

EG  
352.6  
B627

PN-AAA-86



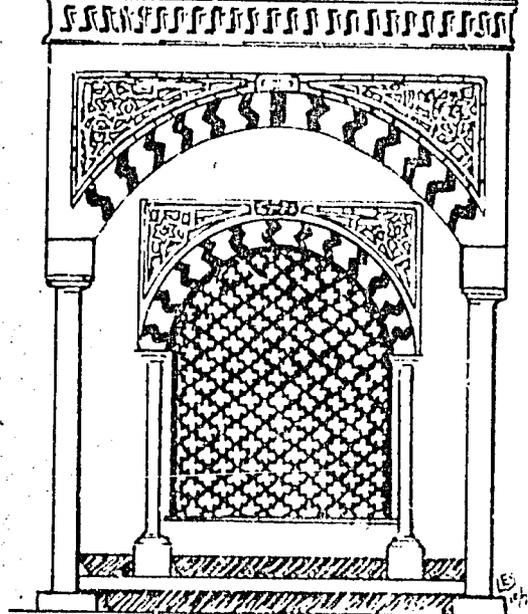
ARAB REPUBLIC OF EGYPT  
MINISTRY OF DEVELOPMENT  
AND NEW COMMUNITIES

MANAGEMENT AND TARIFF STUDIES  
RELATIVE TO WATER/SEWERAGE SYSTEMS

SEWERAGE UTILITY

TARIFFS  
VOLUME 1

FINAL REPORT



بِسْمِ اللّٰهِ الرَّحْمٰنِ الرَّحِیْمِ  
وَجَعَلْنَا مِنَ الْمَاءِ كُلَّ شَيْءٍ حَيٍّ  
عَدَّقَ سَمِ الْعَظِیْمِ

BVI-ATK ASSOCIATES WITH SABBOUR ASSOCIATES

BLACK & VEATCH  
INTERNATIONAL  
CONSULTING ENGINEERS

A.T. KEARNEY, INC.  
MANAGEMENT CONSULTANTS

SABBOUR ASSOCIATES  
CONSULTING ENGINEERS

OCTOBER 1979

USAID GRANT NO 263-0025

# SEWERAGE UTILITY

## TARIFFS VOLUME 1

### FINAL REPORT

#### The Story of Our Cover:-

On our cover is a sketch of a sybil, which is a fountain. During the Ottoman Empire these were a common source of drinking water. A well is located at ground level and a balcony on the second level where children were taught the Koran. Usually located near mosques, sybils were built and then donated to the public by various benefactors.

Beneath the sketch is a quote from the Koran, "We made from water all living things".



**BLACK & VEATCH INTERNATIONAL  
CONSULTING ENGINEERS**

**A. T. KEARNEY, INC.  
MANAGEMENT CONSULTANTS**

**WITH SABBOUR ASSOCIATES  
CONSULTING ENGINEERS**

بلاك أند فيتش العالمية  
استشارات هندسية  
أ. ت. كارني  
استشارات إدارية  
المكتب الهندسي الاستشاري «سببور»  
استشارات هندسية

OUR REF.: 79-254

YR REF.:

DATE: October 8, 1979

Engineer Soliman Abd El Hai  
Chairman  
Advisory Committee for Reconstruction  
Ministry of Development and New Communities  
1, Ismail Abaza Street  
Cairo, A.R.E.

Dear Engineer Abd El Hai:

Pursuant to the provisions of Paragraph 6.7 of Appendix 1 to the Contract dated April 6, 1978 between the Ministry of Housing and Reconstruction and BVI-ATK Associates for Management and Tariff Studies Relative to Water and Sewerage Systems, we are pleased to submit the Final Report on Sewerage Utility, Tariffs. The Report, in two volumes, is responsive to the provisions of Paragraph 5.4.17 of Appendix I to the Contract and incorporates, as appropriate, material related to the review comment on the Interim and Draft Final Reports.

Your attention is directed to Section 0.0 of this report, Executive Summary, where a brief synopsis of the findings and recommendations may be found.

We wish to acknowledge the assistance and cooperation of the many individuals, agencies and organizations contacted during the course of the study.

We appreciate the opportunity to serve the Ministry on this important assignment.

Very truly yours

BVI-ATK ASSOCIATES

*John R. Scott*  
John R. Scott  
Project Director

cc: USAID  
TAMS  
Mr. A.F. Naguib

# TABLE OF CONTENTS

## VOLUME 1

	<u>Page</u>
List of commonly used terms and expressions	
0.0 <u>EXECUTIVE SUMMARY</u>	0-1
0.1 Concepts and Methodology	0-1
0.2 General	0-3
0.3 Findings	0-5
0.4 Recommendations	0-5
1.0 <u>INTRODUCTION</u>	1-1
1.1 Purpose	1-2
1.2 Scope	1-2
1.2.1 Revenue Requirements	1-3
1.2.2 Allocation of Revenue Requirements	1-3
1.2.3 Tariff Design	1-4
1.2.4 Financial Analysis	1-4
1.2.5 Other Considerations	1-4
1.3 Basis for Projections	1-5
2.0 <u>CAPITAL IMPROVEMENTS</u>	2-1
2.1 The National Five Year Plan	2-1
2.2 Consultant's Recommendations	2-3
2.3 Capital Program Used for Tariff Study Purposes	2-4
2.4 Financing Plan	2-6
2.4.1 Revenues from User Charges	2-6
2.4.2 Construction Loans	2-7
2.4.3 Construction Grants	2-8

TABLE OF CONTENTS  
(Cont'd)

	<u>Page</u>
3.0 <u>GROWTH OF SEWERAGE SYSTEMS</u>	3-1
3.1 Population	3-1
3.2 Customers	3-2
3.3 System Loads	3-3
3.4 Summary	3-3
4.0 <u>REVENUES</u>	4-1
4.1 Subsidies	4-1
4.1.1 Operating Subsidies	4-1
4.1.2 Capital Subsidies	4-2
4.2 Miscellaneous Revenues	4-2
4.2.1 Connection Fees	4-2
4.2.2 Sale of Sludge	4-3
4.2.3 Other Revenues	4-3
4.3 Summary	4-4
5.0 <u>REVENUE REQUIREMENTS</u>	5-1
5.1 Operation and Maintenance Expense	5-2
5.1.1 Wages and Benefits	5-3
5.1.2 Utilities	5-4
5.1.3 Head Office Expense	5-4
5.2 Debt Service	5-5
5.2.1 Interest and Principal	5-5
5.2.2 Debt Service Coverage	5-6
5.3 Depreciation	5-6
5.4 Return on Investment	5-8
5.5 Summary of Revenue Requirements	5-11

TABLE OF CONTENTS  
(Cont'd)

	<u>Page</u>
6.0 <u>COST OF SERVICE ALLOCATIONS</u>	6-1
6.1 Cost of Service to be Allocated	6-1
6.2 Allocations to Functional Cost Components	6-2
6.2.1 Functional Cost Components	6-3
6.2.2 Allocation of Operation and Maintenance Expense	6-5
6.2.3 Allocation of Capital Related Cost	6-7
6.3 Summary of Allocation, Cash Basis	6-7
7.0 <u>ALLOCATION TO CUSTOMER CLASSES</u>	7-1
7.1 Customer Classes	7-1
7.2 Units of Service	7-2
7.2.1 Number of Connections	7-2
7.2.2 Volume of Sewage	7-4
7.2.3 Sewage Strengths	7-4
7.2.4 Summary	7-6
7.3 Unit Cost of Service	7-6
7.4 Summary of Allocation	7-6
8.0 <u>PROPOSED TARIFF SCHEDULES</u>	8-1
8.1 Bill Frequency Analysis	8-2
8.2 Socio-Economic or "Ability to Pay" Rates	8-2
8.2.1 Socio-Economic Considerations of Sewerage Tariffs	8-2
8.2.2 Basis for Rate Design	8-4

TABLE OF CONTENTS  
(Cont'd)

	<u>Page</u>
8.3 Service Charge - Volume Charge Rates	8-5
8.4 Combined Flat Rate Service Charge - Volume Charge Rate	8-6
8.5 Utility Basis "Ability to Pay" rates	8-7
8.6 Extra Strength Surcharges	8-8
8.7 Marginal Cost Rates	8-8
8.8 Effect of Sewer User Charges on Water Use	8-8
8.9 Other Tariff Considerations	8-9
8.10 Evaluation of Proposed Tariffs	8-10
8.10.1 Cost of Service Comparisons	8-10
8.10.2 Required Subsidies	8-11
9.0 <u>FUTURE TARIFF ADJUSTMENTS</u>	9-1
9.1 Cost of Service Adjustments	9-1
9.2 Adjusting Existing Tariffs	9-2
9.3 Cost Adjustment Factors	9-2
10.0 <u>FINANCIAL ANALYSIS</u>	10-1
10.1 Statement of Income	10-1
10.2 Statement of Source and Application of Funds	10-2
10.3 Proforma Balance Sheets	10-3
11.0 <u>LEGISLATIVE CONSIDERATIONS</u>	11-1
11.1 Historical Background	11-1
11.1.1 Law No 43 of 1979	11-1
11.1.2 General Organizations for sewerage and Sanitary Drainage	11-2
11.1.3 Governorates	11-3

TABLE OF CONTENTS  
(Cont'd)

	<u>Page</u>
11.2 Enactment of Tariffs	11-3
11.3 Contractual Requirements	11-4
11.4 Conditions for Sewerage Service	11-5
11.5 Subsidies	11-5
11.6 Recommendations	11-6
12.0 SEWERAGE METERING	12-1
12.1 Billed Water Use	12-2
12.2 Industrial and Commercial Customers	12-2
12.3 Extra Strength Customers	12-3
12.4 Implementing a Sewage Metering Program	12-4

LIST OF EXHIBITS

- 8.1 Typical Sewerage Utility Rules and Regulations

VOLUME 2

- Appendix I - Greater Cairo/Helwan Sewerage Utility
- Appendix II - Alexandria Sewerage Utility
- Appendix III - Ismailia Sewerage Utility
- Appendix IV - Port Said Sewerage Utility
- Appendix V - Suez Sewerage Utility

## LIST OF TABLES

Each appendix contains a complete set of each table listed below:

### Table Number

- 2.1 Historical and Proposed Capital Improvement Program
- 2.2 Proposed Debt Service Charges for Construction Costs
- 3.1 Projected Population, Connections and Sewerage Flows
- 4.1 Revenues
- 5.1 Operation and Maintenance Expense
- 5.2 Debt Service Charges with Coverage Requirements
- 5.3 Estimated Depreciation Expense
- 5.4 Proforma Return on Investment
- 5.5 Comparative Summary of Revenue Requirements
- 6.1 Typical Sewerage System Facilities
- 6.2 Allocation of Operation and Maintenance Expense to Functional Cost Components
- 6.3 Allocation of Cash Basis Capital Costs to Functional Cost Components
- 6.4 Allocation of Utility Basis Capital Costs to Functional Cost Components
- 6.5 Summary of Allocation of Cash Basis Cost of Service to Functional Cost Components
- 6.6 Summary of Allocation of Utility Basis Cost of Service to Functional Cost Components
- 7.1 Units of Service
- 7.2 Unit Costs of Service - Cash Basis Revenue Requirements
- 7.3 Unit Costs of Service - Utility Basis Revenue Requirements
- 7.4 Cash Basis Cost of Service Allocated to Customer Classes
- 7.5 Utility Basis Cost of Service Allocated to Customer Classes

LIST OF TABLES  
(Continued)

<u>Table Number</u>	
8.1	Recommended "Ability to Pay" Sewerage User Charges Based on Cash Basis Revenue Requirements
8.2	Proposed Service Charge - Volume Charge Sewerage User Charges Based on Cash Basis Revenue Requirements
8.3	Proposed Combined Flat Rate - Service Charge - Volume Charge Sewerage User Charges Based on Cash Basis Revenue Requirements
8.4	Proposed "Ability to Pay" Sewerage User Charges Based on Utility Basis Revenue Requirements
8.5	Comparison of Revenues under "Ability to Pay" Rates with Cash Basis Cost of Service by Customer Classes
8.6	Comparison of Revenues Under Service Charge - Volume Charge Rates with Cash Basis Cost of Service by Customer Classes
8.7	Comparison of Revenues under Combined "Ability to Pay" - Service Charge - Volume Charge Rates with Cash Basis Cost of Service by Customer Classes
8.8	Comparison of Revenues under "Ability to Pay" Rates with Utility Basis Cost of Service by Customer Classes
8.9	Subsidy Required to Recover Cash Basis Revenue Requirements
8.10	Subsidy Required to Recover Utility Basis Revenue Requirements
10.1	Proforma Statement of Income (Revenues Based on Cash Basis Revenue Requirements)
10.2	Proforma Statement of Income (Revenues Based on Utility Basis Revenue Requirements)
10.3	Proforma Statement of Source and Application of Funds (Revenues Based on Cash Basis Revenue Requirements)
10.4	Proforma Statement of Source and Application of Funds (Revenues Based on Utility Basis Revenue Requirements)
10.5	Proforma Balance Sheet

## Abbreviations

AC	Alternating current
acre	4047 m <sup>2</sup>
BOD	Biochemical oxygen demand
cm	Centimeter
cmd	Cubic meter per day
cmh	Cubic meter per hour
COD	Chemical oxygen demand
DC	Direct current
ea	Each
Feddān	4,200 m <sup>2</sup>
ha	Hectare or 10,000 m <sup>2</sup>
hp	Horsepower
hr	Hour
hz	Hertz
kg	Kilograms
km	Kilometer
kVa	Kilovolt amperes
kW	Kilowatt
kWh	Kilowatt hour
lit/sec	Liter per second
lcd	Liter per capita per day
LE	Egyptian pound
lot	Lot or group, normally of a similar type * of property
m.H	Mega hertz
m <sub>2</sub>	Meter
m <sub>2</sub>	Square meter
m <sub>3</sub>	Cubic meter
mg	Milligrams
mg/l	Milligrams per liter
mm	Millimeter
mms	Milliemes
NA	Not available or not applicable
OC	Original cost
/	per
%	percent
pt	piastre
RC	Reproduction cost
RCLD	Reproduction cost less depreciation
R.p.m	Revolutions per minute
SS	Suspended solids
v	volt
yr	year

## List of Commonly Used Expressions

ACR	Advisory Committee for Reconstruction
AWGA	Alexandria Water General Authority
ARE	Arab Republic of Egypt
CAPMAS	Central Agency for Public Mobilization and Statistics
GOGCWS	General Organization for Greater Cairo Water Supply
GOSSD	General Organization for Sewerage and Sanitary Drainage
IBRD	International Bank for Reconstruction and Development (World Bank)
MODANC	Ministry of Development and New Communities
MOHR	Ministry of Housing and Reconstruction
SCA	Suez Canal Authority
USA	United States of America
USAID	United States Agency for International Development
WHO	World Health Organization

## 0.0 EXECUTIVE SUMMARY

This report presents the conclusions and recommendations of BVI-ATK Associates relative to the study of sewerage utility revenue requirements, cost of service and tariffs. The report is responsive to Section 5.4.17, Appendix I of the contract dated April 6, 1978 for Management and Tariff Studies Relative to Water and Sewerage Utilities in Cairo/Helwan, Alexandria, Ismailia, Port Said and Suez.

This report contains revisions, clarifications, amendments and refinements of material presented in The Interim and Draft Final Reports on Sewerage Utility Tariffs. These changes include, where appropriate, response to review comments received on the two preliminary reports.

### 0.1 CONCEPTS AND METHODOLGY

It is an accepted principle of utility rate making that properly designed rates or tariffs provide the most reasonable and equitable means of producing revenues to finance utility operations. To understand this principle it is important to consider rate philosophy, the overall impact of rate increases and goals for achieving improved sewerage service in the Arab Republic of Egypt.

One objective of this study was to make the sewerage utilities financially self sufficient by the year 1984. To accomplish this, tariffs must be imposed. Funds for operation, maintenance and capital related cost must be obtained from customers, not from governmental subsidies.

The annual costs of capital improvements is the major factor affecting the magnitude of the rate proposed in this report. These costs are keyed to the capital programs recommended by the consultants who prepared the Master Plan studies. These programs represent the requirements needed to bring utility service to normally acceptable standards. They are based upon the physical needs of the nation. They are not influenced by financial, social or political restraints.

The first decision, then, is to determine whether or not these capital programs will actually be constructed? If not will projects be abandoned? Deferred? Modified? This decision is not totally the responsibility of the operating utilities. Others affected will include the Ministries of Finance, Planning and Economy and Economic Cooperation. It also will be influenced by foreign currency grant and loans which are subject to international political decisions.

It is beyond the scope of this study to attempt to quantify the effect of any decisions based on the above discussion. Hence rates were developed using the information that is available.

The effect of the proposed rates on users can be severe. The potential impact on the poor was acknowledged and the recommended "Ability to Pay" rate was developed. To mitigate the financial responsibility to the majority

of users, recommendation for no free service is included. This will eliminate a hidden subsidy in the rate. For the same reason rates vary between communities.

Individual customers may take action to reduce the volume of water used and thus the sewer user charge. An initial reaction to instituting rates is to reduce usage. Typically this resistance disappears with time. Therefore if reduction in water use is really desired, the utilities must engage in an effective and continuing public information program.

Detailed methods used to develop rates are described in the report. Alternative rates are recommended. Methods for implementing rates are presented.

In the end a political decision must be made as to whether the proposed rates will be paid - whether the recommended improvements will be made - whether construction subsidies will be provided to mitigate rates - and whether the people of Egypt will have the sewerage service capable of meeting their needs.

## 0.2 GENERAL

This report presents recommendations for the staged implementation of sewerage user charge tariffs. At the present time no charges are made for sewerage service in any of the study cities. The imposition of sewerage tariffs, when adopted, may result in new social and economic reaction.

Sewerage user charges presented herein are in a form designed to recover costs reasonably from various customer classes. However, socio-economic considerations require that there be cross subsidation within and between customer classes. An "Ability to Pay" concept was considered to be the best rate design for implementation in Egypt.

Tariffs recommended in this report have been computed on both Cash Basis and Utility Basis revenue requirements. Cash Basis tariffs will produce sufficient revenues to pay the cost of operation and maintenance expense, debt interest and principal and provide for routine annual improvements. Utility Basis tariffs will produce sufficient revenues to pay the cost of operation and maintenance expense, meet depreciation expense, and provide a six percent rate of return on investment after 1983.

Tariffs that produce a six percent return develop funds in excess of the cash needs of the utility. Should this practice be acceptable, the excess funds could be used:

- As a payment in lieu of taxes to the Ministry of Finance.
- To construct additional utility plant from earnings rather than from borrowed funds.
- To retire existing debt in advance of scheduled maturities.

Payments in lieu of taxes become a hidden tax of which most customers are unaware. Utility rates should not be used as a normal method of taxation. Construction

of additional plant or early retirement of debt places an obligation on existing rate payers to construct and pay for plant to be used by future rate payers.

### 0.3 FINDINGS

The principal findings presented in this report are:

- The future waste water facility construction program throughout Egypt is the single dominating factor affecting the establishment and magnitude of sewerage user charges.
- Agencies operating sewerage facilities have little statistical data concerning:
  - . Number and location of connections to the sewerage system.
  - . Volume of waste water collected and treated.
  - . Strengths of waste water.
  - . Impact of large customers both as to volume and strengths contributed.
- No enforcement exists of existing regulations related to pollution of the River Nile and other sources used for potable water supply.
- No legislation exists authorizing operating agencies to establish, bill and collect sewer user charges.

### 0.4 RECOMMENDATIONS

The principal recommendations included in this report are as follows:

- Rates shown in Table 8.1 should be adopted by January 1, 1980. These rates, which provide for staged implementation, permit the full recovery of projected revenue requirements by 1984.
- Legislation should be enacted immediately granting operating agencies the authority to adopt sewerage user charge tariff schedules.

- Sewer use ordinances should be adopted defining procedures for providing water service to residences, business and governmental agencies and defining conditions for such service.
- Coordination should be made with the agencies providing water service in the study cities for billing, collecting and remitting revenues from sewerage user charges.
- If needed, subsidies should be provided the agencies operating the sewerage facilities until 1984 at which time the systems should be self supporting. The subsidy should be limited to the agencies cash shortfall.

The recommendations contained in this report are the result of analysis of operating, financial and capital records. The data analyzed was obtained from the operating utilities, reports of other consultants and field investigation by BVI-ATK Associates. The conclusions reached in this report are considered reasonable. Assuming future operations result in substantially the costs projected, rates recommended herein should prove adequate through 1984.

## 1.0 INTRODUCTION

This report is submitted under the provisions of the contract dated April 6, 1978 by and between BVI-ATK Associates and the Ministry of Housing and Reconstruction for Management and Tariff Studies Relative to Water and Sewerage Systems in Cairo/Helwan, Alexandria, Ismailia, Port Said and Suez.

This report is one of three reports being issued as the Final Report on Tariff Studies. It complies with Section 5.4.17 of Appendix 1 of the above referred to contract. The three reports that make up the Final Report on Tariff Studies are:

- Sewerage Utility, Tariffs (This Report)
- Water Utility, Tariffs.
- Water and Sewerage Utility Inventory and Valuation.

This report on Sewerage Utility, Tariffs consists of two volumes. The body of the report contains the background and basis for the study. Appendices, bound separately, set out the statistical and financial tables which support the development of tariffs.

Throughout the body of this report, reference is made to Tables in Appendix I to V. Each table has been prepared for each of the five sewerage utilities covered by this report. Each appendix thus includes a complete set of each table referred to in the body of the report.

The appendices are as follows:

- Appendix I - Greater Cairo/Helwan Sewerage Utility
- Appendix II - Alexandria Sewerage Utility.
- Appendix III - Ismailia Sewerage Utility.
- Appendix IV - Port Said Sewerage Utility.
- Appendix V - Suez Sewerage Utility.

### 1.1 PURPOSE

This report has been prepared to meet the following objectives:

- Recommend a comprehensive tariff system covering all sewerage service, including alternate tariff schedules which recognize social and economic conditions as well as cost of service.
- Review legislation, decrees, policies and administrative practices which relate to tariffs and water service.

### 1.2 SCOPE

The material and recommendations presented herein is limited to the sewerage systems currently owned and operated by:

- General Organization for Sewers and Sanitary Drainage
  - . Greater Cairo/Helwan Sewerage Utility
  - . Alexandria Sewerage Utility (See Section 11.1.)
- Governorate of Ismailia
  - Ismailia Sewerage Utility
- Governorate of Port Said
  - . Port Said Sewerage Utility
- Governorate of Suez
  - . Suez Sewerage Utility

The report covers:

- Development of revenue requirements
- Allocation of revenue requirements to customer classes.
- Design of recommended tariffs.
- Development of a program for implementing tariffs.
- Analysis of the impact of tariffs on the financial position of the sewerage utilities.
- Existing legislative constraints.
- Existing and proposed metering practices.

#### 1.2.1 Revenue Requirements

Revenue requirements were established by two methods:

- Cash basis.
- Utility basis.

Revenue requirements on a cash basis are limited to the cost of operation and maintenance expense, routine annual improvements and debt service charges. Revenue requirements on a utility basis consist of operation and maintenance expense, depreciation expense and return on investment.

#### 1.2.2 Allocation of Revenue Requirements

Revenue requirements have been allocated to functional cost components and customer classes using the volume-strength method. The volume-strength method is more easily understood than are other methods. It is discussed in detail in Section 6.

The effect of incremental or marginal costs on tariffs is discussed in Section 8.

### 1.2.3 Tariff Design

Four alternative tariffs are proposed. Three are based on Cash Basis revenue requirements. One is based on Utility Basis revenue requirements. All are designed to recover total costs of service. The proposed rates are:

- Cash Basis Revenue Requirements

- . "Ability to Pay" Rates (Recommended)
- . Service Charge - Volume Charge Rates
- . Combined Flat Rate - Service Charge - Volume Charge Rates

- Utility Basis Revenue Requirements

- . "Ability to Pay" Rates

### 1.2.4 Financial Analysis

For purposes of this Report, financial analysis of the effects of the proposed rates includes proforma balance sheets, proforma statements of income and source and application of funds.

### 1.2.5 Other Considerations

This report contains a review of legislation under which organizations providing sewerage service are authorized. It also contains broad recommendations for legislative enactments which will permit the adoption of tariffs for sewerage service.

The report includes a brief summary of methods that might be used to measure or meter sewage contributions by individual customers.

### 1.3 BASIS FOR PROJECTIONS

The data presented in this report is based upon historical operating and financial statistics. Future operating conditions have been projected using recommendations of other consultants, expected growth in the sewerage systems and nominal allowances for inflation.

The recommendations of other consultants are based upon expected maximum system loading requirements. Facilities must be constructed to meet the probable maximum loading on the sewerage systems. Thus the projections by others of waste contributions and customers are based on these optimum considerations.

In tariff studies, projected future system growth and loadings must be based on average conditions. As a result the growth and contribution statistics herein are somewhat lower than similar statistics of other consultants.

## 2.0 CAPITAL IMPROVEMENTS

The dominant influence affecting the tariffs recommended in this report is the capital improvement program of each of the sewerage utilities covered by this report. As of the date of this study no official, approved, capital improvement program exists for any of the sewerage utilities covered by the study. Thus for study purposes, an assumed program was required.

As used in this study capital improvements of the sewerage utilities are divided between major capital projects and routine annual requirements. Major projects are those programs included in the master plans recommended by other consultants.

Routine capital improvements are capital expenditures that occur with a reasonable degree of frequency. They include the purchase of office furniture and equipment, tools and work equipment, some laboratory equipment and vehicles of various types. Routine improvements also cover new customer service sewers, and short extensions of lateral sewers.

### 2.1 THE NATIONAL FIVE YEAR PLAN

The Ministry of Planning has issued "The Five Year Plan: 1978-1982". This plan, in twelve volumes, covers the economic and social development of Egypt and sets forth economic guidelines for national capital improvements.

As it relates to public utilities, one policy of the five year plan is:

"renovating and expanding the badly neglected utilities".

The plan also recognizes that:

"a marked increase in the volume of investment spending .. in the utilities .. sector is urgently needed .. in order to meet people's needs".

To achieve these objectives, the Ministry of Planning proposed about LE 623 million be invested in utilities in the 1978-1982 period. Of this amount LE 249 million would be foreign currency expenditure and the balance from local sources. The total allocation to utilities for the Five Year Plan is about 6 percent of the total for all economic sectors.

The allocation of funds for utilities is divided as follows:

Water	LE 309,500,000
Sewerage	279,900,000
Other	<u>33,400,000</u>
	LE 622,800,000

Thus about 45 percent of the total was apportioned to the sewerage utilities. This represents about 2.7 percent of the total for all economic sectors. The distribution of sewerage funds set forth in the Five Year

Plan is as follows:

	<u>Cairo</u> LE 1000	<u>Other</u> <u>Governorates</u> LE 1000	<u>Total</u> LE 1000
Consolidation replacing and renewals			
Local currency	54,100	105,800	159,900
Foreign currency	<u>80,000</u>	<u>40,000</u>	<u>120,000</u>
Total	134,100	145,800	279,900

Projects include construction of pumping stations, cleaning of mains, construction of main centers and expanding of facilities.

While the above data is based upon 1978-1982 projections, The Ministry of Planning indicated that no significant adjustments is expected for 1979-1983. A revised Five Year Plan covering 1979-1983 is to be published in 1979.

## 2.2 CONSULTANTS RECOMMENDATIONS

Various consultants have prepared master plans covering the investment needs of the sewerage utilities. In these plans a review was made of the adequacy of existing facilities to meet current and future requirements. From this review two plans of needed capital improvements were prepared. These are generally described as:

- High Priority Projects
- Staged Construction Projects

High priority projects are those required to meet current needs. Recommendations were made for the construction of these projects within the next five years. Staged construction projects are those that can be deferred until after the high priority projects are completed. As presented in the various master plans most of the projects are normally scheduled for construction after 1982.

The Master Plan programs are represented by constant monetary values using 1977 or 1978 conditions. The estimated cost of these programs through the year 2000 is as follows:

<u>Sewerage Utility</u>	<u>Master Plan Estimates</u>
Greater Cairo/Helwan	LE 1,060,778,000
Alexandria	1,352,256,000
Ismailia	130,123,000
Port Said	83,818,000
Suez	<u>161,594,000</u>
Total	LE 2,788,569,000

### 2.3 CAPITAL PROGRAMS USED FOR TARIFF STUDY PURPOSES

For purposes of this report certain assumptions are required. These assumptions are:

- The capital improvement programs presented in the master plan studies will be used.
- Costs of construction will be adjusted to reflect an allowance for nominal inflation.
- An allowance for routine annual improvements will be added to the master plan recommendation.

The projected cost of the improvements is shown by proposed year of expenditure in Table 2.1, Appendix I to V. These tables also show historical expenditures since 1973. The estimated cost of the program used in this study through the year 2000 is as follows:

<u>Sewerage Utility</u>	<u>Projected cost 1979-2000</u>
Greater Cairo/Helwan	LE 3,239,880,000
Alexandria	1,558,550,000
Ismailia	348,857,000
Port Said	194,499,000
Suez	<u>286,267,000</u>
Total	LE 5,628,053,000

This study includes recommendations for tariffs which will recover total cost of service by 1984. In the period 1979 through 1984, the capital improvements to be constructed are projected to cost approximately as follows:

<u>Sewerage Utility</u>	<u>Projected Cost 1979-1984</u>
Greater Cairo/Helwan	LE 887,760,000
Alexandria	340,940,000
Ismailia	75,875,000
Port Said	58,091,000
Suez	<u>99,476,000</u>
Total	LE 1,462,142,000

On an annual basis, these capital costs are at a rate over four times the amount the Ministry of Planning says is available for all of Egypt. It should be

recognized that with the Peace Treaty now a fact, additional funds may be made available for sewerage system construction.

These funds could be obtained:

- From a larger allocation of the Gross National Product of Egypt.
- Increased loans and grants from foreign governments.

Nevertheless, the capital requirements discussed above and in the Final Report on Water Utility Tariffs can only result in substantial increases in the amount of disposable income that must be spent by residents and businesses for water and sewerage service.

#### 2.4 FINANCING PLAN

Funds to construct the recommended capital improvements are expected to be provided from:

- Revenues from users of sanitary sewers.
- Egyptian currency loans.
- Foreign currency loans or grants.

##### 2.4.1 Revenues from User Charges

One of the objectives of the tariff study is to develop rates through which the sewerage utility becomes self supporting. To be self supporting a sewerage utility should expect to acquire properties with short lives from the proceeds of user charges or tariffs. The improvements, or property additions that fall in this category are:

- Office furniture and equipment.
- Tools, shop and work equipment.

- Replacement laboratory equipment.
- Automobiles, trucks and other power operated equipment.

All of these items have relatively short lives and it would be erroneous to attempt to finance them over a prolonged period of time. Other property that should be financed from annual operating revenue consists of:

- Retirement units of property that will not appreciably prolong the life of the principal property unit.
- Short main extensions.
- Customers connections.

These improvements are acquired on a regular basis. They, together with short lived property, are sometimes referred to as "Routine Annual Additions". Since they occur regularly it is normal to provide for them from annual operating revenues. If routine annual improvements are debt financed, within a few years, debt service will equal or exceed the annual expenditure.

#### 2.4.2 Construction Loans

All capital improvements except for routine additions are assumed to be financed from loans. Table 2.1, Appendix I to V sets forth the estimated cost of construction of sewerage facilities through the year 2000. A portion of this construction will be debt financed from Egyptian currency loans and the remainder from foreign

Debt service charges on all loans has been computed using the following criteria:

- Term of loan, 25 years.
- Interest rate, six percent per annum.
- Even annual interest and principal payments.
- Principal payments waived for first five years.

Table 2.2, Appendix I to V presents an estimate of debt service charges, by year for each sewerage utility covered by this study.

#### 2.4.3 Construction Grants

Construction grants have been issued for studies and projects of the sewerage utilities. There is no repayment required for grants.

The master plan study of the Helwan Sewerage System was made from proceeds of a grant from the Arab Fund. The Management and Tariff Studies, of which this report is a part, is being partially funded from a grant from USAID.

The large reconstruction program for the Cairo sewerage system is expected to be partially financed from a grant from USAID and from the OMB of Great Britain.

Other than the projects described above, it is assumed that all foreign currency capital requirements will be provided from loans. Hence grants are not expected to play a significant role in future construction funding.

### 3.0 GROWTH OF SEWERAGE SYSTEMS

In the development of tariffs consideration must be given to expected future conditions under which the utility will operate. In cities covered by this study, the expected growth in the number of people served is the key to the magnitude of any required change in tariffs. Growth dictates the number and size of facilities, and the requirements for capital and operating funds.

The factors of growth presented in this Section cover:

- Populations
- Number of customers
- System loads

#### 3.1 POPULATION

Population projections used in this report are based in part on Master Plan Studies of Wastewater Systems being conducted by others. Also used was the "Master Plan for the Development of Egyptian Storage and Distribution System for Food Grains" prepared by Black & Veatch International, Consulting Engineers in June, 1978.

Base data was taken from the "Preliminary Results of the General Population and Housing Census, 22/23 November 1976 in Egypt prepared by the Central Agency for Public Mobilization and Statistics (CAPMAS).

All population projections are based upon mid-year equivalent and represent reasonable estimates of the

number of persons expected to be living in areas served by water and wastewater systems. Rural areas in the various governorates are excluded. Populations for the year 2000 are substantially the same as used by consultants preparing the master plan studies. Projections for interim years vary from the projections of others.

As was previously stated in Section 1.0, criteria used as the basis for design must anticipate possible maximum requirements of the utility systems. However, for tariff design the minimum probable limits are used.

3.2 CUSTOMERS

The number of customers of sewerage utilities are defined, for the purposes of this report, as the number of buildings connected to the sanitary sewerage system. Currently, the agencies operating sewerage systems in the study cities have no record of the actual number or location of connections to the systems. All data contained herein is based upon the CAPMAS census of 1976.

A projection has been made of the number of customers, or connections to the sewerage systems. In each projection, it is assumed that about 98 percent of buildings in the areas served by sewers will be connected to the sewers by the year 2000. It is also assumed that population density will average 25 persons per building or connection by the year 2000.

### 3.3 SYSTEM LOADS

The loading of a sewerage system consists of the volume of wastewater collected and treated, and the strength of that wastewater expressed in milligrams per liter. Strength units consist of BOD, COD and suspended solids.

The operating agencies have no accurate record of the volume of sewage collected, treated or bypassed into drains, canals, lakes or the sea. There are no flow meters at any wastewater treatment plant. Similarly little accurate information is available as to the strengths of sewage. For purposes of this report, data developed by other consultants has been used as well as estimates based on pump ratings and estimated hours of operation at principal pump stations.

### 3.4 SUMMARY

The projection of population, customers and sewage flows is shown in Table 3.1, Appendix I to V.

#### 4.0 REVENUES

No sewerage user charges are imposed by either GOSSD or the Governorates. As a result almost all costs of operation and maintenance and capital improvements are financed by subsidies from the national treasury. GOSSD does obtain revenues from sources other than subsidies.

Generally, the sources of revenues for sewerage service include:

- Subsidies.
- Miscellaneous.

#### 4.1 SUBSIDIES

Subsidies received by the sewerage utilities include:

- Operating subsidies.
  - . Current operations.
  - . Head office.
- Capital subsidies.
  - . Capital costs.
  - . Head office.
  - . Project office.

##### 4.1.1 Operating Subsidies

Operating subsidies are the amounts received for operation and maintenance of the sewerage systems. Current operation subsidies for Cairo/Helwan and Alexandria are a matter of record. For the period 1973 through 1978, GOSSD divides operating subsidies between current operations

subsidies and head office subsidies. The latter covers the costs of GOSSD headquarters operations.

No reliable information was available at the Governorates of Ismailia, Port Said or Suez to specifically identify subsidies for sewerage system operations. These subsidies are a part of the overall Governorate operating budget. For this report, current operating subsidies for the Governorates sewerage utility operations are based on Governorate estimates of the level of cost of operations.

#### 4.1.2 Capital Subsidies

Capital subsidies cover the cost of capital improvements. GOSSD is the planning and construction organization for all sewerage systems covered by this study. All capital related subsidies are received by GOSSD. The distribution of these subsidies to the various cities is based upon data provided by GOSSD.

#### 4.2. MISCELLANEOUS REVENUES

Miscellaneous revenues received by the sewerage utilities consists of a small loan in 1974 for Cairo/Helwan and Alexandria construction, and:

- Connection fees.
- Revenues from sale of sludge.
- Other revenues.

##### 4.2.1 Connection Fees

Currently GOSSD contracts with others for the installation of sewer service connections. Under this procedure,

the contractor negotiates the price of the new connection with the customer. No record exists to indicate the magnitude of these charges. Nor is there any indication that a portion of the charges are ultimately transmitted to GOSSD.

No record was received from the Governorates of Ismailia, Port Said and Suez to indicate that connection charges are imposed or collected. Under procedures described in the investigative portion of this study, the cost of new connections is apparently born by the Governorates. The value of this service is not known.

#### 4.2.2 Sale of Sludge

GOSSD receives nominal revenues from the sale of sludge for fertilizer. No record was received from the Governorates as to amounts, if any, that was received from the sale of sludge.

#### 4.2.3 Other Revenues

GOSSD reports miscellaneous revenues described as:

- Fines of (or for) delay.
- Recovery of administrative expense.
- Other.

The precise nature of these revenues could not be obtained.

The Governorate of Ismailia reports a nominal income for Drainage Fees. This has been described as a fee for the collection and disposal of scavenger wastes.

The total amount of reported Miscellaneous Revenues is not significant when measured by the total cost of operations of the sewerage system in the study cities.

#### 4.3 SUMMARY

A summary of historical revenues from subsidies and other sources is shown in Table 4.1, Appendix I to V. A projection of estimated future miscellaneous revenues is also shown in Table 4.1. The projected amounts are nominal. They are considered as non-recurring and have not been used in the development of sewerage user charge tariffs.

## 5.0 REVENUE REQUIREMENTS

The gross revenue requirements of a sewerage utility can be computed on a:

- Cash basis.
- Utility basis.

The cash basis consists of the annual cash required by the sewerage utility to meet:

- Operation and maintenance expense.
- Debt service requirements.
- Routine annual additions.
- Other legal obligations.

The utility basis consists of the annual cash required by the sewerage utility for:

- Operation and maintenance expense.
- Depreciation expense.
- Other legal obligations.
- Return on investment.

The cost of major capital improvements are not considered as revenue requirements for purposes of tariff studies. The cost of constructing major improvements are normally funded from retained earnings or borrowed funds. If the latter source is used, payment of debt service has the effect of charging to current operations the cost of such facilities.

## 5.1 OPERATION AND MAINTENANCE EXPENSE

The costs of operation and maintenance are those costs incurred in the actual operation and maintenance of the sewerage utilities. Expenses are classified somewhat differently by the Governorates and by GOSSD. Operation and maintenance expense includes:

- Wages and benefits.
- Utilities.
- Chemicals.
- Other commodities.
- Services.
- Head office expenses.
- Miscellaneous expenses.

A summary of historical and projected operation and maintenance expense is shown in Table 5.1, Appendix I to V. It should be noted that a provision for billing expense has been included in the projected expenses. For purposes of this study it is assumed that billing will be conducted by the water utilities and that the sewerage utilities will pay for this service.

The historical data shown was taken from records of GOSSD and the Governorates. These records do not make a distinction between items normally considered as operation costs and the costs of repairs or maintenance. Similarly, the systems do not recognize the functional nature of various operations.

It should be noted that only minimal historical operation and maintenance expense records were obtained from the Port Said and Suez Governorates. As a result estimates were made of typical costs for the sewerage utility in these communities. The estimates are based upon the historical experience in Ismailia, Cairo and Alexandria, together with locally available operating data. Data obtained from other consultants was also considered in making projections of future costs.

#### 5.1.1 Wages and Benefits

In the "Report on Management Systems: Personnel Systems" issued concurrently with this report, recommendations are made that, if implemented, would give autonomy to the operating agencies in hiring and pay practices. Such a program is designed to reduce the number of employees in an operating agency. At the same time the technical capabilities of retained personnel would improve.

For purposes of projecting wages and benefits it is assumed that any savings that might accrue to the sewerage utilities as a result of the above stated policy would be offset by increasing the wage levels of the retained personnel. This concept may not be in accordance with existing or future Egyptian policy. Nevertheless, benefits from reductions in force should flow through to the remaining employees. The proportion of savings that accrue to remaining employees and to the utility can not presently be quantified. Hence the methods used in this study are considered appropriate for tariff purposes.

As with other operation and maintenance expenses, projections of wages and benefits are based upon expected growth in the sewerage systems. A nominal allowance for inflation has also been included in the projection.

#### 5.1.2 Utilities

"Utilities" consists mainly of the expense of purchased power. Electrical power supply is a subsidized utility in the Egyptian economy. Discussions with the Ministry of Electricity revealed that a review and study of existing electric rates is now underway. No information is available as to the possible results of that study. If that report indicates a major change in the charges for electric power, adjustment to rates, as described in Section 9, may be necessary.

It should be noted that GOSSD does not practise accrual accounting. Unpaid utility expenses at the end of the year are charged to Miscellaneous Other Expense when paid in the following year. This practice distorts historical costs. In the projections shown in Table 5.1, annual utility costs are properly classified.

#### 5.1.3 Head Office Expense

This classification is used to account for and charge to the operating utilities, costs of GOSSD headquarters and administrative functions. The classification is used in the historical and projected costs of sewerage operations in Cairo and Alexandria.

No such classification exists for the three Suez Canal cities. No evidence was obtained that wages and other expenses of the Governorates are apportioned to the sewerage operations in Ismailia, Port Said or Suez. In recognition that administrative supervision of a sewerage utility is required, an Administrative Expense has been estimated for projected conditions in the Suez Canal cities. This allowance is based generally on the ratio of Head Office expense to total expense, less utilities in Cairo and Alexandria, applied to similar expenses in Ismailia, Port Said and Suez.

## 5.2 DEBT SERVICE

Debt service consists of principal and interest payments on borrowed money. Section 2.4 of this report contains a discussion of a financing plan for the construction of major improvements. Table 2.2, Appendix I to V contains a detailed projection of debt service for the proposed construction. Debt Service may also include coverage provision.

### 5.2.1 Interest and Principal

Debt service projected herein is based upon loan conditions for existing debt. It also includes interest and principal payments on future debt based on criteria set out in Section 2.4.2. Future interest and principal payments are computed on the equal annual payment concept of debt amortization.

### 5.2.2 Debt Service Coverage

Debt service coverage is normally a requirement of loan agreements. Typically they provide that net earnings of the utility, after depreciation expense, shall be a specific percentage of annual interest and principal payments. Debt coverage is designed to protect the investor. If tariffs produce funds to meet the coverage requirements, debt service will be paid and the funds related to the coverage element will be available for other purposes.

Debt coverage used in this study is equal to 25 percent of annual interest and principal. Debt coverage creates funds in excess of operation and maintenance expense and interest and principal. These funds may be used for various purposes. As used in this report they are the source of funds for routine capital improvements.

Table 5.2, Appendix I to V contains a summary of combined debt service and debt coverage charges.

### 5.3 DEPRECIATION

Depreciation, in the accounting sense, is related to dollars previously spent. It is not a cash requirement from current revenues. Annual depreciation is the loss in investment value in the depreciable utility system each year. Annual investment in the system should exceed the estimated loss in investment value from depreciation.

Investment in the sewerage system is made by bond principal payments and annual additions from revenues. Normally these expenditures will equal or exceed the depreciation expense of the utility. Under conditions used in this report, the deferral of principal payment creates a condition where depreciation expense exceeds the investment from annual earning.

This condition results from depreciating property at an annual rate of from three to four percent immediately after construction. During the first five years no principal payment is made. Technically this results in depreciating property that has not yet been paid for. Over the life of the property and the life of the loan, this condition averages out. But in the early years, it appears that the integrity of the property is not maintained.

When considering revenue requirements on a cash basis, no need exists to provide for depreciation. Loss of value in the various sewerage systems is more than recovered by debt principal payments and routine annual additions. However, when considering revenue requirements on a utility basis, the inclusion of depreciation is essential. Everything else being equal, it is obvious that return on investment plus depreciation must at least equal debt service plus routine annual addition.

Tables 5.3, Appendices I to V contain cumulative balances of investment in utility plant in service, less land, through the year 2000. Against these balances, an estimated rate of depreciation has been applied to arrive at an estimate of annual depreciation expense based on original cost.

Although composite rates change as the ratio of investment in utility plant classes change, for purposes of this tariff study, the estimates are considered satisfactory. Balances in Table 5.3 do not include any provision for retirements. This may overstate depreciation expense in later years of the projection, but the amount is not believed to be significant.

#### 5.4 RETURN ON INVESTMENT

A return on investment is determined by dividing the difference between operating revenues and operating expenses by an average value of fixed assets. As provided in the terms of reference for this study, return shall be not less than six percent. Stated another way, if revenues are not equal to:

- Six percent of average value of fixed assets, plus
- Operation and maintenance expense, plus
- Depreciation expense

then revenues must be increased sufficiently to provide the return.

The average value of existing facilities should be based on valuations set forth in the "Report on Water and Sewerage Utilities Inventory and Valuation" issued concurrently with this report. The average value used was the:

- Estimated reproduction cost less depreciation at December 31, 1978.
- Estimates of future cost of construction as shown in Table 2.1, Appendix I to V.
- Adjustments for accrued depreciation for years subsequent to 1978.

The proforma balances as computed by the above criteria were used in determining the level of a six percent return on investment.

Section 5.4.7 of Appendix I of the contract for this study specifies that the:

- "Consultant shall also determine the gross annual revenue requirements -- on the -- principle - that gross annual revenues shall be sufficient to cover total operating costs, including depreciation -- and provide no less than 6% return on investment.

Return on investment shall be computed -- upon the current replacement cost of existing facilities."

Values developed in the Report and Water and Sewerage Utility Inventory and Valuation were used for the current replacement cost of existing facilities. These values, referred to as Reproduction Cost Less Depreciation (RCLD), represent a reasonable estimate of the value of major units of the various sewerage systems as of December 31, 1978.

Proforma return for years subsequent to 1978 was computed on a composite value consisting of the above referred to RCLD plus projected capital improvements. Deductions were made for accrued depreciation. Thus reproduction or replacement value was used for old property and cost of construction for new properties. The results of this determination are presented in Table 5.4, Appendix I to V.

Since Section 5.4.7 of Appendix I refers to replacement cost of existing facilities, the question arises, should plant in service be revalued periodically. If the value of property is used for return on investment, continued increases in plant value will quickly develop a rate of valuation far in excess of actual capital costs of the water utility. The basis for return in Egypt should be the original cost of property upon which funds were borrowed, and upon which debt service is paid. Continued inflation factors, if applied to actual costs, soon develop a value far in excess of the cash needs of the sewerage utility. Return is developed in Table 5.4, Appendix I to V.

Future calculations of the return earned by the sewerage utilities should use a valuation base of original cost less depreciation less the cost of property constructed from construction grants. This method was not used in this report because of the provisions of Section 5.4.7 of Appendix I; and because no information or estimate exists as to just how much of the future capital program will be subsidized by others.

## 5.5 SUMMARY OF REVENUE REQUIREMENTS

A comparative summary of revenue requirements is shown in Table 5.5, Appendix I to V.

The comparison of revenue requirements under the two methods shown in Table 5.5 raises the point:

- Should tariffs be based upon the cash needs of the utility.
- Should tariffs be based upon a return or utility basis.

If the major construction program set forth in the master plans and Section 2 of this report are constructed, the value of every sewerage utility will be doubled by 1980 or 1981. A six percent return on this ever increasing value can easily be prohibitive to the rate payer.

For example, in 1984 tariffs are to be adequate to recover total costs of the sewerage utilities. The following summary illustrates the difference between revenues from sewerage charges on a utility basis over revenues computed on a cash basis:

<u>Sewerage Utility</u>	<u>1984 Revenue Requirements</u>		
	<u>Cash Basis</u> LE 1000	<u>Utility Basis</u> LE 1000	<u>Ratio</u> %
Greater Cairo/Helwan	53,848	106,961	199
Alexandria	20,321	37,838	186
Ismailia	4,290	7,569	176
Port Said	4,504	6,435	143
Suez	6,418	10,210	159

The 1984 revenue requirements on a Utility Basis could be lowered somewhat by using original cost less depreciation basis for computing returns. The amount of such reduction has not been computed. The cost of 1979 to 1984 improvements represents the dominant portion of 1984 plant values used in Table 5.4. Changing its balances at December 31, 1978 from RCLD to OC would not make a significant difference in 1984 revenue requirements

Rates of tariffs developed and recommended in subsequent sections of this report are based upon the "Cash Basis" concept. This decision was made giving consideration to:

- The fact that any sewerage service charge will be a new cost imposed on the public.
- The need for comparable revenues to be developed for the water utilities.
- The general economic conditions affecting a large number of people.
- The concept that increases in utility rates should be minimized if at all possible.

Section 5.4.7 of Appendix I of the contract covering this study provides that Utility Basis revenue requirements will be developed. A rate computed on the same principles as the recommended rate but using Utility Basis revenue requirements has been prepared as a comparison of the effect of the two methods.

## 6.0 COST OF SERVICE ALLOCATIONS

The design of an equitable schedule of sewerage user charges requires the determination of the relative responsibilities of various classes of customers for the costs to be recovered. Cost responsibilities are based upon allocations of various elements of costs of service according to the relative service requirements of the respective customer classes. Factors considered in estimating service requirements include:

- Volume of sewage contributed.
- Strength of sewage contribution.
- Number of connections.
- Relative responsibility for infiltration/inflow.

### 6.1 COST OF SERVICE TO BE ALLOCATED

The total cost of service to be allocated is equal to the revenue to be derived from sewerage user charges. The cost of service allocations are based upon a test year in which costs are considered to be typical of the period that resulting rates are expected to be in effect.

For purposes of this report, a test year ending December 31, 1984 has been selected. This year is being used because:

- Substantial upgrading of the sewerage systems will have been achieved.
- Rates that fully recover gross revenue requirements by 1984 can be designed.

- Interim rates can be designed that will require minimal change in form through the transition period.

The cost of service to be allocated consists of total revenue requirements for the year 1984 as developed in Section 5.0. These revenue requirements consist of the revenue requirements developed on a Cash Basis and on a Utility Basis as shown in Table 5.5.

The Cash Basis costs to be allocated for each sewerage utility are:

- Operation and maintenance expense.
- Capital related costs.
  - . Debt service
  - . Routine annual improvement.

The Utility Basis costs to be allocated are:

- Operation and maintenance expense
- Capital related costs
  - . Depreciation expense
  - . Return on investment.

## 6.2 ALLOCATION TO FUNCTIONAL COST COMPONENTS

The costs of wastewater service to be derived from sewerage user charges are analyzed by system function as a basis for the subsequent allocation of costs to the various classes of customers. Each element of cost is

allocated to functional cost components on the basis of the parameter or parameters having significant influence on the magnitude of that element of cost. Operating expense items are allocated directly to appropriate cost components, while allocation of capital costs are based upon detailed allocations of related capital investment.

#### 6.2.1 Functional Cost Components

The functional cost components used in this study are:

- Volume related costs.
- Strength related costs.
  - . Suspended solids
  - . BOD<sub>5</sub>
- Customer related costs.

The use of these functional components is more easily understood than are other methods. Considering the nature of existing and proposed facilities, the method used permits a reasonable apportionment of costs on the basis of estimated use of the sewerage system by customer classes.

In some cases the functional cost component of capacity could also be used. However, for purposes of this study the capacity component is not considered necessary. By 1984, existing and proposed sewerage system facilities will still be operating at near design capacity making the use of a capacity factor redundant.

6.2.1.1 Volume cost. Volumes costs are those costs which vary with the volume of wastewater treated. Volume

costs include operation and maintenance expense elements of pumping, primary and secondary sedimentation and, where used, chlorination. Capital costs associated with plant investment in preliminary, primary and final sedimentation, together with pumping plant networks, are also allocated to the volume component.

6.2.1.2 Suspended solids cost. Suspended solids costs are those costs which vary with the quantity of suspended solids contained in treatment plant influent. Costs allocated to the suspended solids cost component include portions of both the operation and maintenance expense and capital costs of sludge pumping and disposal equipment.

6.2.1.3 Biochemical oxygen demand. Biochemical oxygen demand or BOD costs are those costs which vary with the BOD of the treatment plant influent. Costs allocated to the BOD component include all of the operation and maintenance expense and capital costs of aeration, reaeration, and waste activated sludge thickening, and portions of those costs related to sludge equipment.

6.2.1.4 Customer costs. Customer costs include the operation and maintenance expense for user accounting and collections and the maintenance of local lateral sewers.

6.2.1.5 Other costs. Indirect costs are allocated to the functional cost components on the basis of the allocation of direct costs. Administrative and general

expense and investment are allocated on the basis of the allocation of other cost elements.

6.2.1.6 Capacity cost. A capacity cost component has not been used in this study. As previously stated, in the 1984 Test Year the sewerage systems will still be operating at or near their design levels and excess capacity will not exist.

The capacity factor is used when excess capacity exists in either the treatment or collections system or both. For example, anticipating future needs a treatment facility might be constructed that is capable of treating twice the volume actually received at time of construction. In such a circumstance a capacity element would be appropriate in the cost of service allocation.

#### 6.2.2 Allocation of Operation and Maintenance Expense

Test year expenses have been restated to permit classification by plant functions. Expenses under the Egyptian Standardized System of Accounts are not in a usable form for allocation to cost components.

To permit the reclassification of expenses it was necessary to establish a model to be used as a basis for reclassification. The model included for each operating utility:

- Selection of a typical treatment facility.
- Development of ratios of typical costs.
- Apportionment of costs.

6.2.2.1 Typical facilities. For each utility operation a typical sewage treatment facility was selected as the model for determining ratios of typical costs. The parameters used for the model for each facility are shown in Table 6.1. The model selected is considered to represent average conditions. When new facilities are actually constructed, the ratios used might vary to some degree.

6.2.2.2 Development of ratios. Using the design criteria established as described in 6.2.2.1, ratios of equivalent costs were developed. In the absence of a system for estimating sewage treatment costs developed exclusively for Egypt, ratios were determined from the manual "Estimating Costs and Manpower Requirements for Conventional Wastewater Treatment Facilities, U.S. Environmental Protection Agency". This manual contains estimates of man hour requirement, pump hour requirements and similar factors for treatment facilities of various sizes. Using this information expected ratios can be developed by which costs can be allocated to plant function.

In addition an analysis was made of historical and projected future relationships in operation and maintenance expenses. This analysis was used to apportion costs between networks, pumping, treatment and administrative expenses. The present and probable future characteristics of each utility were considered separately in arriving at the values used in the apportionment.

6.2.2.3 Apportionment of costs. The 1984 Test Year operation and maintenance expenses are allocated to functional cost components based upon the data previously described. The result of that apportionment is shown in Table 6.2, Appendix I to V.

6.2.3 Allocation of Capital Related Costs

Capital related costs are allocated in proportion to the investment in Utility Plant in Service. As with operation and maintenance expense, a model was used to establish the general relationship between functional components of a typical sewerage system. This relationship was used to apportion capital related costs to functional components. The distribution of capital related costs is shown in Tables 6.3 and 6.4, Appendix I to V. Table 6.3 is computed on the Cash Basis. Utility Basis distribution is in Table 6.4.

6.3 SUMMARY OF ALLOCATION

The total allocation of Cash and Utility Basis cost of service to functional components for the 1984 Test Year is summarized in Table 6.5 and 6.6, Appendix I to V, respectively.

## 7.0 ALLOCATION TO CUSTOMER CLASSES

The responsibility of each customer class for its share of cost of service may be estimated by developing unit cost of service for each functional cost component. The application of these unit costs of service to the units of service contributed by the class permits the determination of a total cost to be recovered from each class of customers. To develop the class responsibility for cost of service it is necessary to:

- Identify customer classes
- Develop units of service
- Compute unit costs of service
- Compute cost of service allocations

### 7.1 CUSTOMER CLASSES

Neither GOSSD nor the Governorates have reliable information of the number and type of connections to the sewerage systems. Customer classes used in this report are based upon the classifications used by the General Organization of Greater Cairo Water Supply, the Alexandria Water General Authority and the Suez Canal Authority.

The customer classes established for this study are:

- Domestic
- Commercial and Institutional
- Industrial

Domestic customers consist of residential or apartment buildings and small commercial establishments. Commercial and Institutional customers consist of larger commercial enterprises such as larger stores, hotels and restaurants, mosques, churches and schools and governmental accounts. Industrial customers are manufacturing plants and large service organizations.

## 7.2 UNITS OF SERVICE

The units of service used in allocating costs to customer classes include:

- Number of connections.
  - . Equivalent meters
  - . Bills
- Estimated contributed volume together with an allowance for infiltration.
- Strengths of BOD and suspended solids.

### 7.2.1 Number of Connections

The number of connections have been estimated for the 1984 Test Year. There is no actual count of existing connections. Nor is there a record of the classification of connections.

The number of connections are based upon analysis of water customers taken from records of GOGCWS, AWGA and SCA. Studies by other consultants were also used. The number of connections are subdivided into two groups. The first, equivalent number of meters, recognizes the

relative relationship between connections or customers of various sizes. The second, number of bills, also takes into consideration the relative size of connections as well as probable variation in billing costs associated with larger customers.

7.2.1.1 Equivalent Meters. The use of equivalent meters permits the allocation of certain costs to larger customers. The relative capacity of connections and the investment associated with connections of various sizes is used as a measure upon which these allocations can be made. For purposes of the sewerage tariff studies, the following equivalent factors have been used:

EQUIVALENT METER RATIOS

<u>Meter Size</u> mm	<u>Equivalent Meter Ratio</u>	<u>Meter Size</u> mm	<u>Equivalent Meter Ratio</u>
20 and under	1	80	12.0
25	1.3	100	14.0
30	1.5	150	21.0
40	1.8	200	29.0
50	2.9	300	48.0

7.2.1.2 Bills. The unit of service classified as "Bills" represents an estimate of the number of bills to be issued annually for each customer class. In Cairo and Alexandria, bimonthly billing has been assumed. This is equal to six bills annually for each active customer. For the Suez Canal Cities, quarterly billings or four bills annually has been used. For purposes of developing sewer user charges, it is assumed that the same billing period will apply.

#### 4.2.2 Volume of Sewage

The volume of sewage allocated to customer classes is based upon data developed from records of GOGCWS and studies by other consultants. Allocated volume includes the estimated contributed volume of sewage plus an allowance for infiltration.

The estimate of contributed volume was developed by factoring class responsibility for water use by the difference in projected number of customers used. The volume of contributed wastes is assumed to be 80 percent of water use.

An allowance for infiltration was added to each customer class. Total system infiltration estimates were divided to classes using the number of equivalent meters for each class.

#### 7.2.3 Sewage Strengths

An estimate was made of the 1984 Test Year strengths allocated to customer classes. Neither GOSSD nor the Governorates have reliable records of the BOD or suspended solids strengths at plant influent or effluent. Neither do they have strength monitoring programs which would indicate large customer strength loadings. Total strength reduction in the treatment process is not a matter of record.

Strengths used in this report are based on estimates and tests of other consultants and the empirical experience of BVI-ATK Associates. Using this data, normalized strengths of sewage and degree of removal were developed for each of the operating sewerage utilities. This data was applied to projected volumes to arrive at the annual average quantities of BOD and suspended solids that should be removed. This concept assumes that plant facilities will be adequate to properly treat the total sewage load and that the sewage treatment facilities will be properly operated and maintained.

Provisions of a sewerage user ordinance are discussed in Section 8.9. Among the provisions of that ordinance is a prohibition on the deposit of sewage with excessive strengths or harmful wastes. For purposes of this study, no analysis has been made as to the potential for industrial pretreatment of waste. Until such time as a strength monitoring system is developed the source of strengths cannot be determined. As a result, the methods used to apportion BOD and suspended solids loadings are considered appropriate.

Total BOD and suspended solids loading were apportioned to customer classes in proportion to the allocated contributed sewage adjusted for local conditions reported by the other consultants and the operating agencies.

#### 7.2.4 Summary

A summary of units of service for the 1984 Test Year is shown in Table 7.1, Appendix I to V

#### 7.3 UNIT COST OF SERVICE

Unit cost of service is obtained by dividing the sum of customer class units of service into the total functional component cost of service. Unit cost of service on a Cash Basis is shown in Table 7.2, Appendix I to V. Unit cost of service on a Utility Basis is shown in Table 7.3, Appendix I to V.

#### 7.4 SUMMARY OF ALLOCATIONS

By multiplying customer class units of service by the unit cost of service, customer class responsibility can be established. Table 7.4, Appendix I to V shows customer class responsibility for test year Cash Basis cost of service. Table 7.5, Appendix I to V shows customer class responsibility for test year Utility Basis cost of service.

## 8.0 PROPOSED TARIFF SCHEDULES

Tariff schedules for sewerage service are presented in this section. Three rate schedules have been prepared using Cash Basis revenue requirements. These are:

- Recommended socio-economic or "Ability to Pay" rates
- Proposed Service Charge - Volume Charge rates
- Proposed combined Flat Rate - Service Charge - Volume Charge rates.

A fourth rate schedule based on Utility Basis revenue requirements has also been prepared:

- Proposed socio-economic or "Ability to Pay" rates

All rates are based on the following assumptions:

- Subsidies will be continued, as necessary, through 1983.
- The "Ability to Pay" rates contain schedules of implementation beginning in 1980. All others are based upon 1984 cost of service allocations.
- All connections shall be billed and there shall be no free service. In the event sewerage service is provided to selected users without charge, i.e. mosques, churches, schools, etc., the charges will be billed to the Governorate.
- All recommendations are based on the principle that total revenue requirements will be recovered by tariffs or specific subsidies.
- Supplemental tariff considerations are recommended.

### 8.1 BILL FREQUENCY ANALYSIS

A bill frequency analysis has been prepared of water usage. This analysis used actual billing records of the operating agencies. The analysis was based upon a hand tabulated sample of billings of GOGCWS and AWGA. An analysis for SCA was based upon computer records plus a hand tabulation of accounts of SCA facilities and employee residences. This was equivalent to a tabulation of actual billing.

The bill frequency analysis is used to establish patterns of water usage and to identify customers by type of service. Hence its value to a sewerage tariff study is the statistical data it provides on customer classes. Details of the bill frequency analysis are contained in Section 8. of the "Report on Water Utility Tariffs" issued concurrently with this report.

### 8.2 SOCIO-ECONOMIC OR "ABILITY TO PAY" RATES

The rates recommended for adoption are based upon an "Ability to Pay" or social concept using Cash Basis revenue requirements.

#### 8.2.1 Socio-Economic Considerations of Sewerage Tariffs

Discussions and interviews were held with a wide range of governmental and utility managers during this study.

One theme predominated when sewerage tariffs were discussed:

- If sewerage tariffs are to be enacted, they must be designed to recognize the ability of the customer to pay for service.

The effect of tariffs on the poor has not been studied in depth. The principal problem of socio-economic rates is the difficulty in identifying customers who are really entitled to relief. Section 5.4.11 of Appendix I of the contract for this study requires that a rate shall be presented for "residential users by income group, or a reasonable surrogate". A suggestion is that average rents may be a measure for determining income groups.

Preliminary analysis suggests that this is not practical in Egypt where rents have been controlled for many years. Determination of actual income levels is not an acceptable method. Property taxes, like rent have not changed with increased property values and thus are not a reliable measure of ability to pay.

For purposes of this Report on Sewerage Utility Tariffs, it is assumed that a reasonable measure of ability to pay is monthly water use. For purposes of determining tariffs, an allowable use has been established for the first block of the recommended rate. It is assumed that a usage of ten cubic meters per month per living unit is adequate to provide the basic sanitary requirements of the average occupants per living unit.

### 8.2.2 Basis for Rate Design

The sewerage user charges recommended for adoption are shown in Table 8.1, Appendix I to V. The rates are based on Cash Basis revenue requirements and contain service charge and inverted block charges. The inverted block charges increase with increased usage. The rates also contain provisions for extra strength surcharges related to total volume and strengths of BOD and/or suspended solids.

Rates recommended in Table 8.1 provide for staged implementation of tariffs. This implementation will permit full recovery of projected revenue requirements by 1984. Ideally staged implementation over a five year period would provide that twenty percent of the 1984 Test Year rate should be adopted for 1980, and in even annual increases until 100 percent of the rate is implemented.

It was anticipated that this procedure would require continued subsidy for operating and capital cost during the period 1980-1983. However, when projections were actually completed, it developed that revenue requirements did not increase uniformly over the implementation period. As a result rates recommended for 1980 and each subsequent year through 1983 sometimes recover total costs for these years requiring varying degrees of subsidy. This subject is discussed more thoroughly in Section 8.10.2.

The recommended rates are based upon an "Ability to Pay" concept. Under this concept it is assumed that water use is an adequate measure of ability to pay. The assumption is that families with very limited incomes reside in smaller homes with inadequate or substandard plumbing and hence use less water than the more affluent customer. For purposes of this report it is assumed that low income customers use less than 10 cubic meters of water each month. Moreover, it is also assumed that this quantity is adequate to meet basic sanitary needs. This criteria falls within ranges of water needs set forth by the World Health Organization for minimum water requirement.

An additional consideration in developing the charge was to limit the combined water and sewerage charge to low income families to from three to four percent of their annual earnings. By 1984 it is estimated that the average annual income for this group will approximate LE 500 per year. This establishes the combined charge for water and sewerage service from LE 15 to LE 20 per year. Assuming one-half this amount is for sewerage service, an average charge of around 60 to 80 milliemes per cubic meter of water billed would not be excessive. The recommended rates achieve this objective.

### 8.3 SERVICE CHARGE - VOLUME CHARGE RATES

A Service Charge - Volume Charge rate is proposed in Table 8.2, Appendix I to V. This rate is designed to recover total Cash Basis cost of service allocated to customer classes. The volume related element of the rate

contains a standard charge per cubic meter of water use. It does not fluctuate with increasing usage. As a result the rate does not provide for social considerations. The rate contains a provision for extra strength surcharge.

The rate presented in Table 8.2 is based on revenue requirements for the 1984 Test Year. If it is desired to adopt this rate in increments, beginning for example in 1980, it is recommended that charges equal to twenty percent of the 1984 rate be used. The rate would then be increased to forty percent in 1981, sixty percent in 1982 and eighty percent in 1983.

#### 8.4 COMBINED FLAT RATE SERVICE CHARGE - VOLUME CHARGE RATES

Table 8.3, Appendix I to V presents a proposed combined rate. The first part of this rate applies only to Domestic Customers. The Domestic rate is designed on a "Flat Rate" concept. The second part of the rate applies to Non Domestic Customers and is a Service Charge - Volume Charge rate exactly as shown for Non Domestic Customers in Table 8.2.

The Flat Rate concept applicable to Domestic customers is based on a standard charge per billing period. The charge is based upon the number of rooms in the building connected to the sewer. The rate can be considered as meeting social criteria. Assuming that the poor or lower income user lives in small flats, the charge per family

will be less than for the more affluent who live in large flats or villas.

The proposed rate is based on cost of service divided by the estimated rooms per living unit in an average building. Information on the average number of living units per building and rooms per living unit was obtained from the report, "The Preliminary Results of the General Population and Housing Census, 22/23 November 1976, in Egypt", prepared by the Central Agency for Public Mobilisation and Statistics (CAPMAS).

#### 8.5 UTILITY BASIS "ABILITY TO PAY" RATES

A proposed alternative rate based on Utility Basis revenue requirements is shown in Table 8.4, Appendix I to V. This rate is similar in form to the rate recommended in Table 8.1. With the exception of the first blocks the charge in each usage block has been increased to meet the increased costs associated with the Utility Basis revenue requirement.

The charge in the first block and in the Domestic class service charge is the same as in Table 8.1. This has been done to preserve the ability to pay concept of small users of water as described in Section 8.2.

#### 8.6 EXTRA STRENGTH SURCHARGES

Each rate includes a recommended Extra Strength Surcharge. This charge is applicable to large industrial customers whose wastes contain excessive strengths of BOD and suspended solids. The charges are designed to recover costs from the waste contributor whose strengths are in excess of average and who create the need for additional strength related treatment facilities.

At present none of the sewerage utilities has an effective strength monitoring program. Such a program should be established and the recommended charges collected.

#### 8.7 MARGINAL COST RATES

For purposes of analysis, marginal cost or incremental costs were computed. This information was intended as a sensitivity test of the recommended rate for the over 10,000 cubic meter usage blocks. The costs of the sewerage utility capital improvement results in average incremental costs far in excess of the recommended charges. No marginal or incremental costs were used in the Sewerage Utility Tariff Study.

#### 8.8 EFFECT OF SEWER USER CHARGES ON WATER USE

It is assumed that sewer user charges will be billed as part of the water bill. The imposition of the charge coupled with increased charges for water should result in resistance to the charges by consumers. Typically this

resistance disappears as consumers become accustomed to paying the charges. A more complete discussion of this matter is contained in Section 9.1.3 of the Report on Water Tariffs.

#### 8.9 OTHER TARIFF CONSIDERATIONS

In addition to establishing a charge for sewerage service, properly enacted tariffs should include other regulations covering the provision for such service.

The subjects to be included in a sewer use law or tariff include, but are not necessarily limited to, the following:

- All buildings adjacent to sewers must be connected to the sewer.
- Customers connected to sanitary sewers but with private water sources, will provide and maintain water meters on the private source for purposes of measuring volume of sewage contribution.
- Industrial customers with unusual strengths or wastewater of unusual characteristics will pretreat sewage.
- There shall be no free sewerage service.
- Connections to sewers will conform to specifications and plans designed by the operating utility.
- All new customers must submit an application for new connections. It is recommended that the customer pay for the cost of the connection plus an application fee.
- Consideration should be given for establishing a Sewerage System Development Fee. This would be assessed against new buildings as a fee to pay for the increment of available capacity used by the new connection.
- Penalties or fines should be established for:
  - . Failure to pay charges when due
  - . Illegal connections

- . Depositing illegal wastes to sanitary sewers
- . Pollution of the River Nile and canals
- Regulations should cover:
  - . Making application for new services
  - . Termination of service
  - . Prohibited discharges
  - . Industrial discharges
  - . Pretreatment of waste
  - . Scavenger wastes
  - . Sale of dewatered sludge

A suggested form of a typical sewer use ordinance or regulation including tariffs is included herewith as Exhibit 8.1.

## 8.10 EVALUATION OF PROPOSED TARIFFS

The adequacy of proposed sewerage tariffs is demonstrated by comparing revenue requirements with proforma revenues at the proposed rates.

### 8.10.1 Cost of Service Comparisons

This comparison is shown in Tables 8.5 to 8.8, Appendix I to V. As appropriate, comparison covers Cash Basis or Utility Basis cost of service allocations with proforma revenues at the proposed rates.

The comparisons show that each rate recovers total projected cost of service. It should be noted that the two "Ability to Pay" rates do not recover customer class

costs equitably. The other two rates recover total costs and also the approximate total of allocated customer class cost of service.

These comparisons clearly demonstrate that socio-economic considerations create a system of cross subsidization between customer classes. Total costs are recovered under all four tariffs. However, under the "Ability to Pay" tariffs there is substantial subsidization of the Domestic class by the Industrial and Commercial and Institutional classes.

#### 8.10.2 Required Subsidies

Tables 8.9 and 8.10 show the relationship between total revenue requirements in the 1980-1984 study period and projected revenues under the two "Ability to Pay" rates. Table 8.9 covers Cash Basis revenue requirements and proforma revenues under rates shown in Table 8.1. Table 8.10 shows Utility Basis revenue requirements and estimated revenues under rates shown in Table 8.4.

Some subsidy is required but the amount varies by city. The variation is the result of differing schedules and amounts in the capital improvement program and in growth in the sewerage utility. Generally, the projections show a subsidy is required in each year until 1984. For Cairo, projected revenues indicate that on a Cash Basis, subsidies are required only in 1980 and 1982. In Suez, the recommended schedule for implementation of rates permits total recovery of Cash Basis revenue requirements, without subsidy, in each year, 1980 to 1984.

TYPICAL SEWERAGE UTILITY  
RULES AND REGULATIONS

- Article 1. Sewerage System Rules
- Article 2. Sewer Use Regulations
- Article 3. Sewerage System Rates, Charges and Fees

---

ARTICLE 1. SEWERAGE SYSTEM RULES

Section 1.1 CONTROL. The sewerage system shall be under the direct supervision of the Chairman of \_\_\_\_\_ . Such Organization to hereinafter be referred to as the Utility.

Section 1.2 RULES. The rates, rules and regulations promulgated by the Utility shall be considered a part of the contract with every person, firm or corporation serviced by the sewerage system. Each person, firm or corporation shall be bound thereby, and in case of violation of any rules or regulations in force, penalties may be imposed, the water may be cut off from the premises or place of violation or the sewer connection plugged and service not restored again except by an order of the Utilities after satisfactory assurance that there shall be no further cause for complaint.

Section 1.3 USE. There shall be no free sewerage service.

Section 1.4 BILLING ACCOUNTS. Once each billing period, unless impossible, a bill shall be rendered the customer. Sewer accounts shall be payable periodically before a date

shown on the statement. So far as practicable, the statement shall be rendered five (5) days before date of payment. If bills are not paid when due, a penalty of 10 per cent shall be added and collected. When any bill is ten (10) days in default, rendition of water service shall be discontinued until all bills and penalties have been paid.

The Utility shall have authority to make corrections or refund of overpayments on improper sewer bills due to errors in the Utility but shall have no authority to remit or diminish bills for any other reason.

Ref.: Fee for Turning On Service, Article 3, Section 3.

Section 1.5 PRIVATE WATER SOURCE. Customers connected to sanitary sewers but with private water sources, will provide and maintain water meters on the private source for the purposes of measuring volume of sewage contribution.

Section 1.6 DEPOSIT REQUIRED. The Utilities may, at its discretion, require a cash deposit from any sewer user to protect the Utility from loss. The amount of the deposit shall be based on the purpose for which the sewer is required. The deposit shall be refunded to the consumer whenever sewer service is discontinued and payment made therefor in full.

TYPICAL SEWERAGE UTILITY  
RULES AND REGULATIONS

Section 1.7. PENALTY. Any person, firm or corporation violating the provisions of this article shall, upon conviction thereof, be fined in accordance with the penalties provided in Section 3.4 for each offense, and in case of continued violation, each day during which such violation continues shall be and constitute a separate offense.

Ref.: Penalties. Article 3, Section 3.4

TYPICAL SEWERAGE UTILITY  
RULES AND REGULATIONS

ARTICLE 2. SEWER USE REGULATIONS

Section 2.1 It shall be unlawful for any person to place, deposit, or permit to be deposited in any unsanitary manner on public or private property any human or animal excrement, garbage, or objectionable waste except in officially designated places established specifically for deposit of these wastes.

Section 2.2 It shall be unlawful to discharge to any natural outlet or storm drain any wastewater or other polluted waters except where suitable treatment has been provided in accordance with all provisions of this enactment.

Section 2.3 Except as hereinafter provided, it shall be unlawful to construct or maintain any privy, or privy vault, septic tank, cesspool, or other facility intended or used for the disposal of wastewaters.

Section 2.4 The owners of all houses, buildings, or properties used for human occupancy, employment, recreation, or other purposes abutting on any street, or right-of-way in which there is now located or may in the future be located a public or combined sewer of the Utility, is required at the owner's expense to install suitable toilet facilities therein and connect such facilities to the proper public sewer in accordance with provisions of this enactment, within ninety (90) days after date of official notice to do so, provided that said public sewer is within 100 meters of the property line.

TYPICAL SEWERAGE UTILITY  
RULES AND REGULATIONS

Section 2.5. Where a public sanitary or combined sewer is not available under the provisions of Section 2.4, the building sewer shall be connected to a private wastewater disposal system complying with the provisions of this Article.

Section 2.6. Before beginning construction of private wastewater disposal system the owner shall first obtain an official written permit from the Utility. The application for such a permit shall be made on a form furnished by the Utility which the applicant shall supplement by plans, specifications and other information required by the Utility. A permit fee shall be paid at the time the application is accepted by the Utility.

Section 2.7. A permit for a private wastewater disposal system shall not become effective until the installation is completed and is approved by the Utility. An authorized representative of the Utility shall be allowed to inspect the installation at any stage of the construction and the applicant shall notify the Utility when the work is ready for final inspection and before any underground portions are covered.

Section 2.8. The design of a private wastewater system shall comply with the standards of the Utility as regards type, location, and layout of the system. No permit shall be issued for any private wastewater system employing subsurface soil absorption where the area of the property is less than fifteen hundred (1500) square metres. No septic tank or cesspool shall be permitted to discharge to any natural outlet or storm drain.

TYPICAL SEWERAGE UTILITY  
RULES AND REGULATIONS

Section 2.9. At such time as a public sewer becomes available to a property served by a private wastewater disposal system, as provided in Section 2.4, a direct connection shall be made to the public sewer within sixty (60) days in compliance with this ordinance and any septic tanks, cesspools and similar private wastewater disposal facilities shall be cleaned of sludge and filled with suitable material as approved by the Utility.

Section 2.10. The owners shall operate and maintain private wastewater disposal facilities in a sanitary manner at all times. The cleaning out or pumping of sludge from septic tanks and cesspools shall be done by the Utility's maintenance crews or by a private contractor licensed by the Utility.

Section 2.11. No person shall uncover, make any connections with or opening into, use alter, or disturb any public sewer or appurtenance thereof without first obtaining a written permit to do so from the Utility.

Section 2.12. There shall be two classes of building sewer permits; (1) residential, commercial and institutional, and (2) industrial. For either class the owner or his authorized representative shall make an application for a building sewer and/or connection on an official application form furnished by the Utility. The permit application shall be accompanied by plans, specifications

TYPICAL SEWERAGE UTILITY  
RULES AND REGULATIONS

and other information required by the Utility. A permit/ inspection fee will be charged. The fee shall be paid to the Utility at the time the application is submitted. The fee will include the cost of processing the application and either the average cost of a sewer connection, if the connection is to be made by the Utility, or an inspection fee, if the connection is to be made by an independent contractor.

Ref.: Fees. Article 3, Section 3.2

Section 2.13. A separate and independent building sewer shall be provided for every building; except where one building stands at the rear of another on an interior lot and no private sewer is available or can be constructed to the rear building through an adjoining alley, court, yard, or driveway. In this latter case, the building sewer at the front building may be extended to the rear building and the whole considered as one building sewer.

Section 2.14. Old building sewers may be used in connection with new buildings only when they are found, on examination and test by the Utility, to meet all requirements of this enactment.

Section 2.15. The size, slope, alignment, materials of construction of building sewer, and the methods to be used in excavating, placing of pipe, jointing, testing, and backfilling the trench, shall all conform to the requirements, rules and regulations of the Utility.

TYPICAL SEWERAGE UTILITY  
RULES AND REGULATIONS

Section 2.16. Whenever possible, the building sewer shall be brought to the building at an elevation below the basement floor. In all buildings in which any building drain is too low to permit gravity flow to the public sewer, sanitary sewage carried by such building drain shall be pumped or otherwise lifted by a means approved by the Utility and discharged to the building sewer.

Section 2.17. No person(s) shall make connection of roof downspouts, foundation drains, areaway drains, or other sources of surface runoff or groundwater to a building sewer or building drain which in turn is connected directly or indirectly to a public sanitary sewer unless such connection is approved by the Utility for purposes of disposal of polluted surface drainage.

Section 2.18. The connection of the building sewer into the public sewer shall conform to the requirements of the building and plumbing code or other applicable rules and regulations of the Utility. Any deviation from the prescribed procedures and materials must be approved by the Utility before installation.

Section 2.19. An applicant for the building sewer permit shall notify the Utility when the building sewer is ready for inspection and connection to the public sewer.

Section 2.20. Streets, sidewalks, parkways, and other public property disturbed in the course of the work shall be restored in a manner satisfactory to the Utility.

TYPICAL SEWERAGE UTILITY  
RULES AND REGULATIONS

Section 2.21. There shall be no discharge of industrial wastewaters directly or indirectly to the sewerage system of the Utility without having first obtained a permit from the Utility in accordance with this enactment. Such a permit shall be in two parts; (1) for the construction of the building sewer and its connection to the public sewer, as set forth in Sections 2.12 through 2.20 above and as required herinafter in Sections 2.22 through 2.30 and (2) for the control of wastewater discharges. The permit shall restrict the quality and quantity characteristics of the discharge as set forth in Sections 2.34 through 2.40 of this enactment and in addition, may require pretreatment of the industrial wastewater, restriction of peak rates of discharge, the discharge of certain wastewater only to specified sewers or drains, relocation of a point of discharge, prohibition of certain wastewater components not included in Sections 2.34 through 2.40; restriction of discharge to certain hours of the day and any other conditions as may be required to carry out the purpose of this enactment. All costs of construction, operation and maintenance of any pretreatment works at the industrial plant shall be borne by the owner.

Section 2.22. The permit issued by the Utility for an industrial wastewater discharge shall contain restrictions and conditions as provided for in Section 2.21. For a discharge occurring at the time of this enactment, a discharger shall be allowed one hundred-twenty (120) days to comply with permit conditions. For a new discharge, compliance shall begin immediately.

TYPICAL SEWERAGE UTILITY  
RULES AND REGULATIONS

The permit conditions shall be for the control of the rate of discharge and/or the control of discharge quality. If for any reason the discharge quantity and/or quality is to be changed because of increase in plant production, installation of new or different processes or change in product, application for a new or amended permit shall be made through regular procedures described above. A new or amended permit shall be required for an increase in average daily flow of fifteen (15) percent or more.

Section 2.23. The Utility may suspend a permit for industrial wastewater discharge for a period not to exceed forty-five (45) day when such suspension is necessary to stop a discharge which presents an imminent hazard to public health, safety, or welfare, to the local environment or to the Utility's facilities. Any discharger notified in writing of a suspension of his permit shall immediately comply with the order to suspend discharge. In the event of failure of the discharger to comply voluntarily with the suspension order, the Utility shall take such legal steps as are necessary to insure compliance. After suspension of a permit, the Utility may reinstate the permit or require an amended permit as appropriate for the purposes of this enactment.

Section 2.24. The Utility may revoke a permit for industrial wastewater discharge upon finding that the conditions of the permit or any provision of this enactment have been violated. Revocation shall be ordered only after a hearing on the question has been held by the Utility. At this hearing the discharger may appear personally or through counsel, cross examine witnesses and present evidence in his own behalf.

TYPICAL SEWERAGE UTILITY  
RULES AND REGULATIONS

Notice of the hearing shall be given to the discharger at least fifteen (15) days prior to the date of the hearing. Any discharger whose permit has been revoked shall stop immediately all discharge of industrial wastewaters to the public sewer(s). The Utility may disconnect or permanently block from the public sewer the building sewer of any discharger whose permit has been revoked if such action is needed to insure compliance with the order of revocation.

Section 2.25. All domestic or sanitary wastewaters from toilets, showers, drinking fountains, etc. in an industrial plant, shall be kept separate from all industrial wastewaters until the industrial wastewaters have passed through the control manhole described in Section 2.26.

Section 2.26. A control manhole of a design approved by the Utility shall be constructed by the discharger, if required, as a condition of the permit. The control manhole shall facilitate inspection, sampling, and flow measurement by personnel of the Utility. The control manhole shall be located outside the plant fence or, if within the plant fence, access at all times to the manhole by Utility personnel shall be guaranteed by the discharger. The control manhole may be used as a junction manhole for domestic sewerage sampling and measuring point.

TYPICAL SEWERAGE UTILITY  
RULES AND REGULATIONS

Section 2.27. Periodic measurements of flow rates and volumes shall be made and sampling of the industrial wastewaters shall be carried out by conditions of the permit. The frequency of such measurements and sampling, and the scope thereof shall be specified in the permit. All sampling analyses and flow measurements shall be performed by a laboratory selected by the discharger and approved by the Utility. The results of the measurements and analyses shall be verified by a responsible administrative official of the industrial discharger under penalty of perjury and submitted to the Utility as specified in the permit. All wastewater analyses shall be in accordance with the procedures contained in "Standard Methods for the Examination of Water and Wastewater", American Public Health Association.

Section 2.28. All dischargers required by the conditions of the permit to make periodic measurements of flow shall furnish and install at the control manhole or other appropriate location a calibrated flume, weir or flow meter of similar device approved by the Utility suitable to measure the industrial wastewater flow rate and total volume. A flow indicating, totaling, and recording register may be required by the Utility. In lieu of flow measurements the Utility may accept records of water usage and adjust the flow volumes by suitable factors to determine peak and average flow rates for the specific discharge. The discharger shall submit to the Utility the results of all measurements and analyses as soon as they are available but not less frequently than once monthly or in accordance with the terms of the permit.

TYPICAL SEWERAGE UTILITY  
RULES AND REGULATIONS

Section 2.29. Measurements to verify the wastewater flows and quantities of waste constituents reported by the industrial dischargers will be conducted on a random basis by personnel of the Utility. Should measurements or other investigations reveal that the industrial discharger is discharging a flow rate, or quantity of flow, or quantities of constituents significantly in excess of that stated on the permit, or in excess of the quantities reported to the Utility by the discharger, the discharger shall be required to apply for an amended industrial wastewater permit. If such verifying measurements and analyses indicate violation of the prohibitions on discharges as set forth in Sections 2.34 through 2.40, the discharger shall be required to stop the discharge of wastewaters within twenty-four (24) hours of notice, shall correct the condition causing the violation in a manner approved by the Utility, and make a new application for an industrial wastewater discharge permit. The discharger shall also pay any penalties imposed under provisions of this enactment prior to application for a new permit.

Section 2.30. Designs of pretreatment works shall be approved by the Utility prior to beginning construction. The Utility shall be allowed access to the site at any time during construction of the pretreatment works for the purposes of inspection.

TYPICAL SEWERAGE UTILITY  
RULES AND REGULATIONS

Section 2.31. Sample Private Waste Disposal Application for Permit

PRIVATE WASTE DISPOSAL APPLICATION

to the Utility .....

The undersigned, being the ..... of the  
(owner, owner's agent)

property located at .....  
(number) (street)

does hereby request a permit to install sanitary sewage disposal facilities to serve the .....  
(residence, commercial building, etc.)

at the location.

1. The proposed facilities include:.....

.....  
to be constructed in complete accordance with the plans and specifications attached hereunto as Exhibit "A".

2. The area of the property is ..... square metres.

3. The name and address of the person or firm who will perform the work is .....

4. The maximum number of persons to be served by the proposed facilities is: .....

5. The locations and nature of all sources of private or public water supply within thirty (30) metres of any boundary of said property are shown on the plat (map attached hereunto as Exhibit "B")

In consideration of the granting of this permit, the undersigned agrees:

1. To furnish any additional information relating to the proposed work that shall be requested by the Utility.

2. To accept and abide by all provisions of Ordinance No..... of the Utility of....., and of all other pertinent ordinances or regulations that may be adopted in the future.

3. To operate and maintain the wastewater disposal facilities covered by this application in a sanitary manner at all times, in compliance with all requirements of \_\_\_\_\_, and at no expense to the Utility.

4. To notify the Utility at least twenty-four (24) hours prior to commencement of the work proposed, and again at least twenty-four (24) hours prior to the covering of any underground portions of the installation.

Date: ..... Signed .....  
(applicant)

.....  
(address of applicant)

LE .....fee paid. ....  
Application approved and (certification of Utility treasurer)  
permit issued:

Date: ..... Signed .....  
(for the Utility)

TYPICAL SEWERAGE UTILITY  
RULES AND REGULATIONS

Section 2.32 Sample Application for Residential and Commercial  
Sewer Connection permit.

RESIDENTIAL OR COMMERCIAL BUILDING  
SEWER CONNECTION APPLICATION

To the Utility .....  
The undersigned, being the .....of the  
(owner, owner's agent)  
property located at ..... does  
(number) (street)  
hereby request a permit to install and connect a building sewer  
to serve the .....  
(residence, commercial building, etc.)  
at said location.

1. The following indicated fixtures will be connected to the  
proposed building sewer:

Number	Fixture	Number	Fixture
.....	Kitchen Sinks	.....	Water closets
.....	Lavatory Sinks	.....	Bathtubs
.....	Laundry tubs	.....	Showers
.....	Urinals	.....	Bidets

- Specify other fixtures .....
- The maximum number of persons who will use the above fixtures is .....
  - The name and address of the person or firm who will perform the proposed work is .....
  - Plans and specifications for the proposed building sewer are attached hereunto as Exhibit "A".

In consideration of the granting of this permit, the undersigned agrees:

- To accept and abide by all provisions of Enactment No..... of the Utility....., and of all other pertinent ordinances or regulations that may be adopted in the future.
- To maintain the building sewer at no expense to the Utility.
- To notify the Utility when the building sewer is ready for inspection and connection to the public sewer, but before any portion of the work is covered.

Date: ..... Signed .....  
(applicant)  
.....  
(address of applicant)  
LE.....fee paid. ....  
Application approved and permit (certification by Utility treasurer)  
issued:  
Date:..... Signed .....  
(for the Utility)

TYPICAL SEWERAGE UTILITY  
RULES AND REGULATIONS

Section 2.33. Sample Application for Industrial Sewer  
Connection Permit.

INDUSTRIAL SEWER CONNECTION APPLICATION

To the Utility .....:  
The undersigned being the .....of the  
(owner, lessee, tenant, etc.)  
property located at .....  
.....  
does hereby request a permit to .....an industrial  
(install, use)  
sewer connection serving the ....., which company  
(name of company)  
is engaged in .....  
.....  
at said location.

1. A plan of the property showing accurately all sewers and drains now existing is attached hereunto as Exhibit "A".
2. Plans and specifications covering any work proposed to be performed under this permit is attached hereunto as Exhibit "B".
3. A complete schedule of all process waters and industrial wastes produced or expected to be produced at said property, including a description of the character of each waste, the daily volume and maximum rates of discharge, and representative analyses, is attached hereunto as Exhibit "C".
4. The name and address of the person or firm who will perform the work covered by this permit is .....

In consideration of the granting of this permit the undersigned agrees:

1. To furnish any additional information relating to the installation or use of the industrial sewer for which this permit is sought as may be requested by the Utility.
2. To accept and abide by all provisions of Enactment No..... of the Utility ....., and of all other pertinent ordinances or regulations that may be adopted in the future.
3. To operate and maintain any waste pretreatment facilities, as may be required as a condition of the acceptance into the public sewer of the industrial wastes involved, in an efficient manner at all times, and at no expense to the Utility.
4. To cooperate at all times with the Utility and its representatives in their inspecting, sampling, and study of the industrial wastes, and any facilities provided for pretreatment.
5. To notify the Utility immediately in the event of any accident, negligence, or other occurrence that occasions discharge to the public sewers of any wastes or process waters not covered by this permit.

Date ..... Signed.....  
(applicant)

LE .....fee paid .....  
Application approved and permit granted: (address of applicant)

.....  
(certification of Utility treasurer)  
Date:..... Signed .....  
(for the Utility)

TYPICAL SEWERAGE UTILITY  
RULES AND REGULATIONS

Section 2.34. Prohibition on Discharges. No discharger shall discharge wastes to a public sewer which cause threaten to cause, or are capable of causing either alone or by interaction with other substances:

- (a) a fire or explosion;
- (b) obstruction of flow or injury to the treatment works; objectionable substances include but are not limited to asphalt, dead animals, offal, ashes, sand, mud, straw, mazout residue, industrial process shavings, metal, glass, rags, feathers, tar, wood, whole blood, paunch manure, bones, hair, fleshings, and paper products either whole or ground.
- (c) danger to life or safety of personnel;
- (d) a strong offensive odor or prevention of the effective maintenance or operation of the treatment works.
- (e) air pollution by the release of toxic or malodorous gases or malodorous gas-producing substances;
- (f) interference with wastewater treatment processes;
- (g) the Utility's effluent or any other product of a treatment process, residues, sludges, or scums, to be unsuitable for reclamation and reuse or to interfere with the reclamation process;
- (h) a detrimental environmental impact or a nuisance in the waters into which the Utility discharges wastewaters, or a condition unacceptable to any public agency having regulatory jurisdiction over the Utility.

TYPICAL SEWERAGE UTILITY  
RULES AND REGULATIONS

- (i) discoloration or any other condition in the quality of the Utility's treatment works effluent such that receiving water quality requirements established by law cannot be met;
- (j) conditions at or near the Utility's treatment works which violate any statute or any rule, regulation, or enactment of any public agency or regulatory body;
- (k) the Utility's treatment works to be overloaded or cause excessive Utility collection or treatment costs.

Section 2.35. Prohibition on Storm Drainage and Ground Water.

Stormwater, groundwater, rainwater, street drainage, subsurface drainage or yard drainage shall not be discharged through direct or indirect connections to a public sewer unless a permit is issued by the Utility. The Utility may approve the discharge of such water only when no reasonable alternative method of disposal is available. If a permit is granted for the discharge of such water into a community sewer, the user shall pay the applicable charges and fees and meet such other conditions as required by the Utility.

Section 2.36. Prohibition on Unpolluted Water. Unpolluted water, including, but not limited to cooling water, process water or blow-down from cooling towers or evaporative coolers shall not be discharged through direct or indirect connection to a public sewer unless a permit is issued by the Utility. The Utility may approve the discharge of such water only when no reasonable alternative method of disposal is available. If a permit is granted for the discharge of such water into a community sewer,

TYPICAL SEWERAGE UTILITY  
RULES AND REGULATIONS

the user shall pay the applicable charges and fees and shall meet such other conditions as required by the Utility.

Section 2.37. Limitations on Radioactive Wastes. No person shall discharge or cause to be discharged, any radioactive waste into a public sewer except:

- (a) when the person is authorized to use radioactive materials by the governmental agency empowered to regulate the use of radioactive materials, and
- (b) when the waste is discharged in strict conformity with current regulations and recommendations for safe disposal, and
- (c) when the person is in compliance with all rules and regulations of all other applicable regulatory agencies.

Section 2.38. Limitations on Point of Discharge. No person shall discharge any substances directly into a manhole or other opening in a public sewer other than through an approved building sewer, unless he has been issued a permit by the Utility. If a permit is issued for such direct discharge the user shall pay the applicable charges and fees and shall meet such other conditions as required by the Utility.

TYPICAL SEWERAGE UTILITY  
RULES AND REGULATIONS

Section 2.39. Holding Tank Waste. No person shall discharge any holding tank waste into a public sewer unless he has been issued a permit by the Utility. Unless otherwise allowed by the Utility under the terms and conditions of the permit, a separate permit must be secured for each separate discharge. This permit will state the specific location of discharge, the time of day the discharge is to occur, the volume of the discharge and the wastewater constituents and characteristics. If a permit is granted for discharge of such waste into a public sewer, the user shall pay the applicable charges and fees and shall meet such other conditions as required by the Utility.

Section 2.40. Limitations on Wastewater Strength.

.01 No person shall discharge wastewater containing an excess of:

- 0.1 mg/L arsenic
- 0.2 mg/L cadmium
- 2.0 mg/L copper
- 1.0 mg/L cyanide
- 1.0 mg/L lead
- 0.01 mg/L mercury
- 1.0 mg/L nickel
- 0.2 mg/L silver
- 0.5 mg/L total chromium
- 3.0 mg/L zinc

Adding water for the purpose of diluting wastes which would otherwise exceed maximum concentration limitations shall be unlawful.

TYPICAL SEWERAGE UTILITY  
RULES AND REGULATIONS

- .02 No person shall discharge any wastewater:
- (a) Having a temperature higher than 65°C.
  - (b) Containing more than 300 mg/L of Oil or Grease of animal or vegetable origin.
  - (c) Containing more than 100 mg/L of Oil or Grease of mineral or petroleum origin.
  - (d) Having a pH lower than 6.0.

.03 Pretreatment Effluent

When pretreatment of industrial wastewater is required as a condition of the permit, see Section 2.21 of this enactment, the permit shall specify the pretreatment plant effluent quality required.

Section 2.41. No person(s) shall maliciously, willfully, or negligently break, damage, destroy, uncover, deface or tamper with any structure, appurtenance or item of equipment which is a part of the sewerage system. Any person(s) violating this provision shall be subject to immediate arrest under charge of (equivalent of disorderly conduct).

TYPICAL SEWERAGE UTILITY  
RULES AND REGULATIONS

ARTICLE 3. SEWER CHARGES, FEES, AND PENALTIES

Section 3.1. Sewer Service Charges - APPROPRIATE SCHEDULES

Section 3.2 Fees

Permit Fees -

Sewer built by Utility forces

<u>Sewer Size</u> mm	<u>Processing Application</u> LE	<u>Average Cost of Connection</u> LE	<u>Total Fee</u> LE
-------------------------	-----------------------------------------	---------------------------------------------	------------------------

150

200

250

300

400

500

Over 500 to be determined by the Utility based on  
each application

Sewer built by other than Utility forces.

<u>Sewer Size</u> mm	<u>Processing Application</u> LE	<u>Average Cost of Connection</u> LE	<u>Total Fee</u> LE
-------------------------	-----------------------------------------	---------------------------------------------	------------------------

150

200

250

300

400

500

Over 500 to be determined by Utility based on  
each application.

TYPICAL SEWERAGE UTILITY  
RULES AND REGULATIONS

Section 3.3. Penalties.

Penalties for violation of this enactment shall be imposed upon violators as hereinafter provided. Upon detection of a violation the Utility shall notify the owner within twenty-four (24) hours, in writing, of the violation. The notification of the violation shall contain a revocation of any valid permit. To reinstate a permit revoked for violation, the owner shall make a new application for permit. A condition for reissue of a permit by the Utility shall be full payment of all penalties imposed as result of the violation. If the violation is a connection to and use of the public sewers without a valid permit, a condition for issue of a permit shall be full payment of all penalties imposed as result of the violation. Penalties shall be imposed each calendar day of the violation, each new day in which there is violation being considered as a new violation.

Penalties for violation shall be as follows:

- (a) No valid residential and commercial permit
  - for private wastewater disposal LE (1.0)\*per day
  - for connection to and use of public sewers LE (1.0)\*per day
- (b) No valid industrial permit
  - for private wastewater disposal LE (500.0)\* )
  - for connection to and use of public sewers LE (500.0)\* ) per day
- (c) Violation of Sections 2.34 through 2.40 by residential and commercial holder of valid permit LE (20.0)\* per day
- (d) Violation of Sections 2.34 through 2.40 by industrial holder of permit LE (5000.0)\* per day
- (e) Penalties for having no valid permit and violation of Article shall be additive

## 9.0 FUTURE TARIFF ADJUSTMENTS

As the sewerage systems continue to grow, revenue requirements will probably increase at a faster rate than will revenue. Periodically rate adjustments will be required. New rates can be established through:

- New cost of service and rate design studies.
- Adjusting existing rates upward or downward.

### 9.1 COST OF SERVICE ADJUSTMENTS

Rates recommended herein were designed to recover total projected revenue requirements in the 1984 Test Year.

They are based on projected:

- Growth in the sewerage system.
- Sewage loadings.
- Operation and maintenance expense.
- Capital improvement programs and financing plans.

These factors are subject to change as time passes. Growth may exceed or be less than presently anticipated. Cost of operations may increase more or less rapidly than projected. Capital improvement programs may be modified or financing may be transferred from loans to grants. All of these factors might lead to the need for rate adjustment.

A new cost of service and rate design study is in order if the changes discussed above are of a material nature. If this is required, not less than six months should be allowed for the study of any one sewerage utility.

This will permit proper determination of new tariffs as well as time to complete the legislative requirements for adoption of the tariffs.

### 9.2 ADJUSTING EXISTING TARIFFS

The tariffs recommended in this study should prove adequate through 1984 providing projected conditions are approximately achieved. In the event changes are required, either because of an increase or decrease in the revenue requirements, the following procedures for adjusting tariffs are recommended:

- Estimate the adjusted revenue requirements.
- Estimate revenues to be produced at existing rates in the first usage block.
- By subtraction, determine revenues which must be produced from all remaining elements of the tariff structure to recover the adjusted revenue requirements.
- Determine ratio that remaining revenue requirements bear to estimated revenues from remaining rate blocks.
- Provide for errors and omissions.
- Increase or decrease remaining rates proportionately.

### 9.3 COST ADJUSTMENT FACTORS

The methods outlined in Section 11.2 should be adequate for general changes in the level of revenue requirements. However, three elements of cost may incur sudden and substantial change. These are:

- Cost of electric power.
- Cost of petroleum products.
- Cost of chlorine.

Electric power and gasoline, diesel fuel and oil are subsidized by the state. Electric power in particular may face rapid increases in price as a result of studies now underway in the Ministry of Electricity. The cost of chlorine has increased substantially in the past two years. It requires considerable electric power for manufacture. Hence a cost increase in electricity may result in cost increases in chlorine.

When sudden major increases in price occur, rates should be adjusted rapidly. It is recommended that the utilities be authorized to automatically increase the volume related portion of the rate whenever the combined total annualized increase in electricity or chemicals exceed five percent of the utility's budget for the year. The increase must be related to total budget, not just the electricity or chemical portion. The following formula may be used to develop the amount that should be added to the charges in each rate step:

Test to determine if increase is allowable:

$$\frac{(CN - CO) + (EN - EO)}{B} = X \text{ percent}$$

Computation of unit cost increase:

$$\frac{(CN - CO) + (EN - EO)}{VT - VI} = \text{increase in volume charge}$$

- CN - Cost of Chemicals at new price, annualized
- CO - Cost of Chemicals at old price, annualized
- EN - Cost of Electricity at new rates, annualized
- EO - Cost of Electricity at old rates, annualized
- B - Total utility budget
- X - Percentage in excess of required percentage for making rate adjustment (to be established by rate approval Authority)
- VT - Estimated annual total of billable volume of water sales
- VI - Estimated annual total of billable volume of water sales in the first block (May be omitted if the rate for small users is to be increased.)

If cost adjustment increases are to be promptly implemented, legislative enactments of new tariffs must include authority for the Board of Directors of each sewerage utility to place the adjustments in operation.

## 10.0 FINANCIAL ANALYSIS

The tariffs recommended in the preceding sections of this report are designed to meet projected or proforma revenue requirements in the 1984 Test Year. The adequacy of these rates, measured against revenue requirements can also be measured by preparing proforma financial statements. These statements can take the form of:

- Statement of income.
- Statement of source and application of funds.
- Balance sheets.

### 10.1 STATEMENT OF INCOME

Proforma statements of income are prepared using historical and projected future data. Tables 10.1 and 10.2, Appendix I to V, present proforma statements of income for the period 1980 to 1988, and in 1990 and 2000. Table 10.1 includes proforma revenues based on Cash Basis revenue requirements. Table 10.2 includes revenues from tariffs computed on Utility Basis revenue requirements.

The proforma statements of income show the impact on revenues of the proposed rates in the years 1980 to 1984. In these statements, it is assumed that after 1984 tariffs will be adjusted annually. This will permit the recovery of revenue requirements in every year.

Net operating income in each year is compared with net utility plant in service developed in Table 5.4. The comparison, expressed as a percentage, is the proforma

return that would be earned in each year. It will be seen that where Cash Basis revenues are used a return of six percent is not achieved until after 1990 by any of the sewerage utilities.

It will be noted in Table 10.1 where revenues are based on Cash Basis revenue requirements, deficit occurs in most years. This is principally a matter of bookkeeping. If depreciation expense is added to the net loss, the resulting balance will be equal to debt principal payments and routine annual additions.

The impact of rates based on Utility Basis revenue requirements that result in a net income is demonstrated in Table 10.2.

This comparison indicates that with tariffs computed on a utility basis excess funds are received. This demonstrates that even though the statements of income in Table 10.1 show net losses, sufficient revenues are received to meet the needs of the utilities.

#### 10.2 STATEMENT OF SOURCE AND APPLICATION OF FUNDS

Statements of source and application of funds expand upon the statements of income by showing the amount of money developed from operation. These statements show where the funds for operations were obtained and what they were used for.

Statements of source and application of funds are shown in Tables 10.3 and 10.4, Appendix I to V. A comparison of these tables clearly demonstrates that revenues based on Utility Basis revenue requirement exceed the cash needs of the utilities. These statements clearly demonstrate that rates based upon a six percent return will place an unnecessary burden on the rate payer.

### 10.3 PROFORMA BALANCE SHEETS

Proforma balance sheet for the years 1980 to 1988 and 1990 and 2000 are shown in Table 10.3, Appendix I to V. Utility plant in service and accumulated provision for depreciation is computed on estimated original plant values at December 31, 1978 and projected additions at cost subsequent thereto.

Current asset values are estimates. Cash is assumed to equal 45 days operation and maintenance expense or 12.5 percent of annual expense. Accounts receivable are assumed to equal three months equivalent revenues from Cash Basis user charges. Material and supplies are estimated at 50 percent of annual requirements for materials and chemicals.

Current liabilities are estimated at an equivalent of two months operation and maintenance expense. Long term debt balances are estimated using proforma debt amortization schedules following the criteria set forth in Section 2 of this report.

The equity capital account thus becomes a balancing factor. Since the net increase in utility plant is at a lesser rate than the increase in long term debt, the equity capital account shows fluctuating balances. This would normally not occur if debt principal payments were not deferred.

## 11.0 LEGISLATIVE CONSIDERATIONS

Laws and decrees exist that relate to the organizations under which sewerage service is provided to the residents of Cairo/Helwan, Alexandria, Ismailia, Port Said and Suez. Generally, these laws are concerned with the responsibilities for operations. No information was developed that related to tariffs for sewerage service. This section contains a review of and or recommendations for legislative and administrative requirements covering:

- Enactment of tariffs for sewerage service.
- Conditions for providing sewerage service.
- Basis for subsidies.

### 11.1 HISTORICAL BACKGROUND

There currently is no basis for enactment of sewerage tariffs. Sewerage utilities are operated by the Governorates and by the General Organization for Sewers and Sanitary Drainage.

#### 11.1.1 Law No. 43 of 1979

Law No. 43 of 1979 includes a provision that local government units will construct and operate the utilities within the boundaries. The Prime Minister is authorized to declare any utility as a national utility.

From the above it can be deduced that GOSSD in Greater Cairo/Helwan is on a national basis while operations in the other areas is subject to supervision by the governorates.

11.1.2 General Organization for  
Sewers and Sanitary Drainage

GOSSD was organized under the authority of Presidential Decree No. 1637 of 1968. Under the decree, GOSSD operates the sewerage systems in Greater Cairo/Helwan including Shoubra El Kheima and in Alexandria. In addition, it is responsible for the design, conditions, standards and technical specification of sewerage projects in the remaining governorates. This includes supervision and execution of all new general sewerage enterprises.

GOSSD evolved from several actions over a period of years. No data was obtained as to the legal basis for operating sewerage utilities prior to 1960. It is assumed that this was a function of local government. By Presidential Decree No. 541 of 1965 the Executive Body for Sewerage Projects of Cairo and Guiza was formed.

At the same time the Executive Body for the Sewerage Projects of Alexandria was formed. These organizations were responsible to the General Sewerage Department, a general department of the Ministry of Housing and Utilities.

In November, 1965 Presidential Decree No 4418 organized the Egyptian General Organization for Utilities. The Executive Body for Sewerage Projects in Cairo and Guiza and the Executive Body for Sewerage Projects in Alexandria were assigned to the new organization.

In 1971, supervision of GOSSD was transferred to the Ministry of Housing by Presidential Decree No. 242.

On August 21, 1979 Presidential Decree No. 363 of 1979 was issued. This decree established the Alexandria General Authority for Sanitary Drainage (AGASD). AGASD is responsible for the operation and construction of sewerage facilities in the Alexandria area. Supervision of the organization will rest with the Governor of Alexandria.

As of the date of the preparation of this report, actual transfer of the operation in Alexandria from GOSSD to AGASD had not taken place.

#### 11.1.3 Governorates

Presently, authority and responsibility for sewerage utilities in Ismailia, Port Said and Suez is vested in the Governorates of those cities. The Governorates are the operating agency while GOSSD is the construction authority as described in Section 11.1.2 above. The Governorates presently operate under authority of the Local Government Law, No. 52 of 1975 and No. 43 of 1979.

#### 11.2 ENACTMENT OF TARIFFS

The exact organization under which sewerage service will be provided has not yet been announced. A form of organization has been suggested by the Minister of Housing. Indications are that the sewerage organization in Cairo may be established as a separate organization. Potentially combined water and sewerage operations will eventually be established in Ismailia, in Port Said and in Suez. Presumably each of these organizations will have a

Chairman and 2. Board of Directors. Activities of the organization would fall under the regulatory authority of the Governorates.

Pending the formal organization of agencies to operate the sewerage utilities, it is recommended that GOSSD be authorized to propose tariffs in Greater Cairo/Helwan. GOSSD proposals should be subject to review and approval of the Council of Governorates. The Council of the Governorates in Alexandria, Ismailia, Ports Said and Suez should be given authority to adopt sewerage tariffs in those cities.

### 11.3 CONTRACTUAL REQUIREMENTS

Although complete details are not available it is understood that most loan and grant agreements stipulate that the recipient sewerage utilities will establish and collect adequate rates. These rates are to be sufficient to protect the loan and the integrity of the property to be constructed.

This action is entered into by agreement of the Ministry of Economics, on behalf of the Arab Republic of Egypt, and the foreign lender. Law appears to be silent on the means the operating sewerage utilities must employ to implement tariff adjustments based on such treaty requirements. It is assumed that the Boards of Directors of GOSSD and Councils of the Governorates will acknowledge the nation's obligations and adjust tariffs accordingly.

#### 11.4 CONDITIONS FOR SEWERAGE SERVICE

GOSSD and the Governorates have general rules defining conditions under which sewerage service will be provided. On the basis of observations during field investigations there appears to be little control of connections to the sewers.

It is recommended that specific rules be adopted by GOSSD and the Governorates covering conditions under which connections to sewers will be permitted. These rules should be confirmed by the Councils of the Governorates. If rules are to be effective, intergovernmental cooperation is essential. The contents of rules covering the provision of sewerage service are discussed in Section 8.9.

It is recommended that administrative procedures at the Governorates be adopted that require acceptance of an application for sewerage and water service from any person or contractor before a building permit is issued including permits for government construction:

- If sewers or water mains are not adequate to handle existing loads imposed by new construction, the construction should be deferred until adequate sewers and water supply is installed.

#### 11.5 SUBSIDIES

A legal basis presently exists for subsidies for sewerage operations and construction. Subsidies are received for operations and capital improvements. Details of existing subsidies are shown in Section 4.0 of this report.

It is recommended that the basis for subsidies be continued in the interim period leading to 1984 when it is assumed the sewerage utilities will be self supporting financially.

#### 11.6 RECOMMENDATIONS

A specific law or Presidential Decree is required to:

- Authorize each sewerage utility to adopt and implement sewerage user charges.
- Identify the organization with operational supervision of each utility.
- Establish a review process.

## 12.0 SEWERAGE METERING

It is a generally accepted principle in utility rate practices that charges based upon usage recover costs more equitably than do other forms of tariffs. In a sewerage utility the terms "contribution" or "loading" is substituted for usage. Technically it would be desirable to base sewer user charges on the waste contribution of each connection to the sewerage system.

Unfortunately, no really satisfactory meter has been developed for measuring waste at the point of customer connections. Sewerage meters do exist but they normally are used where large volumes of wastes pass a given point.

Meters based upon the Venturi principal are normally considered the more reliable for measuring sewage flows than are positive displacement or current meters. Both of the latter types are subject to clogging and other forms of malfunctioning.

If tariffs are to be based upon contributions or loading some other means of measuring the volume of waste must be used. The normally accepted methods are:

- Base sewer user charges on billed water usage.
- Base user charges for industrial or commercial customers on billed water usage, and/or water produced on site, less allowances for process water that is not delivered to the sanitary sewers.
- Base strength charges on periodic waste analysis of customers with high or low strengths.

### 12.1 BILLED WATER USE

Most sewer user charges based upon volume use billed water use as the measure of the waste contributed. The idea behind this concept is that most domestic water use eventually finds its way to the sewers.

This premise is not exactly accurate. Water used for irrigation and some forms of cleaning are disposed of by evaporation or percolation. In Egypt another practise is to use water to reduce dust on streets, roads and sidewalks. Nevertheless, billed water use is a sound method for proportional distribution of cost of service to general customers.

### 12.2 INDUSTRIAL AND COMMERCIAL USERS

Measuring waste contributions of industrial and commercial users cannot always be achieved by the use of billed water use. Normally difficulties are experienced because of:

- Process water used in the product.
- Process or other water not deposited to sanitary sewers.
- Independent unmetered water supply

An example of process water used in the product would be a soft drink bottling plant. Process water for cooling is often discharged to a ditch or canal even though the source of water was the metered potable water supply.

In field tests one small paper processing plant was identified which used an on site well for its process water.

Several major industries have their own water supply from wells, canals or the River Nile. Waste from these sources sometimes are deposited in the sanitary sewers. Conversely many such industries are not connected to sewers and wastes developed from the potable water supply are discharged directly to the Nile, or to canals, ditches and drains.

### 12.3 EXTRA STRENGTH CUSTOMERS

Industrial and commercial customers often deposit wastes with strengths of BOD and suspended solids considerably higher or lower than that of normal domestic sewage. This extra strength requires additional investment in plant facilities and increased operating costs. Thus customers that contribute such waste should expect to pay for the extra costs they create.

Measuring or metering extra strength can be done in several ways. One method is to place automatic sensing devices at the point of discharge from the plant or building. Another is to place an automatic sampler to obtain samples over a selected period of time. The samples are then analyzed for BOD and suspended solids, or for other contaminants.

The more common method is for plant or sewerage utility personnel to take grab samples of the waste for analysis. Since maintenance of automatic equipment is difficult, the grab sample method is acceptable.

#### 12.4 IMPLEMENTATION OF A SEWAGE METERING PROGRAM

At the present time neither GOSSD nor the Governorates of Ismailia, Port Said and Suez have an accurate record of buildings connected to the sanitary sewers. Since 1972 when GOSSD adopted its present connection policy, the reported number of new sewer connections in Cairo has decreased from more than 7,000 per year prior to 1974 to 6,516, 4,649, 4,721 and 4,452 in the years 1974 to 1977 respectively.

During this same period new connections to the Cairo water system were reported as 7,250, 8,301, 9,174, and 13,065 respectively. Recognizing that water service is available in areas where sewers are not yet available, it is still obvious that a large number of unrecorded connections to the sewerage system exist.

If sewer user charges based on measured water use are to be adopted it will be necessary to establish and enforce rules and regulations under which sewerage service will be provided. Requirements for such rules are discussed in Section 8.

If a program to measure sewerage use is to be implemented, it is recommended that:

- Sewer user charges be based upon water utility meter reading.
- Industrial users with independent water supply sources be required to meter this source.
- Each utility adopt and implement a strength monitoring system.

- Each utility adopt rules and regulations relative to the provision of sewerage service.
- Procedures and regulations be established to penalize all illegal connections to sanitary sewers.
- A survey be undertaken to locate and identify all existing connections to the sewerage systems.