide and state clearinghouses and state and federal agencies to measure proposed activities within that framework to ensure that "government" action does not directly promote environmental and economic disruption. The A-95 process minimizes the variables that might affect existing or planned facilities, while directing and structuring growth and development through governmental investment.

Part IV of the A-95 review process will, depending on the specific geographic configuration of regional entities recommended for effective wastewater management, have significant impact on planning relationships. Should it be decided to create satellite organizations to assist in metropolitan wastewater management, linkages will have to be established between regional comprehensive planning agencies and these organizations.

SUB-STATE DISTRICTS

The Commonwealth of Massachusetts is involved in delineating uniform sub-state districts and regions to constitute the basic framework for decentralization of state agencies, regionalization for service delivery, and coordination of federal, state, regional,

and local programs. The establishment of a single set of boundaries will minimize difficulties relating to overlapping jurisdictions, lack of coordination, and fragmented and piecemeal resolution of issues.

The Advisory Commission on Intergovernmental Relations (ACIR) describes the purpose and goals of the sub-state district in these terms:

> "They were designed to bring some simplicity, understandability, accountability, and coordination to a highly complex and confusing set of conflicting boundaries, competing organizations, and insulated leaders."

Sub-state districts are significant not only in terms of the areawide approaches recommended in P.L. 92-500, but also in relation to the decentralization of services to be effected by the Executive Office of Environmental Affairs and other state agencies.

COASTAL ZONE MANAGEMENT

Under P.L. 92-583, the National Oceanic and Atmospheric Administration (NOAA) is authorized to provide grants to states for coastal zone management planning. The purpose of this program is to enable states to establish the means to control land and water use in their coastal zones and to define the organizational and intergovernmental relationships necessary in a coordinated management process. Recognizing the pre-eminence of the wastewater management and water quality control authority of the Environmental Protection Agency under P.L. 92-500, the Coastal Zone Management Act and regulations promulgated by NOAA require that any standard or requirement established by the EPA be incorporated into the state's program.

The Executive Office of Environmental Affairs has been awarded a grant by the NOAA to develop a program for managing the coastal zone in Massachusetts, including criteria and techniques to measure the environmental and ecological impact of activities within the coastal zone. Critical elements of this process are the development of land and water use controls for the immediate shoreline and coastal zone.

The relationship between P.L. 92-500 and P.L. 92-583 is significant in relation to the EPA's permitting standards for ocean discharge, ocean dumping, thermal pollutants, and oil spills. These controls should prove useful to coastal states in controlling the despoliation of the seas and consequent ecological, recreational, and economic degradation.

INTERSTATE AGENCIES

Massachusetts is a member of several significant interstate agencies that were established based on the need for cooperative action in dealing with water resource issues. While the individual states maintain primary responsibility for water quality and pollution abatement for waters within their territorial boundaries, they cooperate, through these interstate agencies, on joint efforts to coordinate activities.

Massachusetts is a contributing member of three major interstate cooperatives.

Connecticut River Valley Flood Control Commission

Established in 1953, this interstate agency consists of the states bordering the Connecticut River: Connecticut, Massachusetts, New Hampshire and Vermont. Involved in flood control and river diversion activities, the agency is supported by appropriations of the several states and federal funds. In FY '75, the Commonwealth provided $37,150 to support the continuing activities of the agency.

New England Interstate Water Pollution Control Compact (NEIWPCC)

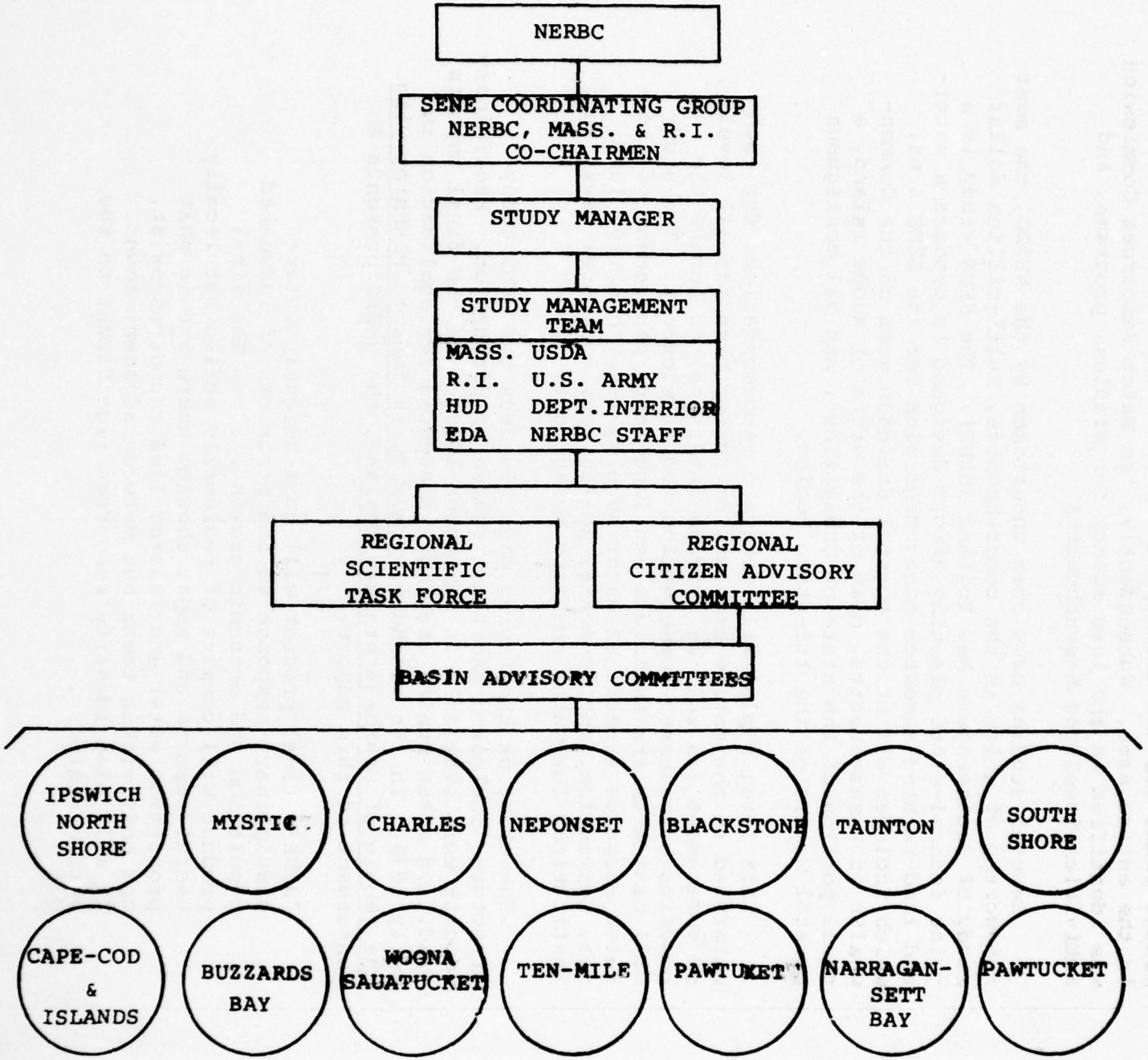
This interstate agency comprises the states of Massachusetts, Connecticut, Rhode Island, New York, Vermont, New Hampshire, and Maine. It has a broad mandate in the field of water pollution control, including the establishment of standards and the development of programs to meet these standards for the various classifications of use in the waters under its jurisdiction.

The NEIWPCC also conducts research and development programs, trains sewerage treatment plant operators, and generally coordinates interstate activities. The FY'75 budget for the Commonwealth contributed $24,025 to this effort.

New England River Basins Commission (NERBC)

Authorized under Title II of the Federal Water Resources Planning Act of 1965 (P.L. 89-80), the NERBC is involved in the most far-reaching planning activities within the New England region. The Commission's area of influence includes the six New England states plus those parts of New York state within river basins of a bordering New England state. The Commonwealth's share of the NERBC's costs for 1975 was $47,390.

ORGANIZATIONAL STRUCTURE



Originally, the NERBC was designated to serve as the principal agency for coordinating all governmental and non-governmental plans for the development of water and land-related resources in the entire area. Subsequently, the Water Resources Commission was identified as the lead agency for studies, programs, and activities involving Massachusetts.

Several studies have been undertaken by the NERBC, the most noteworthy of which is the comprehensive, multi-million dollar study of Southeastern New England (SENE). The SENE study is a joint federal-state planning effort designed to produce a water- and land-related resource management plan for the SENE area, which includes all of the coastal drainage area of the Commonwealth of Massachusetts, most of the state of Rhode Island, a small portion of the state of Connecticut, and all contiguous coastal waters of the tri-state region.

This level B plan will generate recommendations for each watershed in the entire area and an action plan for all levels of government (as well as private interests) to secure the benefits of balanced conservation and development. The study will deal with the immediate and long-range management of the water resource aspects of water supply, water quality, land use, recreation, environmental health, environmental laws, and institutions for water resource management.

The chart on the facing page displays the SENE study structure, including the final stages of production. Preliminary reports were available in September 1975, with the final reports (modified after public hearings) scheduled for publication in early 1976. In its brochure, Tomorrow is Today: Planning with the People of Southeastern New England, the NERBC presents an assessment of this report.

> "SENE's final product will be a uniquely interdisciplinary response to the pressures of increased population and economic growth . . . . The final product will consist of regionally scaled out locally useful reports and maps, showing where and in what proportion water and related land resources exist, not only within towns but between adjacent towns. It will also identify resources significant to the entire region. . . .

> The study will also show existing or proposed water dependent facilities--recreation sites, docking areas or sewage treatment plants--which conflict with critical areas . . . .
>
> Water quality might be preserved by the phased installation of waste treatment facilities to replace individual septic tanks . . . .
>
> The SENE program is developing some unique tools for more intelligent, long-range decisionmaking. Such tools can make more rational the debate surrounding a local wetland zoning proposal, a regional water supply, a state coastal management program, or a national growth policy issue. SENE's aim is that these tools be used."

The SENE study is significant in terms of its relationship to areawide and basin plans developed for eastern Massachusetts. Areawide plans prepared under both Section 208 of P.L. 92-500 and the state's 303 plan will be able to utilize the results of the SENE study as a resource. In addition, the legal institutional studies will serve as a useful tool in the overall design of an organizational and administrative structure for wastewater management.

In addition to these three major interstate agencies, the Commonwealth of Massachusetts also provides financial resources to other commissions involved in water quality planning. The FY '75 budget included funds for two other flood control commissions:

- Thames River Valley Flood Control Commission - $600
- Merrimack River Valley Flood Control Commission - $102,750

Title I of the Federal Water Pollution Control Act Ammendments of 1972 (P.L. 92-500) provides funding and establishes guidelines for interstate compacts to coordinate planning activities of the type conducted by the five commissions noted. Sections 102 and 103 of P.L. 92-500 establish the intent of the EPA to encourage interstate solutions to water pollution prevention, control, and abatement.

APPENDIX V-1

Section 204 (b)(1) of the Federal Water Pollution Control Act Amendments of 1972 requires that each recipient of waste treatment services within an applicant's jurisdiction pay its proportionate share of the costs of operation and maintenance of any waste treatment services provided by the applicant. Guidelines regarding this requirement (issued on August 21, 1973 in "Grants For Construction of Treatment Works," Appendix B) state that a user charge system must distribute the costs of operation and maintenance to each user in proportion to such user's contribution to the total wastewater loading of the treatment works.

The terms "proportionate" and "treatment works" require clarification as to whether they are intended to apply to a total system (i.e., network of sewers, interceptors, and treatment plants of a service district) or solely to the service area of each facility.

Alternative II (recommended) is "system" oriented, dividing the costs of all facilities constructed and operated by the MSD among all communities within the MSD's boundary; as such, it may be contradictory to an official interpretation of the rules and regulations regarding the determination of user charges. Accordingly, PMM&Co. suggests that the recommendations regarding the development of user charges be submitted to EPA officials for a ruling on their adherence to federal guidelines.

APPENDIX V-2

Section 204 (b)(1)(B) of the Federal Water Pollution Control Act Amendments of 1972 specifies that no grant shall be approved unless the applicant "has made provision for the payment to such applicant by the industrial users of the treatment works, of that portion of the cost of construction of such treatment works (as determined by the Administrator) which is allocable to the treatment of such industrial wastes to the extent attributable to the Federal share of the cost of construction." In subsequent guidelines issued by the EPA on August 21, 1973 ("Grants For Construction of Treatment Works," Section 35.925-12), requirements regarding the preparation of construction plans and specifications (step 2) stipulate a grant applicant's responsibility to secure signed letters of intent from each significant industrial user to pay that portion of the grant amount allocable to the treatment of its wastes. The regulations define a significant industrial user as one that will contribute greater than 10% of the design flow or design pollutant loading of the treatment works.

These rules and guidelines may be interpreted in two ways. First, the service area of each facility could determine which industries are to support the ICR program for a facility constructed with grant assistance. Several sub-service boundaries would have to be identified, associating specific industrial entities with only the facilities they use.

Secondly, all projects can be considered part of a total system and an ICR program accordingly developed for all industries within the gross service district boundary. This approach results in uniform distribution of ICR-related costs among all user industries in the service district, regardless of the treatment works to which they are directly connected and from which they derive service.

This interpretation is significantly easier to implement in a large metropolitan service area, and therefore increases the likelihood of quick and efficient implementation of an ICR program. Accordingly, PMM&Co.'s recommendations accepted the second interpretation of ICR rules and regulations. Nonetheless, the recommendations should be submitted to federal officials for official interpretation prior to their acceptance and implementation.

APPENDIX V-3

ALTERNATIVE METHODS FOR ACQUIRING EXISTING FACILITIES

The EMMA Study was designed to plan the future wastewater needs of the Metropolitan Boston area, which includes the present 43-community service area of MSD and surrounding fringe communities. Study requirements considered the possibility of expanding the present MSD service area and could have created the need for annexation of existing wastewater treatment facilities of other communities or districts. Annexation and the resulting need to reimburse original owners would have been a factor affecting the cost allocation study and the final financing recommendations.

The final engineering recommendations provided for a modest expansion of the present MSD service area. Expansion is expected to occur in areas where treatment facilities do not presently exist and, accordingly, is not a factor in cost allocation and financing recommendations.

Had acquisition been necessary, providing for the transfer of ownership, valuation, and reimbursement would have been necessary to consider. Related problems are summarized below.

TRANSFER OF OWNERSHIP

Acquisition implies transfer of ownership. Acquired facilities are operated and maintained by the new owner and may be used to provide exclusive service to the original owner or mutual service to several users.

In some circumstances, it may be legally impossible to transfer ownership. These restrictions are typically found in bond indentures which may also restrict usage of facilities. It may be possible, however, to transfer only operating responsibilities to the acquiring entity, ownership remaining with the original owner.

In a situation dealing with ownership transfers, a legal interpretation should be requested.

VALUATION

The value of facilities determines the purchase price. Several methods are used for determining value, and each method may yield a different purchase price.

Original Cost

Original cost of facilities may be used as a basis for working out a settlement price. However, original cost does not include any consideration of factors for wear on machinery and equipment or the effects of inflation.

Original Cost, Net of Depreciation

As an accounting concept, depreciation distributes the cost of a facility over its estimated useful life. Depreciation may be viewed as a deduction from the facility's value for wear and tear. Hence, original costs, net of depreciation, is the remaining cost of an asset after charges for depreciation have been deducted from the cost of acquisition.

Because depreciation is calculated on the basis of original cost, original cost, net of depreciation may not reflect the true value of a facility. A change in economic and environmental conditions may cause a facility to increase in value. In addition, there are varying methods which can be used to calculate annual depreciation charges, each yielding a different result.

Replacement Cost

Replacement cost is determined by estimating the cost to build similar facilities using current cost data. The estimated replacement cost is then adjusted for depreciation. Subjective judgment, however, is unavoidable in determining replacement values.

The use of replacement cost as a method of estimating the value of facilities may not be appropriate where original investments were derived from federal and state granting sources. This would present a situation in which the seller could receive credit for facilities not rightfully financed by him. Such transactions could be in violation of grant provisions.

Outstanding Debt

An item which may be of most concern to the seller may be the outstanding debt (bonds) obligation incurred to finance the facilities.

A settlement price determined in consideration of outstanding debt is not as much an estimate of actual value as it is a compromise in reaching a transfer price that is agreeable to both

buyer and seller. Obviously, when facilities have in a large part been financed with grants, the outstanding debt obligation does not fairly reflect the cost or value of facilities.

REIMBURSEMENT

While any variation of payment terms can be derived, they may be summarized under two categories: 1) lump sum, and 2) stream of payments.

Lump Sum

A lump sum payment represents a single payment to the owner of facilities based upon a settlement price. Lump sum payments, however, may be sufficiently large to require the buyer to finance the purchase through a bond issue. This may be disadvantageous if the refinancing is at a higher interest cost than that of the initial financing.

Stream of Payments

A stream of payments may be developed to satisfy the settlement price. The payment stream may be developed to repay existing bond obligations as they mature. A credit arrangement, offsetting the stream of payments with annual costs of providing services, may be arranged between buyer and seller.

APPENDIX VII-1

ASSUMPTIONS RELATED TO THE COST ALLOCATION METHOD AND CAPITAL REQUIREMENT AND DEBT SERVICE COSTS

The following are assumptions related to the Cost Allocation Method and Capital Requirement and Debt Service costs.

ASSUMPTIONS RELATED TO THE COST ALLOCATION METHOD

1. Present and future wastewater treatment costs are shared by all presently connected communities, with all paying at the same rate.

2. Debt service costs incurred for constructing extensions to the present interceptor system for the purpose of connecting newly joining municipalities are repaid by only those municipalities.

3. Flow, BOD, and SS were the three wastewater characteristics to be considered in municipal cost allocations. Each municipality's share of operations and maintenance costs and debt service costs are determined as follows:

   . O&M costs were apportioned on the basis of flow and strengths from the community as a whole (Exhibit VII-13), and the percent of flow, BOD, and SS attributable to industrial users in each community was used to allocate costs to the industrial class (Exhibit VII-14).

   . All existing debt service (as of June 30, 1975) was considered flow related. All new debt service costs were allocated to wastewater characteristics according to the following percentages (as noted in Exhibit VII-9).

Flow	BOD	SS
63.529%	22.167%	14.304%

4. Industrial cost recovery amounts were calculated for all projects except combined sewer projects (i.e., projects 3, 12, 13, 15 of Exhibit VII-5). These projects are not subject to ICR according to present interpretations of EPA guidelines.

ASSUMPTIONS RELATED TO
FUTURE CAPITAL REQUIREMENT

1. Capital requirements were determined by PMM&Co. from the selected construction program, which did not include the following "on-going" projects:

Facility	Estimated Cost ($000)
Squantum Pumping Station	$ 1,350
Reading Extension Sewer	4,237
Braintree-Weymouth Extension Sewer	6,443
Upper Neponset Valley Sewer	9,154
Charles River Marginal Conduit	30,000
No. Charles Relief Sewer	7,400
Total	$58,584

These projects were added to the proposed construction program for determining future capital requirements. Additionally, all six projects were considered flow-related, and the project start and end dates were the same as those for Project 1, "Sludge management." (Exhibit VII-5.)

2. Two projects that represent alternative solutions to the construction of the two satellite plants on upper Neponset and Middle Charles Rivers (projects 10 and 11 of Exhibit VII-5) were not considered in determining cash flows.

3. Step 3 of I/I Analysis (South System) and I/I Analysis (North System), projects 2 and 3 exclusively, were not included in the proposed construction program. For cash flow purposes, no costs were assumed for Step 3, but "start" and "end" dates were arbitrarily assigned to reflect incoming federal and state reimbursement related to Step 1 of these projects.

It was also assumed that current 75% federal construction grants and 15% state grants will continue to be available through the construction period. Receipt of federal and state reimbursements was assumed as follows:

Grant	Project Step(s) (See Exhibit VII-5)	Reimbursement
Federal	1, 2 & 3	Quarterly, after completion of work - 75% of costs. Cost allocation model assume reimbursement received in quarter following work completion.
State	1	No reimbursement.
	2	Monthly, 25% of actual Step 2 costs. Cost allocation model assumes reimbursement received in month following completion of work.
	3	a) First quarter - Up to 10% of total project cost (steps 1, 2 & 3) less amount already paid. b) Quarter following completion of project - 3% of total project cost. c) Second quarter following completion - 2% of total project costs.

ASSUMPTIONS RELATED TO DEBT SERVICE COSTS

1. Current outstanding debt, which will mature in 1980 and 1990, was extracted from Public Document 92, Commonwealth of Massachusetts, 1974 Assessment for Interest, Serial Bonds and Maintenance of the Metropolitan District. Amortization schedules for debt issued from July 1, 1974 through September 22, 1975 were provided by the State Treasurer's office.

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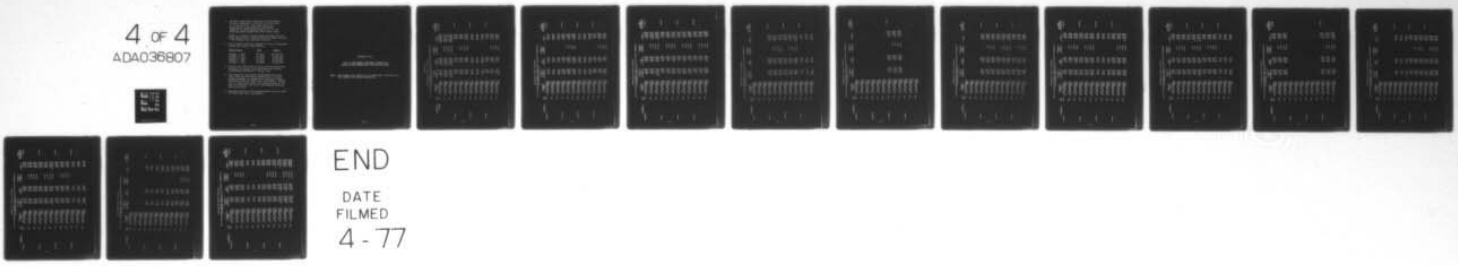

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2. The most recent bond issue sold for the benefit of MSD is dated May 1, 1975 for $1 million and at a rate of 6.2%. Since that issue, the Commonwealth of Massachusetts Bond rating (Moody's) has been reduced from AA to A1. No bonds have been issued since the rating change.

   Based on a review of construction programs with the First Boston Corp., General Obligation Bonds carrying 7.25% interest rate have been utilized.

3. The following bond sale schedule is used in developing future debt service requirements:

Date of Sale	Term	Amount
January 1, 1975	30 Years	$10,000,000
January 1, 1977	30 Years	12,000,000
January 1, 1979	30 Years	22,000,000
January 1, 1981	30 Years	25,000,000
January 1, 1982	30 Years	24,000,000

4. Future bond issues were retired in serial maturities, annually, to provide level principal and interest requirements throughout a 30-year term.

5. The cumulative net capital requirements for years 1982, 1983, and 1985 which exceed the $93 million bonding schedule is assumed to be financed through short-term lines of credit with local banks. Borrowing on a short-term basis will increase costs in the year of borrowing, but not in the selected 1980 and 1990 study years.

6. Retained portions of ICR reimbursements were not used to reduce cash flow requirements.

APPENDIX VII-2

COST OF WASTEWATER MANAGEMENT PROJECTS TO
PARTICIPATING COMMUNITIES FOR SELECTED YEARS

Note: See Chapter VII, Section E for additional information on data sources and study assumptions.

APPENDIX VII-2

METROPOLITAN DISTRICT COMMISSION

COST OF WASTEWATER MANAGEMENT PROJECTS TO PARTICIPATING COMMUNITIES
FOR SELECTED YEARS (1975 $)

COMMUNITY	YEAR	WASTEWATER SOURCE	OPERATIONS AND MAINTENANCE	DEBT SERVICE	INDUSTRIAL COST RECOVERY	TOTAL	1974 ASSESSMENTS (PER PD-92)
TOTALS:	1974	LARGE INDUSTRIAL	854,085	600,072		1,454,157	16,448,454
		ALL OTHER SOURCES	8,806,751	6,187,547		14,994,298	
		TOTAL	9,660,836	6,787,619		16,448,455	
	1980	LARGE INDUSTRIAL	1,526,283	1,123,536	254,580	2,904,399	
		ALL OTHER SOURCES	11,877,417	9,289,682		21,167,099	
		TOTAL	13,403,700	10,413,218	254,580	24,071,498	
	1990	LARGE INDUSTRIAL	3,515,168	1,319,977	2,366,727	7,201,872	
		ALL OTHER SOURCES	24,927,838	10,215,603		34,243,441	
		TOTAL	27,543,006	11,535,580	2,366,727	41,445,313	
ASHLAND	1974	LARGE INDUSTRIAL	16,346	11,485		27,831	42,188
		ALL OTHER SOURCES	12,637	8,878		21,515	
		TOTAL	28,983	20,363		49,346	
	1980	LARGE INDUSTRIAL	24,271	17,947	3,894	46,112	
		ALL OTHER SOURCES	18,391	13,813		32,204	
		TOTAL	42,662	31,760	3,894	78,316	
	1990	LARGE INDUSTRIAL	42,054	17,123	24,886	84,063	
		ALL OTHER SOURCES	80,817	32,920		113,737	
		TOTAL	122,871	50,043	24,886	197,800	
ARLINGTON	1974	LARGE INDUSTRIAL					398,226
		ALL OTHER SOURCES	193,217	135,752		328,969	
		TOTAL	193,217	135,752		328,969	
	1980	LARGE INDUSTRIAL					
		ALL OTHER SOURCES	262,134	204,807		466,941	
		TOTAL	262,134	204,807		466,941	
	1990	LARGE INDUSTRIAL					
		ALL OTHER SOURCES	529,600	224,502		754,102	
		TOTAL	529,600	224,502		754,102	
BEDFORD	1974	LARGE INDUSTRIAL	5,410	3,801		3,211	68,005
		ALL OTHER SOURCES	33,233	23,349		56,582	
		TOTAL	38,643	27,150		65,793	
	1980	LARGE INDUSTRIAL	11,923	8,127	2,136	22,186	
		ALL OTHER SOURCES	50,085	37,504		87,587	
		TOTAL	62,008	45,631	2,136	109,773	
	1990	LARGE INDUSTRIAL	31,428	11,468	22,248	65,144	
		ALL OTHER SOURCES	143,162	60,548		203,710	
		TOTAL	174,590	72,016	22,248	268,854	

METROPOLITAN DISTRICT COMMISSION

COST OF WASTEWATER MANAGEMENT PROJECTS TO PARTICIPATING COMMUNITIES
FOR SELECTED YEARS (1975 $)

COMMUNITY	YEAR	WASTEWATER SOURCE	OPERATIONS AND MAINTENANCE	DEBT SERVICE	INDUSTRIAL COST RECOVERY	TOTAL	1974 ASSESSMENTS (PER PD-92)
BELMONT	1974	LARGE INDUSTRIAL					190,745
		ALL OTHER SOURCES	86,948	61,089		148,037	
		TOTAL	86,948	61,089		148,037	
	1980	LARGE INDUSTRIAL					
		ALL OTHER SOURCES	114,693	90,261		204,954	
		TOTAL	114,693	90,261		204,954	
	1990	LARGE INDUSTRIAL					
		ALL OTHER SOURCES	229,224	98,215		327,439	
		TOTAL	229,224	98,215		327,439	
BRAINTREE	1974	LARGE INDUSTRIAL	1,169	821		1,990	213,465
		ALL OTHER SOURCES	105,100	73,843		178,943	
		TOTAL	106,269	74,664		180,933	
	1980	LARGE INDUSTRIAL	1,693	1,308	263	3,264	
		ALL OTHER SOURCES	148,199	113,757		261,956	
		TOTAL	149,892	115,065	263	265,220	
	1990	LARGE INDUSTRIAL	3,553	1,457	2,039	7,049	
		ALL OTHER SOURCES	330,331	138,069		468,400	
		TOTAL	333,884	139,526	2,039	475,449	
BROOKLINE	1974	LARGE INDUSTRIAL					352,419
		ALL OTHER SOURCES	241,521	169,690		411,211	
		TOTAL	241,521	169,690		411,211	
	1980	LARGE INDUSTRIAL					
		ALL OTHER SOURCES	317,618	250,764		568,382	
		TOTAL	317,618	250,764		568,382	
	1990	LARGE INDUSTRIAL					
		ALL OTHER SOURCES	635,953	272,675		908,628	
		TOTAL	635,953	272,675		908,628	
BURLINGTON	1974	LARGE INDUSTRIAL	5,072	3,563		8,635	125,613
		ALL OTHER SOURCES	43,232	30,375		73,607	
		TOTAL	48,304	33,938		82,242	
	1980	LARGE INDUSTRIAL	6,615	5,380	969	12,968	
		ALL OTHER SOURCES	63,197	48,012		111,209	
		TOTAL	69,816	53,392	969	124,177	
	1990	LARGE INDUSTRIAL	12,796	5,432	6,765	24,993	
		ALL OTHER SOURCES	192,704	79,219		271,923	
		TOTAL	205,500	84,651	6,765	296,916	

METROPOLITAN DISTRICT COMMISSION

COST OF WASTEWATER MANAGEMENT PROJECTS TO PARTICIPATING COMMUNITIES FOR SELECTED YEARS (1975 $)

COMMUNITY	YEAR	WASTEWATER SOURCE	OPERATIONS AND MAINTENANCE	DEBT SERVICE	INDUSTRIAL COST RECOVERY	TOTAL	1974 ASSESSMENTS (PER PD-921)
CAMBRIDGE	1974	LARGE INDUSTRIAL	29,466	20,702		50,168	990,037
		ALL OTHER SOURCES	559,845	393,343		953,188	
		TOTAL	589,311	414,045		1,003,356	
	1980	LARGE INDUSTRIAL	46,684	36,548	7,342	90,574	
		ALL OTHER SOURCES	745,422	585,919		1,331,341	
		TOTAL	792,106	622,467	7,342	1,421,915	
	1990	LARGE INDUSTRIAL	111,081	42,492	71,689	225,262	
		ALL OTHER SOURCES	1,314,171	581,288		1,895,459	
		TOTAL	1,425,252	623,780	71,689	2,120,721	
CANTON	1974	LARGE INDUSTRIAL	6,492	4,561		11,053	116,218
		ALL OTHER SOURCES	70,795	49,740		120,535	
		TOTAL	77,287	54,301		131,588	
	1980	LARGE INDUSTRIAL	9,152	7,760	1,328	18,240	
		ALL OTHER SOURCES	103,672	78,197		181,869	
		TOTAL	112,824	85,957	1,328	200,109	
	1990	LARGE INDUSTRIAL	22,981	8,859	14,365	46,205	
		ALL OTHER SOURCES	277,077	113,805		390,882	
		TOTAL	300,058	122,664	14,365	437,087	
CHELSEA	1974	LARGE INDUSTRIAL	6,840	4,806		11,646	284,923
		ALL OTHER SOURCES	109,090	76,645		185,735	
		TOTAL	115,930	81,451		197,381	
	1980	LARGE INDUSTRIAL	10,153	7,610	1,616	19,379	
		ALL OTHER SOURCES	139,157	111,240		250,397	
		TOTAL	149,310	118,850	1,616	269,776	
	1990	LARGE INDUSTRIAL	19,821	8,041	11,697	39,559	
		ALL OTHER SOURCES	227,614	98,908		326,522	
		TOTAL	247,435	106,949	11,697	366,081	
DEDHAM	1974	LARGE INDUSTRIAL	5,565	3,910		9,475	216,207
		ALL OTHER SOURCES	81,383	57,179		138,562	
		TOTAL	86,948	61,089		148,037	
	1980	LARGE INDUSTRIAL	7,147	5,741	1,050	13,938	
		ALL OTHER SOURCES	110,689	86,652		197,341	
		TOTAL	117,836	92,393	1,050	211,279	
	1990	LARGE INDUSTRIAL	13,409	5,823	6,766	25,998	
		ALL OTHER SOURCES	256,057	107,830		363,887	
		TOTAL	269,466	113,653	6,766	389,885	

METROPOLITAN DISTRICT COMMISSION

COST OF WASTEWATER MANAGEMENT PROJECTS TO PARTICIPATING COMMUNITIES
FOR SELECTED YEARS (1975 $)

COMMUNITY	YEAR	WASTEWATER SOURCE	OPERATIONS AND MAINTENANCE	DEBT SERVICE	INDUSTRIAL COST RECOVERY	TOTAL	1974 ASSESSMENTS (PER PD-921)
DOVER	1974	LARGE INDUSTRIAL					
		ALL OTHER SOURCES					
		TOTAL					
	1980	LARGE INDUSTRIAL					
		ALL OTHER SOURCES					
		TOTAL					
	1990	LARGE INDUSTRIAL					
		ALL OTHER SOURCES					
		TOTAL					
EVERETT	1974	LARGE INDUSTRIAL	47,153	33,151		80,334	342,275
		ALL OTHER SOURCES	165,385	116,177		281,532	
		TOTAL	212,538	149,328		361,866	
	1980	LARGE INDUSTRIAL	72,342	60,712	10,966	144,620	
		ALL OTHER SOURCES	211,969	169,002		380,971	
		TOTAL	284,311	229,714	10,966	524,691	
	1990	LARGE INDUSTRIAL	131,697	71,732	126,573	330,002	
		ALL OTHER SOURCES	369,550	161,396		530,946	
		TOTAL	561,247	233,128	126,573	920,948	
FRAMINGHAM	1974	LARGE INDUSTRIAL	15,766	11,077		26,843	305,189
		ALL OTHER SOURCES	218,094	151,526		367,920	
		TOTAL	231,360	162,903		394,763	
	1980	LARGE INDUSTRIAL	34,253	28,390	5,502	68,145	
		ALL OTHER SOURCES	311,459	236,968		548,858	
		TOTAL	346,142	265,358	5,502	617,003	
	1990	LARGE INDUSTRIAL	17,541	19,330	28,201	65,372	
		ALL OTHER SOURCES	778,717	313,233		1,091,950	
		TOTAL	826,558	332,563	28,201	1,187,322	
HINGHAM	1974	LARGE INDUSTRIAL					52,193
		ALL OTHER SOURCES	19,422	13,575		32,897	
		TOTAL	19,422	13,575		32,897	
	1980	LARGE INDUSTRIAL					
		ALL OTHER SOURCES	29,604	22,153		51,757	
		TOTAL	29,604	22,153		51,757	
	1990	LARGE INDUSTRIAL					
		ALL OTHER SOURCES	113,539	47,241		160,780	
		TOTAL	113,539	47,241		160,780	

METROPOLITAN DISTRICT COMMISSION

COST OF WASTEWATER MANAGEMENT PROJECTS TO PARTICIPATING COMMUNITIES
FOR SELECTED YEARS (1975 $)

COMMUNITY	YEAR	WASTEWATER SOURCE	OPERATIONS AND MAINTENANCE	DEBT SERVICE	INDUSTRIAL COST RECOVERY	TOTAL	1974 ASSESSMENTS (PER PD-92)
HOLBROOK	1974	LARGE INDUSTRIAL					
		ALL OTHER SOURCES					
		TOTAL					
	1980	LARGE INDUSTRIAL					
		ALL OTHER SOURCES					
		TOTAL					
	1990	LARGE INDUSTRIAL					
		ALL OTHER SOURCES					
		TOTAL					
HOPKINTON	1974	LARGE INDUSTRIAL					
		ALL OTHER SOURCES					
		TOTAL					
	1980	LARGE INDUSTRIAL					
		ALL OTHER SOURCES					
		TOTAL					
	1990	LARGE INDUSTRIAL					
		ALL OTHER SOURCES					
		TOTAL					
LEXINGTON	1974	LARGE INDUSTRIAL	2,300	1,405		3,405	229,088
		ALL OTHER SOURCES	84,348	59,684		144,632	
		TOTAL	86,348	61,089		148,037	
	1980	LARGE INDUSTRIAL	2,676	2,144	398	5,218	
		ALL OTHER SOURCES	123,205	93,420		216,625	
		TOTAL	125,881	95,564	398	221,843	
	1990	LARGE INDUSTRIAL	5,162	2,164	2,801	10,127	
		ALL OTHER SOURCES	288,932	118,797		407,729	
		TOTAL	294,094	120,961	2,801	417,856	
LINCOLN	1974	LARGE INDUSTRIAL					
		ALL OTHER SOURCES					
		TOTAL					
	1980	LARGE INDUSTRIAL					
		ALL OTHER SOURCES					
		TOTAL					
	1990	LARGE INDUSTRIAL					
		ALL OTHER SOURCES					
		TOTAL					

METROPOLITAN DISTRICT COMMISSION

COST OF WASTEWATER MANAGEMENT PROJECTS TO PARTICIPATING COMMUNITIES
FOR SELECTED YEARS (1975 $)

COMMUNITY	YEAR	WASTEWATER SOURCE	OPERATIONS AND MAINTENANCE	DEBT SERVICE	INDUSTRIAL COST RECOVERY	TOTAL	1974 ASSESSMENTS (PER PD-92)
LYNNFIELD	1974	LARGE INDUSTRIAL					
		ALL OTHER SOURCES					
		TOTAL					
	1980	LARGE INDUSTRIAL					
		ALL OTHER SOURCES					
		TOTAL					
	1990	LARGE INDUSTRIAL					
		ALL OTHER SOURCES					
		TOTAL					
MALDEN	1974	LARGE INDUSTRIAL	3,942	2,769		6,711	421,566
		ALL OTHER SOURCES	227,918	160,134		388,052	
		TOTAL	231,860	162,903		394,763	
	1980	LARGE INDUSTRIAL	5,580	4,120	886	10,586	
		ALL OTHER SOURCES	307,371	241,014		548,385	
		TOTAL	312,951	245,134	886	558,971	
	1990	LARGE INDUSTRIAL	9,493	4,096	5,011	18,600	
		ALL OTHER SOURCES	571,826	242,379		814,205	
		TOTAL	581,319	246,475	5,011	832,805	
MEDFORD	1974	LARGE INDUSTRIAL	3,787	2,661		6,448	544,872
		ALL OTHER SOURCES	266,716	187,392		454,108	
		TOTAL	270,503	190,053		460,556	
	1980	LARGE INDUSTRIAL	12,134	7,433	2,367	21,934	
		ALL OTHER SOURCES	357,230	280,680		637,910	
		TOTAL	369,364	288,113	2,367	659,844	
	1990	LARGE INDUSTRIAL	31,473	10,684	24,841	66,998	
		ALL OTHER SOURCES	690,927	294,568		985,495	
		TOTAL	722,400	305,252	24,841	1,052,493	
MELROSE	1974	LARGE INDUSTRIAL	3,140	2,206		5,346	259,217
		ALL OTHER SOURCES	122,451	86,033		208,484	
		TOTAL	125,591	88,239		213,830	
	1980	LARGE INDUSTRIAL	4,717	3,526	754	8,997	
		ALL OTHER SOURCES	160,794	127,063		287,857	
		TOTAL	165,511	130,589	754	296,854	
	1990	LARGE INDUSTRIAL	9,550	3,830	5,610	19,050	
		ALL OTHER SOURCES	323,881	138,765		462,646	
		TOTAL	333,431	142,655	5,610	481,696	

METROPOLITAN DISTRICT COMMISSION

COST OF WASTEWATER MANAGEMENT PROJECTS TO PARTICIPATING COMMUNITIES
FOR SELECTED YEARS (1975 $)

COMMUNITY	YEAR	WASTEWATER SOURCE	OPERATIONS AND MAINTENANCE	DEBT SERVICE	INDUSTRIAL COST RECOVERY	TOTAL	1974 ASSESSMENTS (PER PD-92)
MILTON	1974	LARGE INDUSTRIAL	1,652	1,161		2,813	254,766
		ALL OTHER SOURCES	85,296	59,928		145,224	
		TOTAL	86,948	61,089		148,037	
	1980	LARGE INDUSTRIAL	6,663	4,815	1,233	12,716	
		ALL OTHER SOURCES	117,108	91,035		208,143	
		TOTAL	123,776	95,850	1,233	220,859	
	1990	LARGE INDUSTRIAL	23,589	7,478	19,585	50,652	
		ALL OTHER SOURCES	242,961	101,947		344,908	
		TOTAL	266,550	109,425	19,585	395,560	
NATICK	1974	LARGE INDUSTRIAL	30,519	21,442		51,961	185,268
		ALL OTHER SOURCES	95,072	66,797		161,869	
		TOTAL	125,591	88,239		213,830	
	1980	LARGE INDUSTRIAL	51,008	41,860	7,873	100,741	
		ALL OTHER SOURCES	136,851	104,456		241,307	
		TOTAL	187,859	146,316	7,873	342,048	
	1990	LARGE INDUSTRIAL	140,902	51,494	96,609	289,005	
		ALL OTHER SOURCES	317,812	131,433		449,245	
		TOTAL	458,714	182,927	96,609	738,250	
NEEDHAM	1974	LARGE INDUSTRIAL					207,295
		ALL OTHER SOURCES	96,608	67,876		164,484	
		TOTAL	96,608	67,876		164,484	
	1980	LARGE INDUSTRIAL					
		ALL OTHER SOURCES	139,285	105,978		245,263	
		TOTAL	139,285	105,978		245,263	
	1990	LARGE INDUSTRIAL					
		ALL OTHER SOURCES	333,884	139,526		473,410	
		TOTAL	333,884	139,526		473,410	
NEWTON	1974	LARGE INDUSTRIAL	10,366	7,283		17,649	747,510
		ALL OTHER SOURCES	347,085	243,859		590,944	
		TOTAL	357,451	251,142		608,593	
	1980	LARGE INDUSTRIAL	18,427	12,805	3,165	34,397	
		ALL OTHER SOURCES	465,283	364,763		830,046	
		TOTAL	483,710	377,568	3,165	864,443	
	1990	LARGE INDUSTRIAL	37,332	14,421	24,439	76,192	
		ALL OTHER SOURCES	908,328	387,343		1,295,671	
		TOTAL	945,660	401,764	24,439	1,371,863	

METROPOLITAN DISTRICT COMMISSION

COST OF WASTEWATER MANAGEMENT PROJECTS TO PARTICIPATING COMMUNITIES
FOR SELECTED YEARS (1975 $)

COMMUNITY	YEAR	WASTEWATER SOURCE	OPERATIONS AND MAINTENANCE	DEBT SERVICE	INDUSTRIAL COST RECOVERY	TOTAL	1974 ASSESSMENTS (PER PD-92)
NORWOOD	1974	LARGE INDUSTRIAL	15,998	11,240		27,238	186,603
		ALL OTHER SOURCES	99,932	70,211		170,143	
		TOTAL	115,930	81,451		197,381	
	1980	LARGE INDUSTRIAL	22,909	17,472	3,579	43,960	
		ALL OTHER SOURCES	137,589	106,681		244,270	
		TOTAL	160,498	124,153	3,579	288,230	
	1990	LARGE INDUSTRIAL	45,901	19,103	25,725	90,729	
		ALL OTHER SOURCES	306,194	129,156		435,350	
		TOTAL	352,095	148,259	25,725	526,079	
QUINCY	1974	LARGE INDUSTRIAL	11,052	7,765		18,817	726,211
		ALL OTHER SOURCES	414,025	290,890		704,915	
		TOTAL	425,077	298,655		723,732	
	1980	LARGE INDUSTRIAL	13,567	11,304	1,918	26,789	
		ALL OTHER SOURCES	552,780	433,854		986,634	
		TOTAL	566,347	445,158	1,918	1,013,423	
	1990	LARGE INDUSTRIAL	25,948	11,356	12,653	49,957	
		ALL OTHER SOURCES	1,099,361	470,385		1,569,746	
		TOTAL	1,125,309	481,741	12,653	1,619,703	
RANDOLPH	1974	LARGE INDUSTRIAL	2,203	1,548		3,751	152,066
		ALL OTHER SOURCES	55,762	39,178		94,940	
		TOTAL	57,965	40,726		98,691	
	1980	LARGE INDUSTRIAL	2,631	2,204	368	5,203	
		ALL OTHER SOURCES	80,589	61,601		142,190	
		TOTAL	83,220	63,805	368	147,393	
	1990	LARGE INDUSTRIAL	4,512	2,016	2,093	8,621	
		ALL OTHER SOURCES	200,988	82,635		283,623	
		TOTAL	205,500	84,651	2,093	292,244	
READING	1974	LARGE INDUSTRIAL					111,134
		ALL OTHER SOURCES	48,304	33,938		82,242	
		TOTAL	48,304	33,938		82,242	
	1980	LARGE INDUSTRIAL					
		ALL OTHER SOURCES	69,470	52,586		122,056	
		TOTAL	69,470	52,586		122,056	
	1990	LARGE INDUSTRIAL					
		ALL OTHER SOURCES	174,590	72,016		246,606	
		TOTAL	174,590	72,016		246,606	

METROPOLITAN DISTRICT COMMISSION

COST OF WASTEWATER MANAGEMENT PROJECTS TO PARTICIPATING COMMUNITIES
FOR SELECTED YEARS (1975 $)

COMMUNITY	YEAR	WASTEWATER SOURCE	OPERATIONS AND MAINTENANCE	DEBT SERVICE	INDUSTRIAL COST RECOVERY	TOTAL	1974 ASSESSMENTS (PER PD-92)
REVERE	1974	LARGE INDUSTRIAL	2,628	1,846		4,474	262,884
		ALL OTHER SOURCES	161,606	113,544		275,150	
		TOTAL	164,234	115,390		279,624	
	1980	LARGE INDUSTRIAL	6,387	4,287	1,166	11,840	
		ALL OTHER SOURCES	209,941	166,629		376,570	
		TOTAL	216,328	170,916	1,166	388,410	
	1990	LARGE INDUSTRIAL	16,651	5,804	12,518	34,973	
		ALL OTHER SOURCES	414,253	179,091		593,344	
		TOTAL	430,904	184,895	12,518	628,317	
SHARON	1974	LARGE INDUSTRIAL					
		ALL OTHER SOURCES					
		TOTAL					
	1980	LARGE INDUSTRIAL					
		ALL OTHER SOURCES					
		TOTAL					
	1990	LARGE INDUSTRIAL					
		ALL OTHER SOURCES					
		TOTAL					
SHERBORN	1974	LARGE INDUSTRIAL					
		ALL OTHER SOURCES					
		TOTAL					
	1980	LARGE INDUSTRIAL					
		ALL OTHER SOURCES					
		TOTAL					
	1990	LARGE INDUSTRIAL					
		ALL OTHER SOURCES					
		TOTAL					
SOMERVILLE	1974	LARGE INDUSTRIAL	12,153	8,539		20,692	622,510
		ALL OTHER SOURCES	345,298	242,603		587,901	
		TOTAL	357,451	251,142		608,593	
	1980	LARGE INDUSTRIAL	17,110	13,621	2,591	33,322	
		ALL OTHER SOURCES	450,510	357,604		808,114	
		TOTAL	467,620	371,225	2,591	841,436	
	1990	LARGE INDUSTRIAL	35,440	14,362	20,656	70,458	
		ALL OTHER SOURCES	792,861	342,191		1,135,052	
		TOTAL	828,301	356,553	20,656	1,205,510	

METROPOLITAN DISTRICT COMMISSION

COST OF WASTEWATER MANAGEMENT PROJECTS TO PARTICIPATING COMMUNITIES
FOR SELECTED YEARS (1975 $)

COMMUNITY	YEAR	WASTEWATER SOURCE	OPERATIONS AND MAINTENANCE	DEBT SERVICE	INDUSTRIAL COST RECOVERY	TOTAL	1974 ASSESSMENTS (PER PD-921)
SOUTHBORO	1974	LARGE INDUSTRIAL					
		ALL OTHER SOURCES					
		TOTAL					
	1980	LARGE INDUSTRIAL					
		ALL OTHER SOURCES					
		TOTAL					
	1990	LARGE INDUSTRIAL					
		ALL OTHER SOURCES					
		TOTAL					
STONEHAM	1974	LARGE INDUSTRIAL					146,952
		ALL OTHER SOURCES	67,626	47,513		115,139	
		TOTAL	67,626	47,513		115,139	
	1980	LARGE INDUSTRIAL					
		ALL OTHER SOURCES	91,029	71,567		162,596	
		TOTAL	91,029	71,567		162,596	
	1990	LARGE INDUSTRIAL					
		ALL OTHER SOURCES	183,469	77,947		261,416	
		TOTAL	183,469	77,947		261,416	
STOUGHTON	1974	LARGE INDUSTRIAL	3,246	2,281		5,527	109,463
		ALL OTHER SOURCES	54,719	38,445		93,164	
		TOTAL	57,965	40,726		98,691	
	1980	LARGE INDUSTRIAL	4,833	3,612	771	9,216	
		ALL OTHER SOURCES	78,041	59,387		137,428	
		TOTAL	82,874	62,999	771	146,644	
	1990	LARGE INDUSTRIAL	9,002	3,669	5,260	17,931	
		ALL OTHER SOURCES	220,674	91,418		312,092	
		TOTAL	229,676	95,087	5,260	330,023	
WAKEFIELD	1974	LARGE INDUSTRIAL	28,635	20,118		48,753	165,895
		ALL OTHER SOURCES	87,295	61,333		148,628	
		TOTAL	115,930	81,451		197,381	
	1980	LARGE INDUSTRIAL	34,176	29,007	4,726	67,909	
		ALL OTHER SOURCES	121,420	94,106		215,526	
		TOTAL	155,596	123,113	4,726	283,435	
	1990	LARGE INDUSTRIAL	63,901	28,138	30,504	122,543	
		ALL OTHER SOURCES	284,827	119,022		403,849	
		TOTAL	348,728	147,160	30,504	526,392	

METROPOLITAN DISTRICT COMMISSION

COST OF WASTEWATER MANAGEMENT PROJECTS TO PARTICIPATING COMMUNITIES
FOR SELECTED YEARS (1975 $)

COMMUNITY	YEAR	WASTEWATER SOURCE	OPERATIONS AND MAINTENANCE	DEBT SERVICE	INDUSTRIAL COST RECOVERY	TOTAL	1974 ASSESSMENTS (PER PD-82)
WALPOLE	1974	LARGE INDUSTRIAL	92,512	64,998		157,510	93,639
		ALL OTHER SOURCES	42,740	30,029		72,769	
		TOTAL	135,252	95,027		230,279	
	1980	LARGE INDUSTRIAL	144,475	110,882	22,926	278,283	
		ALL OTHER SOURCES	61,690	46,887		108,577	
		TOTAL	206,165	157,769	22,926	386,860	
	1990	LARGE INDUSTRIAL	321,310	125,596	201,418	648,324	
		ALL OTHER SOURCES	171,683	71,064		242,747	
		TOTAL	492,993	196,660	201,418	891,071	
WALTHAM	1974	LARGE INDUSTRIAL	92,647	65,093		157,740	377,351
		ALL OTHER SOURCES	245,482	172,474		417,956	
		TOTAL	338,129	237,567		575,696	
	1980	LARGE INDUSTRIAL	138,805	109,787	21,425	270,017	
		ALL OTHER SOURCES	337,995	262,162		600,157	
		TOTAL	476,800	371,949	21,425	870,174	
	1990	LARGE INDUSTRIAL	309,962	121,480	191,991	623,433	
		ALL OTHER SOURCES	730,071	307,921		1,037,992	
		TOTAL	1,040,033	429,401	191,991	1,661,425	
WATERTOWN	1974	LARGE INDUSTRIAL	7,246	5,091		12,337	280,466
		ALL OTHER SOURCES	137,667	96,723		234,390	
		TOTAL	144,913	101,814		246,727	
	1980	LARGE INDUSTRIAL	9,713	7,570	1,473	18,756	
		ALL OTHER SOURCES	188,199	146,497		334,696	
		TOTAL	197,912	154,067	1,473	353,452	
	1990	LARGE INDUSTRIAL	17,519	7,564	9,033	34,116	
		ALL OTHER SOURCES	325,244	137,833		463,137	
		TOTAL	342,763	145,457	9,033	497,253	
WELLESLEY	1974	LARGE INDUSTRIAL					160,057
		ALL OTHER SOURCES	96,608	67,876		164,484	
		TOTAL	96,608	67,876		164,484	
	1980	LARGE INDUSTRIAL					
		ALL OTHER SOURCES	130,894	102,001		232,895	
		TOTAL	130,894	102,001		232,895	
	1990	LARGE INDUSTRIAL					
		ALL OTHER SOURCES	269,466	113,653		383,119	
		TOTAL	269,466	113,653		383,119	

METROPOLITAN DISTRICT COMMISSION

COST OF WASTEWATER MANAGEMENT PROJECTS TO PARTICIPATING COMMUNITIES
FOR SELECTED YEARS (1975 $)

COMMUNITY	YEAR	WASTEWATER SOURCE	OPERATIONS AND MAINTENANCE	DEBT SERVICE	INDUSTRIAL COST RECOVERY	TOTAL	1974 ASSESSMENTS (PER PD-92)
BOSTON	1974	LARGE INDUSTRIAL					
		ALL OTHER SOURCES					
		TOTAL					
	1980	LARGE INDUSTRIAL					
		ALL OTHER SOURCES					
		TOTAL					
	1990	LARGE INDUSTRIAL					
		ALL OTHER SOURCES					
		TOTAL					
WESTWOOD	1974	LARGE INDUSTRIAL					84,531
		ALL OTHER SOURCES	28,983	20,363		49,346	
		TOTAL	28,983	20,363		49,346	
	1980	LARGE INDUSTRIAL					
		ALL OTHER SOURCES	42,662	31,760		74,422	
		TOTAL	42,662	31,760		74,422	
	1990	LARGE INDUSTRIAL					
		ALL OTHER SOURCES	141,083	58,776		199,859	
		TOTAL	141,083	58,776		199,859	
WEYMOUTH	1974	LARGE INDUSTRIAL					336,585
		ALL OTHER SOURCES	96,608	67,876		164,484	
		TOTAL	96,608	67,876		164,484	
	1980	LARGE INDUSTRIAL					
		ALL OTHER SOURCES	136,834	105,458		242,292	
		TOTAL	136,834	105,458		242,292	
	1990	LARGE INDUSTRIAL					
		ALL OTHER SOURCES	370,758	153,864		524,622	
		TOTAL	370,758	153,864		524,622	
WILMINGTON	1974	LARGE INDUSTRIAL	8,656	6,082		14,738	86,536
		ALL OTHER SOURCES	29,987	21,068		51,055	
		TOTAL	38,643	27,150		65,793	
	1980	LARGE INDUSTRIAL	11,770	9,389	1,763	22,922	
		ALL OTHER SOURCES	44,642	33,580		78,222	
		TOTAL	56,412	42,979	1,763	101,154	
	1990	LARGE INDUSTRIAL	23,732	9,818	13,266	46,786	
		ALL OTHER SOURCES	191,130	77,635		268,765	
		TOTAL	214,832	87,453	13,266	315,551	

METROPOLITAN DISTRICT COMMISSION

COST OF WASTEWATER MANAGEMENT PROJECTS TO PARTICIPATING COMMUNITIES
FOR SELECTED YEARS (1975 $)

COMMUNITY	YEAR	WASTEWATER SOURCE	OPERATIONS AND MAINTENANCE	DEBT SERVICE	INDUSTRIAL COST RECOVERY	TOTAL	1974 ASSESSMENTS (PER PD-921
WINCHESTER	1974	LARGE INDUSTRIAL	13,429	9,435		22,864	239,160
		ALL OTHER SOURCES	83,179	58,441		141,620	
		TOTAL	96,608	67,876		164,484	
	1980	LARGE INDUSTRIAL	21,094	16,733	3,284	41,111	
		ALL OTHER SOURCES	113,289	88,205		201,494	
		TOTAL	134,383	104,938	3,284	242,605	
	1990	LARGE INDUSTRIAL	48,614	18,549	31,416	98,579	
		ALL OTHER SOURCES	205,238	86,975		292,213	
		TOTAL	253,852	105,524	31,416	390,792	
WINTHROP	1974	LARGE INDUSTRIAL					151,282
		ALL OTHER SOURCES	57,965	40,726		98,691	
		TOTAL	57,965	40,726		98,691	
	1980	LARGE INDUSTRIAL					
		ALL OTHER SOURCES	74,828	59,827		134,655	
		TOTAL	74,828	59,827		134,655	
	1990	LARGE INDUSTRIAL					
		ALL OTHER SOURCES	128,384	54,875		183,259	
		TOTAL	128,384	54,875		183,259	
WOBURN	1974	LARGE INDUSTRIAL	56,661	39,810		96,471	310,267
		ALL OTHER SOURCES	107,573	75,580		183,153	
		TOTAL	164,234	115,390		279,624	
	1980	LARGE INDUSTRIAL	123,492	99,029	20,252	242,773	
		ALL OTHER SOURCES	152,183	116,704		268,887	
		TOTAL	275,675	215,733	20,252	511,660	
	1990	LARGE INDUSTRIAL	398,694	135,286	302,553	836,533	
		ALL OTHER SOURCES	386,482	160,594		547,076	
		TOTAL	785,176	295,880	302,553	1,383,609	
BOSTON	1974	LARGE INDUSTRIAL	312,304	219,422		531,726	5,297,777
		ALL OTHER SOURCES	3,281,526	2,305,572		5,587,098	
		TOTAL	3,593,830	2,524,994		6,118,824	
	1980	LARGE INDUSTRIAL	649,274	432,403	116,596	1,198,273	
		ALL OTHER SOURCES	4,369,888	3,435,127		7,805,015	
		TOTAL	5,019,162	3,867,530	116,596	9,003,288	
	1990	LARGE INDUSTRIAL	1,439,850	531,252	1,013,516	2,984,618	
		ALL OTHER SOURCES	8,274,015	3,543,885		11,817,900	
		TOTAL	9,713,865	4,075,137	1,013,516	14,802,518	