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Institutional Support Contract
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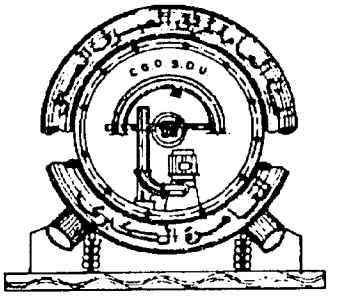
General Organization for Sanitary Drainage
Institutional Support Contract (ISC)

Wastewater Rate Study and Five Year Financial Plan

Volume I - Final Report



March 26, 1994

Prepared by ERNST & YOUNG for
CH2M HILL/OMI
in association with
A.A. WARITH and TEAM MISR

General Organization for Sanitary Drainage
Institutional Support Contract (ISC)

Wastewater Rate Study and Five Year Financial Plan

Volume I - Final Report

March 26, 1994

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September 30, 1993

Mr. Otto Vydra
Senior Vice President
Technical Director
CH2M Hill International Ltd.
Cairo Sewerage II Project
32 Ramsis Street
Cairo, Egypt

Dear Mr. Vydra:

Ernst & Young is pleased to present this *Wastewater Rate Study and Five Year Financial Plan* for the General Organization for Sanitary Drainage for Greater Cairo (GOSD). This report documents the results, methodology, and assumptions used in calculating wastewater service charges and a five year plan for GOSD to attain financial autonomy by fiscal year 1998/99 with regards to operating and maintenance costs of the wastewater system.

Volume I - Final Report presents an Executive Summary and numerous sections describing our methodology, estimated system demand, revenue requirements, recommended rates, and a five year financial plan to achieve financial autonomy. The majority of revenues generated by the GOSD would, in the short term, continue to be through a surcharge on each customer's water bill. A five year financial plan presents estimates of annual revenues and expenses from operating the utility, and a capital improvement plan for maintenance and rehabilitation of existing plant and equipment, as well as completing planned new facilities.

Under separate cover, we present **Volume II - Appendices**, which presents all of the schedules which support the recommended wastewater service charges and five year financial plan. These appendices include the projected operating and capital costs for each of the major wastewater facilities, in sufficient detail to reflect the size and complexity of each facility.

The wastewater service charges and capital improvement plan presented in this report are based upon assumptions and financial, engineering, and operational data provided to us by CH2M Hill International (CH2M Hill) and Operations Management International, Inc.(OMI), the GOSD, and the General Organization for the Greater Cairo Water Supply (GOGCWS). Recommendations are made for wastewater service charges for a five year period, fiscal years 1994/95 through 1998/99. The cost and revenue projections presented in this report should not be construed as actual outcomes because events and circumstances frequently do not occur as expected, and the results of such differences may be material. The five year financial plan should be updated at least every two years as circumstances change.

This study required significant participation by a number of personnel from CH2M Hill/OMI, the GOSD, and other Egyptian governmental entities.

Much appreciation goes to GOSD Chairman General Maksoud and Engineer Sayed Abou El Ela, the GOSD Project Manager of this Institutional Support Contract, who was able to direct numerous GOSD resources to provide assistance to our project team. Engineer Afaf Ibrahim El Marakbi of the GOGCWS was instrumental to our obtaining necessary information from the water utility regarding water flows, water customers, and water billing and collection.

The USAID Cairo staff provided a valuable input and penetrating insights during our two presentations as well as in the course of the formal review. We are particularly indebted to Mr. Charles McElroy for his thorough review and thoughtful comments to the report final draft.

Many other people, too numerous to name, provided invaluable insight and assistance during the duration of the project. We appreciate the time and effort all involved have devoted to this rate study.

A committee was formed by the GOSD Chairman to review the draft *Wastewater Rate Study and Five Year Financial Plan*. The committee issued a letter report with their comments on the rate study and their recommendations for completing the final report. In response to the committee recommendations, we made changes to the Executive Summary including two new subsections M and N, plus two changes made to the main body of the report.

We have enjoyed working with CH2M Hill/OMI on this important project. If you should have any questions regarding this report, please contact Mr. Michael Geiss or Mr. Edward Kaempf in Sacramento, California, at (916) 449-3400.

Very truly yours,

Ernst + Young

TABLE OF CONTENTS

TABLE OF CONTENTS
(CONTINUED)

APPENDICES

LIST OF EXHIBITS

LIST OF EXHIBITS
(CONTINUED)

LIST OF FIGURES

EXECUTIVE SUMMARY

ERNST & YOUNG

Executive Summary

The General Organization for Sanitary Drainage (GOSD) operates and maintains a wastewater system serving nine million of the 12 million residents in the Greater Cairo area. Wastewater service is provided by six wastewater treatment plants, 17 major pump stations, and a series of trunk lines, culverts, tunnels, and subsidiary pump stations.

Residents, businesses, and industry currently pay very little of the cost to operate the wastewater system and pay none of the costs to maintain the system or build required new facilities. Nearly all operations, maintenance, and capital costs are paid for by the central government and donor nations.

This study presents recommendations for appropriate wastewater user charges necessary to recover the full costs of operating and maintaining the sewer utility, allowing the GOSD to become financially autonomous. A five year financial plan provides a road map for the utility in its efforts to become an efficient utility providing wastewater services at a reasonable cost. A number of recommendations also are presented to address concerns with the GOSD's ability to actually operate independently and implement wastewater charges acceptable to customers within a five year planning horizon.

A. Study Background

Since 1978, the United States Agency for International Development (USAID), the United Kingdom, the European Community, and Italy have provided substantial funding for the expansion and rehabilitation of the wastewater system. The overall goal was to assist the Government of Egypt (GOE) by improving, expanding, and assuring proper management of the wastewater collection and treatment system for Greater Cairo. The Organization for the Execution of the Greater Cairo Wastewater Project (CWO), a temporary agency, became responsible for design and construction of most major wastewater facilities. The GOSD was responsible for the operation and maintenance of the system, as well as design and construction of some facilities.

Initial funding from the United States, entitled Cairo Sewerage I, totaled $US 129 million. A second phase of funding, for Cairo Sewerage II, totaled $US 816 million through September 1994. Total funding from the United States is $US 945 million.

In consideration of continued funding from USAID for new and rehabilitated facilities, a strategic objective of the GOSD is to become an institutionally autonomous utility, managed in a business-like manner, and able to sustain itself financially. The GOSD executed an Institutional Support Contract (ISC) funded by USAID on February 11, 1992, with CH2M Hill International and Operations Management International (OMI). The primary objective of the ISC is to provide the GOSD with a well managed and institutionally strong organization with program sustainability.

To achieve the primary objective of the ISC, CH2M Hill/OMI is providing the GOSD technical assistance to:

- ☐ Strengthen management, operation, and maintenance capabilities
- ☐ Achieve organizational effectiveness
- ☐ Strengthen internal training and information transfer capacity

- Establish financial control and automated management information systems
- Attain financial viability
- Procure vital equipment and spare parts, and establish an effective stores program
- Implement a US twinning relationship (an exchange program to allow training of GOSD personnel in the US).

Attaining financial autonomy through sewer service charges sufficient to recover at least salary, O&M, and maintenance capital costs in the near-term is the focus of this report.

In April 1993, CH2M Hill/OMI engaged Ernst & Young, as a subcontractor, to prepare a rate study and financial plan for the GOSD. The remainder of this Executive Summary presents the results of the rate study and financial plan, including recommendations for actions the GOSD should take in order to become financially autonomous.

B. Study Objectives and Scope

The primary goals of this study are to: (1) identify the operating and capital costs of the sewer utility for a five year period, (2) determine cost-of-service user charges to recover salary, operations, and maintenance capital costs, and (3) prepare a five year financial plan which summarizes all cost, revenue, and tariff cash flows.

The scope of this study includes all facilities comprising the Greater Cairo wastewater system. The planning period is for five fiscal years: 1994/95 through 1998/99. At the request of the GOSD, wastewater charges continue to be determined as a surcharge on a customer's water bill.

Though not within the scope of this study, developing a new, independent wastewater rate structure should be a long-term objective of the GOSD. Other recommendations also are made regarding the ability of the GOSD to run an efficient utility capable of providing quality service at a reasonable cost.

C. Overview of Wastewater System

Residents of Greater Cairo are provided service in three regions: the West and East Banks of the Nile, and the South (Helwan) area. The wastewater system covers an area of approximately 921 square kilometers.

Table 1 lists six existing and planned major wastewater treatment plants. The collection system includes 17 major pump stations, and a series of major trunk lines, tunnels, subsidiary pump stations, and culverts.

Table 1
Wastewater Treatment Plant Design Capacity

Name	Level of Treatment	Design Capacity (m^3/day)
West Bank		
1. Abu Rawash	Primary[a]	400,000
2. Zenein	Primary and secondary	330,000
East Bank		
3. Berka	Primary and secondary	600,000
4. Gabal el Asfar	Primary and secondary	1,000,000
5. Shoubra El Kheima	Primary and secondary[a]	600,000
South		
6. Helwan	Primary and secondary	350,000
Total		3,280,000

(a) Commissioned as primary treatment plant; construction of secondary treatment units suspended indefinitely.

The customers of the water and wastewater system are presently classified based on public policy and political decisions and not based on a customer's cost impact on the system. This report recognizes this and uses the current water rate structure.

Because the GOSD does not know how much wastewater is discharged by different classes of customers, estimates of water flow are used in this study as an indirect measure of the load each customer class places on the wastewater system. The number of customers in each class and their estimated annual water flows are provided in **Table 2**, below.

Table 2
Annual Water Flows by Customer Class
(FY 1992/93)

Customer Class	Number of Accounts	Annual Water Flows FY 1992/93 (m^3 x 1000)
1. Domestic	437,172	854,433
2. Government	9,531	249,269
3. Small Factories and Shops	28,430	68,389
4. Large Industrial Factories	285	25,072
5. Tourism and Investment	563	13,034
6. Worship and Charities	3,296	10,368
7. Sports Clubs and Embassies	454	7,118
Total	479,731	1,227,683

If all customers discharge the same amount of wastewater in proportion to the water they consume, then using water flows as the basis for wastewater charges has no discriminatory charge impact. However, if there are differences in the proportion of water consumed which is discharged as wastewater, then the charges in this report do discriminate. Those customers discharging a higher percentage would be subsidized unfairly by those customers discharging a lower percentage.

Wastewater service currently is charged to customers as a percent of their water bill (prepared every two months). The current surcharge is 20 percent of the water bill for domestic customers and 50 percent for all other customers. The effective wastewater charges and average bi-monthly bill are presented in **Table 3**.

Current wastewater charges recover very little of GOSD's operating costs and none of its investments in rehabilitated or new facilities. The low rates lead to inefficient operations and a complete reliance on central government and donor nation subsidies for capital funds.

In addition, government customers benefiting from the wastewater system pay only 30 percent of their wastewater bills.

Table 3
Current Wastewater Charges and Average Bi-Monthly Bill

Customer Class	Charge per Cubic Meter FY 1992/93 (Piastres)	Average Bi-Monthly Wastewater Bill (LE)
1. Domestic (0-60 cubic meters per bi-monthly period)	2.0	1.00
Domestic (>60 cubic meters per bi-monthly period)	2.6	2.31
2. Government	10.0	435.90
3. Small Factories and Shops	11.5	46.12
4. Large Industrial Factories	15.5	2,272.61
5. Tourism and Investment	27.5	1,060.95
6. Worship and Charities	4.0	20.96
7. Sports Clubs and Embassies	6.5	169.85

resulting in the largest subsidy of any customer class. Based on full cost of service, government customers pay only eight percent of the costs of providing service to them.

There is very little incentive for the GOSD to become more efficient or make cost-effective investments because any overruns are funded by the government. Further, because there is little financial incentive to maintain the system, a portion of central government and donor nation subsidies (intended to expand the coverage of sewer collection and treatment) are used to repair or replace facilities that deteriorate quickly.

D. Financial Autonomy

There is a present need for fiscal discipline, given the limits of funding from the GOE and foreign donors and the continued buildup of the wastewater system. The recommended wastewater charges will create incentives to help keep costs low because costs will have to be passed on directly to customers. Retention of user charge revenues by the GOSD would provide funds to help maintain the existing system and demonstrate to potential lenders the capability to service long-term debt for rehabilitation and expansion.

Wastewater charges based on costs would reduce (or remove) the arbitrary nature of setting rates by external agencies. Instead, the GOSD would estimate the actual cost of providing this service, then allocate this burden equitably among users. Charges would be based on principles of cost accounting, cost-effectiveness, equitable cross-subsidization, and financial reporting.

The GOSD is defined as being financially autonomous if revenues from wastewater charges and other non-service related fees are sufficient to recover salaries, operations, maintenance capital projects, and operating reserves. As a baseline for this study, fiscal year 1998/99 is determined as the first year that the GOSD could realistically reach financial autonomy. Attaining financial autonomy any earlier is unrealistic, would require much larger increases in wastewater user fees, and would require the GOSD to implement significant organization, management, and process changes much sooner than the utility is capable of achieving.

E. Methodology for Determining Wastewater Charges

Projections are made of the annual costs to operate and maintain all six wastewater treatment plants and 17 major pump stations. Added to these direct facility costs are the costs to maintain all subsidiary pump stations and the vast collection system, plus the salaries of all GOSD administrative personnel (e.g., finance, payroll, procurement). Finally, projections are made of capital costs to maintain and replace existing facilities, to construct new facilities, and to provide an operating reserve (i.e., working capital). All these costs are projected on a cash basis.

A projection is made of expected water flows for each of the seven customer classes. Wastewater charges then are determined by dividing projected costs by projected water flows. The recommended charges would be sufficient to recover the projected costs for salaries, operations, maintenance capital projects, and operating reserves by fiscal year 1998/99.

Within the five year rate study period, new capital projects are assumed funded by the GOE and donor nations, not through wastewater charges. The GOSD has proposed to recover these costs within the next eleven years through wastewater charges by fiscal year 2004/05.

Because current wastewater charges are so low, there will be substantial increases required for all customers in order to become financially autonomous. In order to mitigate the impact of such large increases on domestic (residential) customers, adjustments are made to provide a subsidy to domestic customers from charges levied on government, small factories and shops, large industrial factories, and tourism and investment.

F. Revenue Requirements

Projections are made of total GOSD salary, operations, maintenance capital projects, and new capital projects costs for five fiscal years: 1994/95 through 1998/99. However, because not all costs will be recovered through wastewater service charges prior to fiscal year 1998/99, costs are phased in during the five year study period.

Exhibit I, on the next page, shows that only a portion of projected GOSD costs are assumed recovered from customers during the five years of the rate study. Costs not recovered by wastewater customers are assumed funded by the Government of Egypt or donor nations.

It is estimated that the GOSD generated approximately LE 46 million in revenues from customer service charges and other sources in fiscal year 1992/93. These revenues are projected to be LE 80 million in fiscal year 1994/95 under the recommended wastewater rates. These higher revenues reflect required increases in wastewater charges which must be implemented in order to begin the transition to financial autonomy by fiscal year 1998/99. Clearly, the rates currently charged for sewer service are well below the utility's total costs and also below those costs expected to be recovered through wastewater charges during the five year rate study. Reaching financial autonomy will require substantial increases in rates.

Salaries account for LE 56 million of the estimated LE 167 million in operating costs during fiscal year 1994/95. All salaries are assumed funded by the GOE; none are recovered through user charges until fiscal year 1997/98.

It is estimated that in fiscal year 1994/95, electricity costs will be LE 76 million, 45 percent of estimated salary and operating expenses. Electricity is the largest single operating cost. The GOSD paid 18 piastres per kilowatt-hour (kwhr) in 1992/93 for electricity, below the estimated full price of 29 piastres per kwhr.

It is assumed that through the first four years of the rate study, the GOSD will pay an increasing portion of the full price for electricity. In fiscal year 1997/98, it is assumed that the GOSD pays the full, unsubsidized price of 47 piastres per kwhr (assumes the full price of electricity escalates at 10 percent annually). If the GOSD continued to pay the lower, subsidized electricity price of 18 piastres per kwhr, then costs required to be recovered in fiscal year 1998/99 would decline from LE 491 million to LE 375 million. If the GOE continued to subsidize electricity prices for the GOSD, then the required wastewater charges in fiscal year 1998/99 would be nearly 25 percent less than those recommended in this report.

Maintenance capital costs account for LE 114 of the LE 133 million in capital costs in fiscal year 1994/95. These projects are required to: (1) maintain the fixed assets of the GOSD in operating condition, (2) ensure financial resources are available for necessary replacement of equipment, and (3) upgrade facilities when equipment and buildings need to be replaced. Including maintenance capital more accurately reflects the true costs of all maintenance activities, helps plant and equipment reach their full useful service

Projected GOSD Costs and Funding

(LE 000s)

Cost Item	Fiscal Year				
	1994/95	1995/96	1996/97	1997/98	1998/99
Salaries and Operations Costs					
Salaries	55,993	60,855	66,995	71,686	76,703
Electricity	76,045	95,289	142,158	157,629	177,083
Other Operations	35,231	44,738	67,689	74,458	81,917
Total Salaries and Operations	167,269	200,882	276,842	303,773	335,703
Capital Costs					
Maintenance Capital Projects	114,325	123,355	132,386	141,416	150,446
Other Capital	18,831	27,199	41,095	39,761	47,428
Total Capital	133,156	150,554	173,481	181,177	197,874
Total GOSD Costs	**300,425**	**351,436**	**450,323**	**484,950**	**533,577**
Costs Recovered by GOSD	**80,175**	**123,841**	**193,296**	**313,879**	**491,434**

lives, and ensures that customers pay their fair share of maintaining the wastewater system.

It is assumed that, in the future, maintenance capital projects are recognized and implemented by the GOSD as truly being part of O&M costs. It is assumed that the GOE funds all these projects through fiscal year 1996/97 and 96 percent of these projects in fiscal year 1997/98. Not until fiscal year 1998/99 are all maintenance capital project costs assumed recovered through wastewater charges. Only when these costs are recovered through user fees is the GOSD financially autonomous with respect to salaries and true O&M costs.

G. Recommended Wastewater Charges

Table 4 presents the recommended wastewater service charge per cubic meter for each of the five years of the rate study. To determine a wastewater surcharge, simply divide the recommended charge by the current water charge per cubic meter.

Wastewater charges are recommended for each of the five years of the rate study. In addition to determining charges based on the cost of providing service to each customer class, adjustments are made to meet the following objectives: (1) provide a subsidized charge for domestic customers to avoid rate shock and to provide lower income households relief from higher service charges, (2) ensure that charges for domestic customers do not increase by more than 50 percent per year, (3) provide equity among selected customer classes so that charges are approximately the same by fiscal year 1998/99 (i.e., wastewater charges for government and tourism and investment are the same, and wastewater charges for small factories and shops and large industrial factories are the same), and

Table 4
Recommended Wastewater Service Charges
(Piastres per Cubic Meter)

	Fiscal Year				
	1994/95	1995/96	1996/97	1997/98	1998/99
1. Domestic					
0 - 60 cubic meters	3.50	5.00	7.50	11.00	16.50
> 60 cubic meters	5.20	7.80	11.70	16.90	24.70
2. Government	20.00	30.00	46.00	69.00	107.00
3. Small Factories and Shops	20.70	29.90	44.85	67.85	96.60
4. Large Industrial Factories	26.35	35.65	49.60	69.75	96.10
5. Tourism and Investment	41.25	52.25	68.75	85.25	107.25
6. Worship and Charities	6.40	8.00	10.40	13.20	16.80
7. Sports Clubs and Embassies	11.05	16.25	24.05	37.70	52.00

(4) smooth the rate increases during the five years to avoid erratic shifts in charges from year to year.

Table 5 presents the change in wastewater charges from fiscal year 1992/93 to fiscal year 1998/99. Charges for all classes of customers must be increased from 26 percent to 48 percent each year for the next six fiscal years (1993/94 through 1998/99) in order for the GOSD to become financially autonomous by fiscal year 1998/99. Wastewater charges for domestic customers must be increased from eight to 9.5 times over current charges.

Table 5
Change in Wastewater Service Charges

Customer Class	1998/99 Charge (PT/m^3)	Compared with 1992/93 Charges: Percent Change	Compared with 1992/93 Charges: Annual Compound Rate of Change
1. Domestic			
0 - 60 m^3	16.50	725%	42%
> 60 m^3	24.70	850	46
2. Government	107.00	970	48
3. Small Factories and Shops	96.60	740	43
4. Large Industrial Factories	96.10	520	36
5. Tourism and Investment	107.25	290	26
6. Worship and Charities	16.80	320	27
7. Sports Clubs and Embassies	52.00	700	41

Lifeline Charge

When the GOSD proposes new wastewater charges, it should be sensitive to customers' ability and willingness to pay. Low income households may either be unable to pay the large increase in charges or may resist the increases for political or cultural reasons.

To address such concerns, it is typical to institute a lifeline charge for low income households. Such a charge provides for basic wastewater service at a rate below the amount necessary to recover the full costs of basic wastewater service.

Implementing a lifeline charge requires either metering water use or identifying income levels of each account. Because there is insufficient metering of both water and wastewater use, it is difficult to enforce a lifeline charge based on the quantity generated. A lifeline charge would require a radical change to the existing rate structure, requiring a third, lower consumption block. Also, it is presently difficult to determine which wastewater customers are low income.

Because of the difficulties above, it is recommended that the first block of domestic customers (0 to 60 cubic meters of water flow per billing period) be substantially subsidized in lieu of a lifeline charge, and that the second block of customers (more than 60 cubic meters) be partially subsidized. This essentially provides a lifeline charge to a much broader customer base.

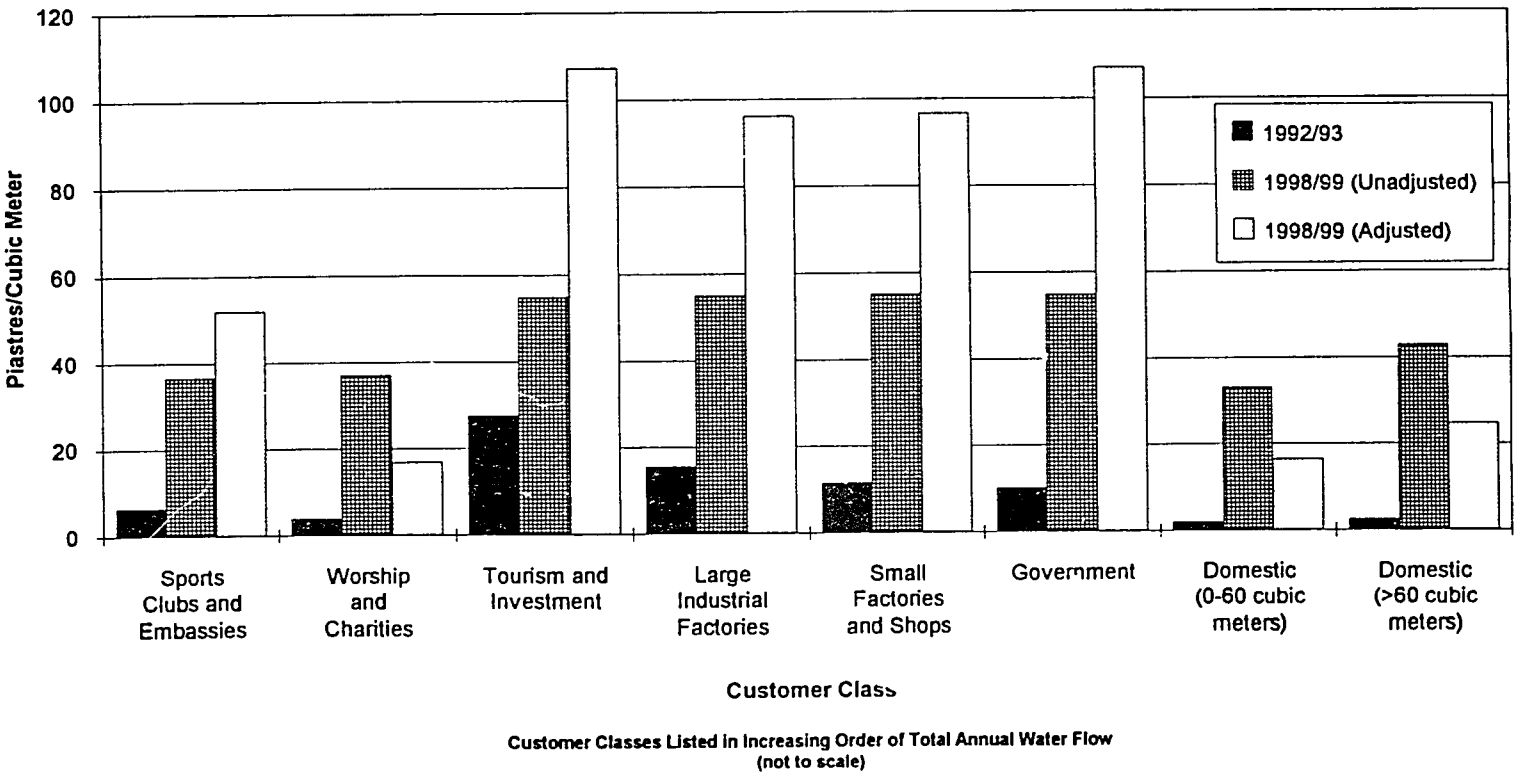
In order to provide lower charges to domestic customers, additional revenues must be generated from other customer classes. The balance of revenues required to subsidize domestic customers is generated from higher charges proposed for government, small factories and shops, large industrial factories, and tourism and investment customers.

Exhibit II, following this page, illustrates these subsidies. For each customer class, three wastewater charges are shown:

- Charges in fiscal year 1992/93

Current and Proposed Wastewater Charges

(Piastres/Cubic Meter)



Customer Classes Listed in Increasing Order of Total Annual Water Flow
(not to scale)

EXHIBIT II

- Charges required to recover all costs allocated to the class in fiscal year 1998/99 (unadjusted)
- Charges adjusted to provide a cross subsidy to domestic customers in fiscal year 1998/99.

A significant increase in current charges would be required to recover all the costs allocated to each class, particularly domestic customers. Without any cross subsidy, the charge for a domestic customer in the first consumption block (0 to 60 cubic meters) would need to be increased from the current charge of two piastres per cubic meter to 33 piastres per cubic meter in fiscal year 1998/99. Instead, the recommended charge for domestic customers in the lower consumption block is 16.50 piastres per cubic meter in fiscal year 1998/99.

Government is expected to pick up a portion of the subsidy for domestic customers during the transitional stage, as are factories and small shops, large industrial factories, and tourism and investment customers. In the long term (10 years), the GOSD should gradually increase rates for domestic customers toward full cost recovery. The GOGCWS also should consider a third block (e.g., 0 to 30 cubic meters per billing period) to provide a true lifeline charge to lower income households.

H. Revenues Generated from Each Customer Class

Domestic customers accounted for approximately 70 percent of water flows in fiscal year 1992/93, and approximately 43 percent of wastewater revenues. By fiscal year 1998/99, domestic customers are estimated to account for approximately 76 percent of water flows and 55 percent of revenues.

A comparison of estimated revenues by customer class is provided in **Exhibit III**, on the next page. This exhibit also shows for each customer class the following:

- Revenues received in fiscal year 1992/93, based on current wastewater service charges. These revenues reflect the fact that government customers pay only 27 percent of the amount billed; all other customers pay approximately 80 percent of the amount billed
- Revenues which would be generated in fiscal year 1998/99 if full cost-of-service rates were implemented (unadjusted)
- Revenues estimated for fiscal year 1998/99 based on recommended wastewater service charges. By this year, the collection rate for all customers, including government, is assumed to be 80 percent.

According to the GOSD, these expected revenues will depend greatly upon the success both the Government of Egypt and the local Governate have in applying the proposed new wastewater changes.

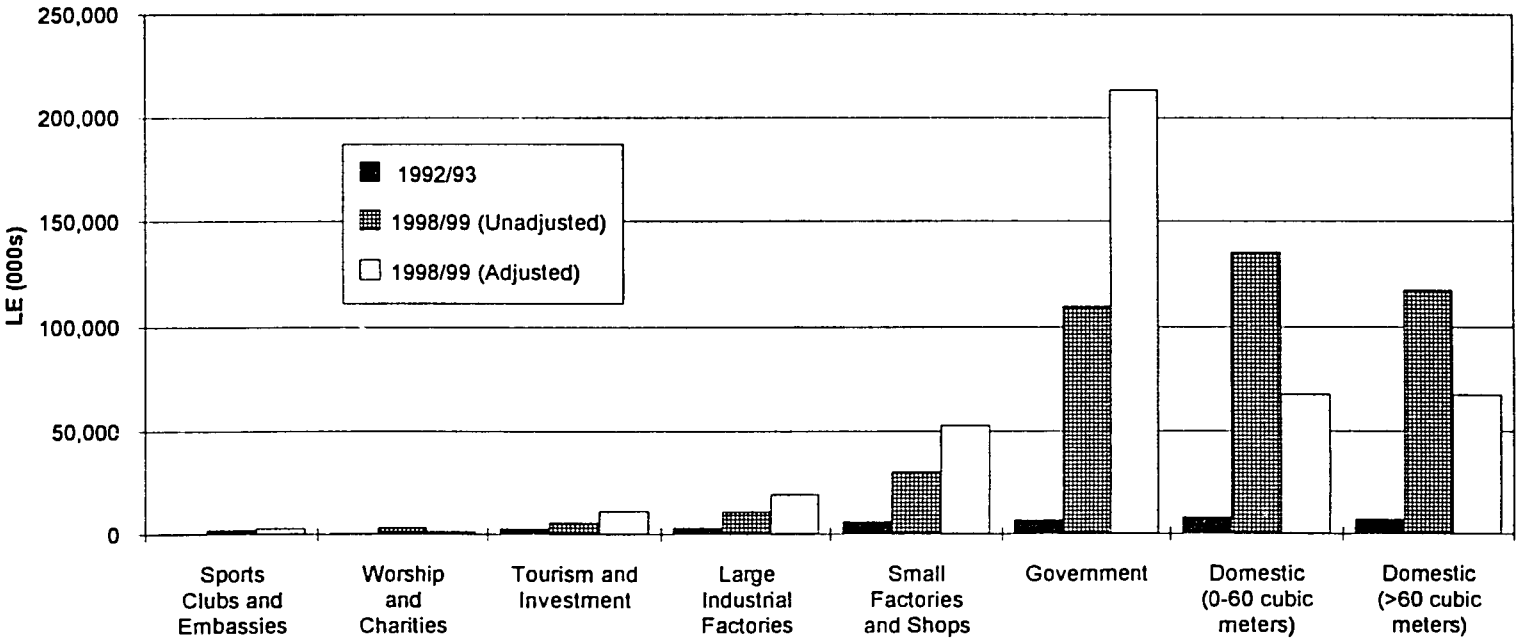
I. Industrial High Strength Surcharge

High strength wastewater can damage sewage infrastructure, produce hazardous conditions for neighborhoods and sewage workers, interfere with biological treatment processes, and compromise the efficient reuse of sludge. The GOSD should impose a high strength surcharge on industrial customers to recover the additional costs of treating wastewater which is of greater strength than an established threshold.

The surcharge would be fiscally sound and equitable, as well as consistent with GOE laws limiting the strength of wastewater which can be discharged into the Greater Cairo wastewater system. The actual charge is based on estimated costs of the GOSD to remove two pollutants: (1) biochemical oxygen demand, or BOD, and (2) total suspended solids, or TSS.

Current and Proposed Wastewater Revenues

(LE 000s)



Customer Classes Listed in Increasing Order of Total Annual Water Flow
(not to scale)

EXHIBIT III

The charge would be LE 0.35 per kilogram of BOD removed and LE 0.25 per kilogram of TSS removed.

The total amount actually charged to a customer would be based on the flow and strength of wastewater discharged by the customer. Projected annual revenues to the GOSD from the surcharge are estimated at seven million Egyptian pounds in the first year the GOSD is expected to be able to implement the high strength surcharge, which is fiscal year 1997/98.

Substantial infrastructure must still be completed before a surcharge can be implemented. The first priority should be to develop more reliable estimates for maintenance capital projects. Based on estimates of total system-wide asset value, maintenance capital costs could account for 40 percent of true operations and maintenance costs each year. However, because the GOSD could not estimate the individual asset value of any of the six treatment plants, these costs could not be included in the calculation of the industrial high strength surcharge.

In addition, a formal industrial monitoring program must be established. Also, more reliable information is needed on treatment plant operating costs, flows, influent strengths, and removal efficiencies; and better estimates are needed for a threshold limit for establishing the surcharge. These and other study recommendations are presented at the end of this Executive Summary.

J. Other Related Findings

In the course of this rate study, a general assessment was made of the potential for GOSD to do its own billing and collection. We also examined the potential for generating revenues from the sale of sludge and reclaimed water. Finally, we examined the feasibility of continuing GOSD farming operations.

Billing and Collection

The GOSD cannot actually be financially autonomous when it depends on a separate organization for its revenues, as under the present water billing arrangement. The GOSD is entirely dependent on the water utility to ensure that: (1) all customers are billed, (2) bills are correct, (3) bills are issued on time, (4) revenues collected are what were billed, (5) all money is transferred to the GOSD daily, (6) and any revenues withheld are appropriate.

If financially feasible, the GOSD should ultimately perform their own billing and collection functions. This should be accomplished within the five years of this rate study.

A GOSD billing and collection function would be responsive to GOSD needs, which the current General Organization for Greater Cairo Water Supply (GOGCWS) system is not, and provide immediate payback in terms of improved cash flow, collection rates, and overall financial control. Also, customer relations would be greatly improved. The GOSD could respond to customer inquiries directly and quickly, rather than explaining to the water utility what the inquiry is and relying on the water utility for a response.

The GOSD could contract with the GOGCWS to shut off water to non-paying customers. This would provide the GOSD leverage over customers in billing and collecting wastewater bills.

In the interim, the GOSD should staff a small (three person) accounting function at the water utility. The responsibilities of this unit would include auditing wastewater billings and collections and preparing monthly financial reports.

Developing a relationship between the GOSD and the water utility will require a formal protocol (interagency contract), according to the GOSD. This protocol would define the policies and objectives of the interim unit, responsibilities of the GOSD and water utility, billing and collection requirements, and required management reports. This protocol also should define fees which the water utility may charge to the GOSD to recover the allocated costs of billing and collecting wastewater service charges. Finally, this protocol would define the wastewater charges to be implemented, by customer class, and require the same penalties for non-payment as are in place for water bills.

Sludge Sales

The two basic alternatives for sludge disposal are: (1) dry the sludge and sell it as fertilizer, or (2) pump the waste into lagoons, evaporation ponds, percolating pits, or other suitable containment areas. The economic cost of producing sludge for reuse is comparable to pumping sludge to containment areas. The environmental benefits of producing sludge are lower microbiological concerns and risks.

Revenues from sludge sales have increased from LE 38 thousand in fiscal year 1990/91 to LE 118 thousand in fiscal year 1992/93. The GOSD has been successful at marketing the sludge. According to CH2M Hill/OMI, the GOSD is able to sell all of the sludge it produces if the sludge meets the buyer's specifications.

The GOSD should focus on bringing sludge quality up to legal and market specifications, specifically reducing the content of heavy metals, toxic substances, and water. This should increase the production of sludge per acre and justify a substantial increase in the price charged.

Reclaimed Water Sales

The GOSD believes it can sell reclaimed water from its secondary treatment plants for irrigation and agricultural use. This conclusion underestimates the complexities and costs involved with designing, funding, constructing, producing, and delivering reclaimed water to customers.

Common processes to produce reclaimed water include nutrient removal, filtration, demineralization, organic removal, and disinfection. In addition to constructing the facilities for these unit processes, the GOSD would need to build transmission lines and pumps, distribution pipelines to a customer's property, diversion pumps, and storage tanks. The costs of an 80,000 cubic meters per day facility may be LE 200 million.

The reclaimed water must be delivered to the consumer at a competitive price. Raw water is currently supplied by the water utility at just eight piastres per cubic meter. Some industries illegally pump water from the Nile River or from Cairo's canals and drains. Therefore, the GOSD will find it difficult to persuade potential customers to switch to reclaimed water.

According to the CWO, the potential for GOSD reclaimed water sales is at least a decade away. Though reclaimed water sales are not feasible during the five year rate study, the long-term potential and benefits should not be dismissed. Reclaimed water is a valuable resource that would ease the pollutant loads on the Nile River. The GOSD should perform a comprehensive feasibility study and address several issues outlined in Section VII of this report.

Farming Operations

The GOSD should focus on its core mission, which is ensuring wastewater is properly collected, treated, and disposed.

Farming of land owned or leased by the GOSD is an unrelated activity which loses money. Farming by the GOSD also violates official Government of Egypt policy that all public agencies eliminate any operations not essential to their primary business.

Estimates prepared for this report show that revenues from farming during the last two fiscal years recovered only 12 percent of direct salary costs and none of the operating and supply costs. The cost of farming is not separately tracked by the GOSD, but rather included in total utility salary costs. As a result, farming costs are being recovered from wastewater user charges. This is unfair to wastewater customers and is an erroneous assignment of costs.

The GOSD should phase out its farming operations. If it is GOE's goal to provide employment for people farming the lands, it should do so under the direction of the Ministry of Agriculture and Land Reclamation. The Ministry then should make the decision to keep the farming operation or eliminate it.

K. Five Year Financial Plan

Exhibit IV, on the following page, presents projected five year financial results of the utility. These financial results reflect the proportion of total costs to be recovered through wastewater charges each year. Operations costs are to be recovered first, followed by salaries, operating reserves, and finally maintenance capital project costs. By fiscal year 1998/99, the GOSD is projected to recover the costs required to operate and maintain the wastewater system.

Salaries are first assumed recovered through wastewater charges beginning in fiscal year 1997/98. The subsidies for electricity prices are gradually reduced during the first three years of the five year rate period. The full, unsubsidized price of electricity is assumed recovered through wastewater charges in fiscal years 1997/98 and 1998/99. Electricity accounts for approximately half of the projected operations costs.

All maintenance capital projects are assumed funded by the GOE through the third year of the five year plan. In the fourth year, four percent of these costs are assumed recovered through wastewater charges; in the fifth year, all maintenance capital costs are assumed recovered through wastewater surcharges.

Revenues from wastewater charges increase from LE 68 million in the first year to LE 472 million by the fifth year of the plan. This is a projected average increase of 62 percent each year in service charge revenues.

L. Recommendations for Becoming a Financially Autonomous Utility

Over the past ten years, an estimated LE 4.8 billion has been authorized to improve the collection and treatment of wastewater in Greater Cairo. However, very few substantive changes have been made in the management and operation of the sewer utility. All major responsibilities of one of the largest sewer utilities in the world are still micro-managed by both local and central government authorities.

Acceptance by Cairo residents and businesses of new, higher rates depends on the confidence customers have in the ability of the GOSD to run an efficient utility capable of providing quality service at a reasonable cost. To become efficient, the GOSD must greatly improve or implement management, personnel, information, and financial processes which are necessary for the operation of a self-supporting utility.

Projected Five Year Financial Results

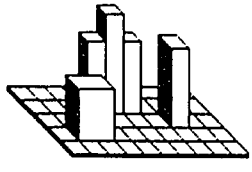
(LE 000s)

	Fiscal Year				
	1994/95	**1995/96**	**1996/97**	**1997/98**	**1998/99**
Expenditures					
Salaries	0	0	0	71,686	76,703
Operations	79,897	123,453	193,060	232,087	259,000
Maintenance Capital	0	0	0	5,657	150,446
Capital Projects	0	0	0	4,276	5,092
Total Expenditures	**79,897**	**123,453**	**193,060**	**313,706**	**491,241**
Revenues					
Service Charges	68,035	111,420	180,583	295,129	472,370
Non-Service Charges	12,140	12,421	12,713	18,750	19,064
Total Revenues	**80,175**	**123,841**	**193,296**	**313,879**	**491,434**
Net Surplus/Deficit	278	388	236	173	193

Becoming financially autonomous requires the utility to also become institutionally autonomous. However, we found serious deficiencies in GOSD's ability to plan for, and implement, wastewater user charges and to control the revenues raised through these user charges. Most significant was the lack of an effective long-range capital and financing plan. Without this plan, it is difficult to determine required wastewater charges and to justify these rates on sound cost accounting and financial reporting principles.

Below is a summary of specific recommendations to improve the GOSD's chances of becoming financially autonomous. The contract and scope of work for preparing this rate study did not include developing these recommendations. However, we identified several significant barriers to GOSD becoming financially autonomous which are not being directly addressed or implemented by the GOSD. The recommendations which follow are to ensure that GOSD is aware of the significant challenges ahead in becoming truly autonomous.

Capital and Financial Planning



- **Prepare Forecasts of Customer Demand and Economic Conditions Affecting Capital and Financial Planning**

  On a periodic basis, perhaps every two years, the GOSD should prepare forecasts of customer demand for wastewater services and identify economic conditions which impact the costs of providing service in order to properly prepare a capital and financial plan. The GOSD should identify facilities to be included in the capital plan, steps the GOSD should take to protect its capital investment and maintain full service, and specific needs to replace deteriorating facilities. Included would be projections of a reduced role for the GOE and donor nations in funding operating and capital costs.

- **Prepare a Facility Master Plan**

  The GOSD should prepare a comprehensive Facility Master Plan to identify capital facilities for rehabilitation, replacement, upgrade, and expansion to the sewer system. Because many of the facilities are designed to meet long-term demand, the planning horizon should span 25 years.

  The plan should be a comprehensive document and address strategic objectives of the GOSD. Background information should be provided for all major operational and regulatory issues affecting the plan. The plan should describe the level of technology to be incorporated, select an appropriate configuration to address Greater Cairo wastewater requirements, relate the plan to wastewater demand estimates, and consider financial and operational impacts of adopting the plan. The Facility Master Plan is a primary document needed to secure external financing for the facilities.

- **Prepare a Capital Improvement Plan (CIP)**

  The GOSD should prepare a five year Capital Improvement Plan for the first increment of new capital projects in the Facility Master Plan. This CIP should include the following:

  - *New capital projects* identified to expand the capacity of the

system and extend coverage to new customers

- *Minor capital outlays* not identified in the Facility Master Plan. These would include costs of sewer extensions and minor capital outlays.

In addition to showing when capital is needed for new facilities, the CIP should demonstrate the type and amount of financing to be used to fund the plan. The combination of short- and long-term borrowings, government grants, plus "pay as you go" funding should be identified.

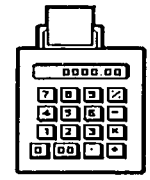
The impact of the CIP on wastewater user charges should be evaluated before adopting the CIP. The GOSD must be able to recover the costs through wastewater charges or it cannot afford the CIP.

❒ **Prepare Maintenance Management (Replacement) Improvement Estimates**

This rate study report had to make the simplifying assumption that maintenance capital costs (replacement, repairs, and rehabilitation) are two percent of GOSD assets. The GOSD should establish a strategy and a plan to estimate these capital maintenance projects, and to prepare a reliable five-year projection of these annual costs.

Maintenance capital projects are those required to replace equipment when necessary, and to upgrade facilities to improve efficiencies. These projects are critical to the integrity of the wastewater system, though not now formally recognized by the CWO or GOSD. A first priority of the GOSD should be to recognize these projects as required maintenance investments and to prepare reliable estimates of costs for these projects.

Accounting and Budgeting



❒ **Improve Accounting Processes**

In order for the GOSD to manage the utility autonomously, it must develop a common system for classifying costs consistent from year to year. Specifically, costs should be classified in a manner to:

- Support cost-of-service and rate setting calculations
- Provide proper monitoring and reporting of O&M and capital costs
- Allow for comparing costs among the six wastewater treatment plants and among the 17 major pump stations
- Provide appropriate information for management to operate the system effectively.

CH2M Hill/OMI is assisting the GOSD to develop a chart of accounts. It is recommended that the GOSD ensure that the chart of accounts is in sufficient detail to classify all assets, liabilities, costs, revenues, and other financial transactions on a consistent basis.

In addition to simply identifying a chart of accounts, accounting processes should be established to ensure that all financial transactions get recorded properly and that useful information is made available to management to operate the utility effectively.

❒ **Develop Financial Reporting System**

Currently, there is a need to improve the reporting to GOSD management of

the financial performance of the utility. Improvements are required in order to allow GOSD management to improve planning and budgeting, deploy personnel or financial resources, measure the performance of GOSD managers, determine the need for replacement or new facilities, establish wastewater charges, and communicate performance to wastewater customers.

The GOSD should establish a committee of managers from a range of functional areas (e.g., engineering, operations, maintenance, and accounting) to define: (1) a process for financial reporting, (2) the format for reporting financial performance, and (3) how to act upon the information. The overriding goal of the financial reporting system should be to improve the quality, speed, and accuracy of the information supplied in the most efficient manner possible.

The financial reporting system should be derived from the use of standard data in order to simplify the process. The number of financial and performance measures also should be limited to those essential to running the utility. Examples include:

- Annual revenues and expenditures
- Capital investment per cubic meter of wastewater collected
- Capital investment per cubic meter of wastewater treated
- Bill collection rates by class of customer
- Treatment plant efficiencies (percent reduction in pollutants)
- Capital costs per 1,000 connections
- Connections per employee.

Improvements should be made in the following areas in order for the financial reporting system to work:

- Data collection, integrity, and reporting formats
- Ability to perform ad hoc analyses, such as those usually required to establish wastewater charges
- Communication of results to plant and station managers.

Finally, the financial reporting system should not just focus on delivering the financial information, but also how to act upon it. The committee of managers formed to develop a financial reporting system should determine what actions should be taken in response to specific financial results.

❒ **Develop an Improved Budgeting Process**

The present budgeting and financial planning process can be described as bureaucratic, top down, and not fully based on future needs. Existing procedures present substantial challenges to the GOSD's goal of financial autonomy.

Currently, there is no work planned or being performed to design or implement an adequate budgeting process. Therefore, it is recommended that the GOSD begin to develop a comprehensive budgeting process and plan to implement new procedures within three years. Basic elements of the budgeting process should include the following:

- ❒ Responsibilities and plans for each organizational unit for each of the next two fiscal years
- ❒ Estimates of workload in each of the next two fiscal years
- ❒ Annual historical costs, by line item

- ❒ Staffing level, by pay grade and by personnel classification
- ❒ Cost-based estimates of non-staffing costs (e.g., electricity)
- ❒ Funding sources
- ❒ Consolidation and reconciliation of individual organizational budgets into a GOSD budget document
- ❒ Reporting variances from budgets
- ❒ Budget change process for modifications to budgets during the fiscal year.

Organization and Personnel

❒ **Approve Proposed Presidential Decree**

The GOSD must be given the authority and freedom to implement wastewater rate adjustments, unencumbered by existing tariff regulations and external pressures from multiple levels of Egyptian government. Approval of the Presidential Decree proposed by the GOSD would help provide for this autonomy.

The GOSD should eventually be given unrestricted access to capital markets without government interference or guarantees. However, access to these markets will not occur until the GOSD demonstrates that it can operate efficiently and is financially sustainable.

Issuing a new presidential decree to amend Decree No. 133 (1984, formulation of GOSD) should transform GOSD from a service organization to an economically viable organization. This is considered by the GOSD to be a main factor of success to achieve financial autonomy.

❒ **Transfer Capital Planning Functions Now Performed by Other Agencies**

Planning the design and construction of new wastewater facilities should be a goal of the GOSD. The CWO, a "temporary" agency established 10 years ago, currently is responsible for planning, designing, and constructing new wastewater facilities. The GOSD is primarily responsible for operating and maintaining the facilities, although the GOSD does plan facility expansions and improvements. The responsibilities of design, construction, and operation of the system should all be integrated within the GOSD. This will require significant changes in organization, personnel practices, and compensation.

❒ **Establish the Utility as an Enterprise Fund**

The proposed Presidential Decree should ensure that the accounting for wastewater operations be established as an Enterprise Fund. As an Enterprise Fund, the utility should be viewed as a business. All operating and capital costs should be recovered or financed primarily through user charges.

Also, the GOSD should be allowed to retain all revenues collected from wastewater customers; it now is allowed to retain only 10 percent of what is collected. Transferring 90 percent of revenues to the Ministry of Finance defeats any attempt to become financially autonomous. A provision to ensure 100 percent retention of wastewater revenues should be included in a revised draft of the Presidential Decree.

Operating as an Enterprise Fund also should result in more accountability to rate payers; all costs and revenues of the GOSD would be separately reported from those of the GOE. Charges should be established based on principles of cost identification, accounting, and financial reporting.

❒ **Establish a Financial and Economic Analysis Unit**

A separate unit should be established, reporting to at least the assistant chairman, with the responsibility to set wastewater charges. Among its responsibilities, this unit would:

- Develop background data on Greater Cairo demographics
- Prepare demand and economic forecasts
- Prepare the CIP
- Coordinate capital finance needs
- Determine the utility's costs of service
- Identify pricing objectives
- Recommend new wastewater charges
- Make recommendations for improving how feasibility studies of new projects are conducted.

This group also would provide assistance on financing plans (e.g., interest rates and costs of issuance) and acceptable short- and long-term debt instruments. Finally, this group would provide advice on other forms of financing utility costs, such as development fees and privatization of selected operations.

Staffing levels for the section should be determined by the GOSD. However, given the size of the utility and the responsibilities being assigned to this group, three professional and one clerical positions may be required. The group should be headed by a senior financial professional, with education and experience in finance, economics, or accounting.

❒ **Recruit Personnel for Economic and Rate Analysis Function**

An autonomous GOSD will need to attract and retain employees trained in financial management, cost accounting, economic analysis, and rate setting. This may require increasing salaries and providing incentives and opportunities for advancement to attract and retain qualified personnel in the utility.

❒ **Establish Performance Goals**

If the GOSD expects consumers to pay higher wastewater charges, and if the GOSD is to secure private sector financing for capital projects in the future, the GOSD must demonstrate that it has the management capabilities to operate the system efficiently, that investments in the system would be sufficiently protected, and that the GOSD has financial capacity to repay its loans. The utility must be able to operate under full cost recovery principles, attain a sustained level of financial performance through proper wastewater charges, and meet reasonably expected financial performance criteria.

Utility-wide performance goals should be established and monitored, as should performance goals for individual operating units. These goals should include both financial and non-financial targets. GOSD employees should understand how

their targets are to be achieved and be given the authority to take direct action without requiring approval from the Chairman's office.

A potential mechanism for improving employee performance which the GOSD should consider is providing monetary and non-monetary incentives. This includes providing higher salaries to qualified employees who are recruited and trained by the GOSD. The ISC program is implementing new training programs and organizational changes to improve staff capabilities, which could result in demand for higher salaries. These higher salaries may be necessary to recruit and retain highly qualified personnel who will enable the GOSD to operate efficiently, maintain the facilities, and provide improved customer service, all of which are strategic objectives of the GOSD to become an autonomous utility.

❒ **Improve Collection Rates**

An aging (accounts receivable) report should be prepared monthly to monitor and act upon non-payment of wastewater bills. In the case of government customers, the amount owed to the GOSD should be formally requested from the GOE as a direct payment to the GOSD. In the case of non-government customers, attempts should be made to collect the payments by letters or phone calls. Any chronically delinquent accounts (e.g., greater than six months) should be seriously counseled. Ultimately, the water supply could be shut off to force payment of delinquent accounts.

Rate Structure

❒ **Add Third Domestic Consumption Block**

The first consumption block for domestic customers is established at 60 cubic meters or less per billing period. Given average water flows of the lowest income households, the first block should be set at no greater than 30 cubic meters per billing period This would reflect essential water and wastewater needs for a poor household. The second and third blocks would be reestablished for average flows of middle and high income households.

Three consumption blocks would allow the GOSD to more fairly distribute the costs of the system to those who have the ability to pay. Three blocks also would allow phasing in of full cost recovery without an undue impact on lower income households.

❒ **Implement Full Cost-of-Service Wastewater Charges**

The recommended wastewater charges still provide for substantial cross-subsidization among wastewater customers. The GOSD should transition towards a true cost-of-service rate structure over a ten year period so that customers pay their fair share for wastewater services.[1] This would provide for fair and equitable wastewater charges that are justified on cost accounting principals.

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[1] The one exception would be for lifeline charges, which should be subsidized so that low income customers can afford basic wastewater services.

Demand Management

- **Improve Metering and Billing Practices**

If the water utility is responsible for determining water and wastewater bills, then significant improvements must be made in metering customers and billing for wastewater services. Customers should not be expected to accept the higher wastewater charges recommended in this report if their bills are determined arbitrarily and without any relation to actual demand placed on the wastewater system.

The water utility should end the practice of guessing a customer's water use, and not allow meter readers to arbitrarily set water use. If the water utility is planning to install new meters, then sufficient funds and personnel must be made available to maintain the meters in a working condition. Fines should be assessed any customer for tampering with or breaking a water meter. The cost to replace a damaged meter should be charged to the customer.

If the water utility will not be installing new water meters, then engineering studies should be conducted to determine average monthly or bi-monthly water flows, by size of lateral pipe and by type of customer. These estimates would become the basis for water demand for all customers of a specified class.

- **Measure Wastewater Flows and Strengths**

Water flows are used in this report as an estimate of wastewater flows. This is fair so long as the proportion of water usage which is discharged as wastewater is the same for each customer class. However, if the proportion of water usage which is discharged is different, there will be a hidden and unfair discrimination in rates between customer classes.

The GOSD should perform engineering studies to measure wastewater flows and strengths by customer class. These studies would confirm or refute the implicit assumption in this report that wastewater generation is a fixed proportion of water use for all customers. If there are differences, then the wastewater charge should be adjusted to reflect the findings of the engineering surveys.

- **Establish Industrial Monitoring Program**

An industrial high strength surcharge is assumed to be instituted by the GOSD by fiscal year 1997/98. This charge will be assessed those customers that discharge wastewater into the collection system at pollutant strengths above the average strength of wastewater. The charge is based on the flow and strength of the customer's wastewater. Revenues are estimated to be approximately LE seven million annually.

It is recommended that the GOSD establish an industrial waste sampling and enforcement program to control industrial discharges and to monitor customers who are assessed the surcharge. This program would establish formal test protocols for sampling a customer's wastewater, identify industrial customers, measure their flow and strength of wastewater discharge, review test results with the customer, and monitor these flows and strength on an ongoing basis. The

purpose is to identify customers that should be assessed the charge, provide on-going engineering data to determine the amount of the charge, and encourage industrial customers to decrease their discharge of high-strength wastewater.

This program also should include implementation and administration of a wastewater pretreatment program. The long-term goal of this program should be to eliminate discharges which violate existing Egyptian legal standards. More immediate term goals would be to inform major polluters of the law, encourage and monitor efforts by industry to reduce the pollutants discharged, and provide technical assistance to industry on alternatives to reduce or pretreat their wastewater.

The industrial high strength surcharge should be reevaluated based upon updated costs of treatment. Other recommendations provided in this section of the report should provide more accurate estimates of the full costs of treatment, which is the basis for the surcharge. Finally, several recommendations in this section provide for comprehensive engineering surveys. These surveys should provide better estimates of flows, strengths, and efficiency levels of treatment plants, improving the basis for setting the high strength surcharge.

- **Monitor Average Wastewater Flows and Strengths at GOSD Treatment Plants**

The GOSD should conduct comprehensive engineering surveys to develop accurate and reliable estimates of flow, strength, and removal efficiencies at each treatment plant. This information is critical to managing the performance of each plant, assuring that the treatment plants, which users are paying for, are being operated efficiently, and establishing the industrial high strength surcharge.

Information Management

- **Identify Information Needs**

Information available from the GOSD to establish wastewater charges is essentially non-existent. Nearly all of the information for this rate study had to be generated from a variety of secondary sources, interviews, and simplifying assumptions.

The GOSD should determine the information it needs to: (1) monitor the utility's financial performance, and (2) determine wastewater charges in the future. This information should include the following:

- Capital costs and timing:
  - -- Maintenance capital projects. (Estimating these costs should be a top priority of the GOSD.)
  - -- New capital projects
- Financing sources, including level of funding from the GOE and donor nations
- Current value of wastewater equipment and buildings
- Staffing levels, labor hours, and labor rates
- Electricity consumption at major facilities
- Electricity prices
- Fuel consumption and costs

- Average daily flows for each treatment plant and major pump station
- Treatment plant performance and efficiency of removing pollutants
- Bill frequency analysis for each class of customer to determine both the average and range of water and wastewater demand for each customer class
- Billings and collections, by customer class (collection rates)
- Revenues from wastewater user charges, by customer class
- Revenues from secondary services (connection fees, administrative fees, others)
- Financial performance of the utility (e.g., income statement, sources and uses of funds, collection rates, accounts receivable, costs per unit of flow, head count per unit of flow).

❑ **Integrate GOSD Business Processes with Automation**

The computer system being considered for GOSD will initially provide for automation of the GOSD data processing along existing functional lines. Later, as the GOSD reorganization progresses, the system should be utilized increasingly more as a management information system. A determination then should be made of what information is needed to monitor major utility processes and to establish costs to be recovered through wastewater user charges. Major utility processes include collection and treatment of wastewater and planning for future expansion.

M. Implementation Steps

The prior subsection contains a number of recommendations which are not directly related to establishing wastewater service charges but which are actions required for the GOSD to become financially autonomous. In addition, the new wastewater service charges recommended in this report must be adopted by the Government of Egypt, the Cairo Governor, the Board of Governors, and the GOSD.

The third year of the ISC program will begin to address many of these recommendations. The ISC program will be organized in two major divisions, Financial Viability and Sector Reform. A substantial portion of the Financial Viability work effort will be to begin implementation of some of the recommendations made in this report. Seven major financial viability activities to be implemented during the third year are the following:

❑ **Annual Maintenance (Replacement) Capital Improvement Estimates**

Major expenditures of operating the sewer utility are replacements, repairs, and rehabilitation projects. The purpose of this activity is to establish a plan to estimate these capital maintenance projects, and to prepare a reliable five-year projection of these annual costs.

❑ **Capital Facility Organization Plan**

Improving the planning capability in GOSD is essential for an autonomous agency operation. During the third year, the ISC is to design a new Capital Improvement Planning organization within the GOSD, define responsibilities of this new organization, and establish policies for the GOSD capital facility planning function. This organizational unit will assume responsibility for capital

improvement planning, including new capital projects, but not maintenance capital projects.

- **Utility Budgeting Design**

  The purpose of this task is to design an effective utility-wide budgeting process and develop a plan to implement the new process. Basic elements of the budgeting process should be designed in the third year, and include: (1) responsibilities of each GOSD organizational unit to submit their budget plants, (2) format and content of the budget, (3) major milestones and schedule to prepare the annual budget, and (4) interfaces with proposed accounting systems. Full implementation of the design will occur after the third year of the ISC.

- **Industrial High Strength Surcharge**

  The ISC is to calculate surcharges based on the real costs of removing pollutants above a specified threshold. This surcharge, designed to recover costs of treating high strength effluent and to encourage customers to pretreat their effluent, will require estimates be made of the removal efficiencies of each treatment plant, the operating costs of each treatment plant, and the average strength of wastewater. The ISC is to assist the GOSD with implementation of a step-by-step procedure for billing, collection, and accounting of the surcharge.

- **Financial and Economic Analysis Unit Plan**

  The ISC is to assist the GOSD to design and implement a Financial and Economic Analysis Unit. This new unit would prepare demand and economic forecasts, determine the costs of service, and recommend appropriate wastewater charges. This task should include recommendations on the skills needed, policies, management organization, and the framework and format for the unit's activities.

- **Billing and Oversight Plan**

  If billing for wastewater charges is to be done by the water utility, then a new unit needs to be developed to oversee the billing and collection of wastewater charges. Doing so will enable the GOSD to gain control of its revenues and accounts payable. This task includes determining responsibilities, functions, and staffing levels for the new oversight unit.

- **Updated Wastewater Rate Recommendations**

  The third year program will result in estimates of annual costs for maintenance (replacement) capital costs, a major cost of the utility. Also, the GOSD is to develop estimates of salaries for each of the utility's major facilities and for administration, and prepare reliable estimates of electricity consumption and costs. The purpose of this third year task is to review these new cost estimates, verify their reasonableness, and develop an update to the rate study in terms of wastewater rates for a five-year period, 1995/96 through 1999/00.

N. Discussion of GOSD Comments

A committee was formed by the GOSD Chairman to review a draft of this report, *Wastewater Rate Study and Five Year Financial Plan*. The committee issued a letter report on January 31, 1994, with their comments on the rate study and their recommendations for completing the final report. This subsection of the Executive Summary presents our response to GOSD

committee recommendations for modifying the final rate study report and financial plan.

The GOSD assembled a team of 12 professionals from the utility to review the study report. This action indicates the Chairman's leadership in directing the transition to an autonomous utility. The Chairman recognizes the vital need to set tariffs sufficient to recover GOSD operating costs and to base these tariffs on reliable estimates of operating costs.

Recommendations made by the GOSD committee regarding the draft rate study include suggested changes to estimated costs for fiscal year 1994/95, plus suggested changes to the draft final report text to clarify a few issues raised in the rate study. As discussed below, the recommended changes to the cost estimates should not be made to the rate study report, but rather be made as part of the third year of the ISC. This subsection does address the committee's recommended changes and additions to the text which do not affect costs. All of these narrative changes are made in this Executive Summary, with two changes made in the main body of the rate study report.

(a) Suggested Changes to Fiscal Year 1994/95 Costs

The GOSD committee prepared a table which compares fiscal year 1994/95 costs contained in the rate study report with new estimates prepared by the committee. The table shows that costs in the rate study for salaries (BAB one) and operations (BAB two) are lower than committee estimates, and that costs in the rate study for capital (BAB three) are higher than committee estimates. The net difference is 15 million LE, or five percent of total costs shown in the table.

Neither salaries nor capital costs are included in any of the proposed rates for the first three years of the rate study, 1994/95 through 1996/97. Also, operations costs are only phased in over the same three years, and are not all included in the rate base until year four (1997/98). Therefore, none of these costs significantly impact proposed rates in the near term.

During the third year of the ISC, significant work is planned to establish more refined estimates for maintenance capital costs, a major cost of the utility. The GOSD also will provide substantiated estimates for salaries, based on staffing levels, grades, and salaries. These new cost estimates would become the basis for a revised wastewater rate schedule to be prepared by Ernst & Young during the third year program.

Considering the comments above, we believe that there is little, or no, benefit in currently updating the wastewater rates in the draft final report. There would be little impact on rates in the short term, and updating the costs would require that we review and verify the cost estimates for fiscal year 1994/95 which were provided by the committee.

(b) Recommendations Regarding Narrative in the Executive Summary

The committee also recommended eight other modifications be made to the text to clarify issues not directly related to costs. All of these issues have been addressed in the revision to this Executive Summary: in addition, two of the eight suggested changes required revisions to the body of the report. In the Executive Summary, new text was added to subsections H, J, and L, and a new subsection M, Implementation Steps, was added. Changes also were made in: (1) Section I.B.1.17 to address the roles of the CWO and the GOSD in planning capital projects, and (2) Section VIII.D.2 to revise the description of GOSD's existing financial reporting system.

SECTION I

OPERATING ENVIRONMENT

ERNST & YOUNG

Section I. Operating Environment

The General Organization for Sanitary Drainage for Greater Cairo (GOSD) is responsible for the operations and maintenance of the wastewater system serving Greater Cairo. Wastewater service is provided by a system of 17 pump stations, six wastewater treatment plants, and a series of major trunk lines, tunnels, subsidiary pump stations and culverts. Wastewater service is provided to approximately nine million of the 12 million residents of Cairo, the highest level of service coverage for any wastewater system in Egypt.

Wastewater service revenues currently fund only rudimentary system maintenance. The GOSD presently depends on external funding to recover most costs of the sewer system. Nearly all operations and maintenance costs, and all salary and capital costs, are funded from external sources, including the Government of Egypt (GOE), United States, and other countries. The system's costs will increase significantly in the next few years as major new facilities are completed and put into service.

Since 1978, the United States Agency for International Development (USAID) has provided substantial funding for the expansion and rehabilitation of this wastewater infrastructure. The goal was to increase the system's collection, treatment, and disposal capabilities to meet the growing wastewater demands of greater Cairo's residents, businesses, and institutions.

With the rehabilitation and construction of new facilities nearing completion, institutional and financial autonomy are major strategic objectives for the GOSD. To begin to become financially autonomous, salaries and operations and maintenance costs of the system must be recovered directly from the users of the system.

In February 1992, the GOSD executed an Institutional Support Contract (ISC) with CH2M Hill International Services, Inc. (CH2M Hill) and Operations Management International, Inc. (OMI) to provide management and technical assistance for the Cairo Sewerage II Project. The primary goal of the ISC is to help provide the GOSD with a well-managed and institutionally autonomous organization which can ultimately sustain itself financially. Attaining financial autonomy through sewer user charges sufficient to recover at least salary and operations and maintenance costs in the near term is the focus of this report.

In April 1993, Ernst & Young was engaged as a subcontractor to CH2M Hill/OMI, to prepare a rate study and five year financial plan for the GOSD. The primary goals of this study are to: (1) identify the GOSD's current major revenue sources, (2) estimate the cost of providing wastewater service for Greater Cairo, (3) determine cost-of-service user charges, including lifeline charges and new connection fees, and (4) prepare a five year financial plan which summarizes all cost, revenue, and tariff cash flows. The purpose of the financial plan is to demonstrate the economic trade-offs that must be made for the GOSD to become financially self-sufficient.

The scope of this study covers all facilities comprising the wastewater system for Greater Cairo. This includes the regional service areas for the East and West Banks of the Nile, and the South (Helwan) system.

The remainder of this Section I provides an overview of the wastewater collection and treatment system, the organization of the GOSD, and the current funding for GOSD operations. This section is organized as follows:

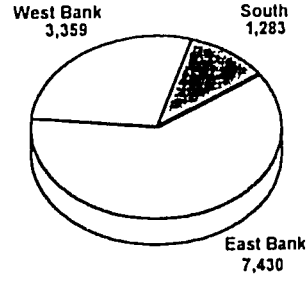
- *System Overview*
- *Organization Overview*
- *Financial Overview.*

A. System Overview

1. Demographics

In 1990, approximately 12 million people lived in the areas served by the Greater Cairo Wastewater Project.[1] The majority of the population resides on the older East Bank within the Cairo Governorate. However, the West Bank and South areas are expanding more rapidly than the East Bank. The annual population growth rates of the three areas are estimated to be about 2.9 percent (East Bank), 4.9 percent (West Bank), and 5.4 percent (South).[2] **Figure I-1**, below, shows the estimated population by region in 1990.

Figure I-1
1990 Population in GOSD Regional Service Areas (000s)



12,072,000 Total Population

Source: AMBRIC, *Greater Cairo Wastewater Project, System Load Review*, February 1991. CAPMAS 1986 Census. South determined from 1986 census figures and AMBRIC growth rates for Maadi-Basateen. El Toura and El Maasara populations are included in South figures of 1986 Census.

In addition to the estimated 12 million Cairo residents, up to two million people from outside surrounding areas arrive daily to work in Cairo's businesses, institutions, and government offices. It is estimated that more than 9 million of the 14 million daily population currently are served by the facilities of the Greater Cairo Wastewater System.[3]

Another important characteristic of the Cairo wastewater system is that it serves its more than nine million customers in a relatively small area. The population density of Cairo is approximately 13,029 people per square kilometer.[4]

Personal income levels vary widely in Cairo, as does the ability and willingness of residents to pay for wastewater services. The average annual per capita income in all urban areas of Egypt for fiscal year 1990/91 was LE 1,084, or LE 90 per month ($30 US)[5] Assuming there is an average of five people living in each household, monthly household income in all of Egypt is approximately LE 450 ($US 150).

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1 Sources: AMBRIC, *Greater Cairo Wastewater Project, System Load Review*, Volume III Appendices, February 1991 for East Bank and West Bank 1990 total of 10,789,000. Population for south region calculated using 1986 Census population data provided by the Central Agency for Public Mobilization and Statistics (CAPMAS) and the Maadi growth rate provided in AMBRIC's System Load Review.

2 Source: AMBRIC, *Greater Cairo Wastewater Project, System Load Review, Volume III Appendices*, February 1991.

3 Source: The number of customers served by the wastewater system is derived from estimates of East Bank, West Bank, and Maadi sewered populations provided in AMBRIC's *Greater Cairo Wastewater Project, System Load Review, Volume III Appendices*, February 1991. Estimates of sewered population in the South Region are assumed to be equal to the same proportion of population in East Bank and West Bank which are sewered.

4 The calculation is as follows: 12 million people divided by 921 square kilometers. The Greater Cairo sewer system covers approximately 921 square kilometers.

5 Source: El-Laithy and Kheir-El-Din, *Assessment of Poverty in Egypt Using Household Data*, page 14, August 1993. Statistics are not provided for individual cities. Urban area statistics are primarily from Cairo and Alexandria. The report was written in the framework of a project on "Developing Poverty-Conscious Macro Frameworks in Egypt" and was financed by the World Bank.

Cairo residents of lesser economic means may find any increases in wastewater charges difficult to accept. The economic well being of the GOSD's customers is a major consideration in developing new wastewater charges.

2. Wastewater Facilities and Regional Service Areas

Residents of Greater Cairo are provided service in three regional service areas: the East and West Banks of the Nile, and the South area (south of the City of Cairo). Efforts to subdivide the East Bank into a fourth, North service area, currently are being considered by the GOSD but are not incorporated into this study. Currently, the wastewater system covers an area of approximately 921 square kilometers.[6] The following are brief descriptions of the facilities currently operating in the GOSD's regional service areas and those that will be built in the future.[7]

West Bank

The West Bank system primarily serves the cities of Giza, Dokki, and Mohandesin. The collection system of the West Bank currently consists of:

- ❒ Two wastewater treatment plants (one primary and one secondary treatment)
- ❒ Two main collectors
- ❒ Twelve main pump stations
- ❒ Thirty subsidiary pump stations
- ❒ Four pump stations with associated force mains.

The major new facilities on the West Bank include eight screw pump stations and the major collection and conveyance systems. Nineteen subsidiary pump stations on the West Bank will be abandoned when construction of the newer facilities is completed. The rehabilitated and newly constructed West Bank is designed to provide complete sewerage interception, conveyance, treatment, and disposal services to the greater Cairo area West of the Nile River.

East Bank

At present, the East Bank collection and treatment system consists of:

- ❒ Two wastewater treatment plants (primary treatment)
- ❒ Three main collectors, totaling 30 kilometers (km)
- ❒ Six main pump stations
- ❒ Sixty-nine subsidiary pump stations
- ❒ Nine pump stations
- ❒ Three thousand kilometers of lateral and collection sewers
- ❒ Eighteen grit traps
- ❒ Forty ejector stations with associated force mains.

The two primary wastewater treatment plants currently operating on the East Bank are the Berka and the old Gabal el Asfar treatment facilities. The old Gabal el Asfar treatment plant will be decommissioned once the new East Bank collection and treatment system is fully operative. East Bank new construction will increase the main collectors of the existing system by approximately 59 kilometers.

The major new facilities on the East Bank include two new wastewater treatment plants at the Gabal el Asfar and Shoubra el Kheima sites, expansion of the Berka wastewater treatment plant to include secondary treatment, and one

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6 Source: CH2M Hill, *Sewer Cleaning Department Report*, Basic Data Table 2E-1.0

7 Source: AMBRIC, *Greater Cairo Wastewater Project, Wastewater Service Charge Study*, October 1992 and June 1993

major pump station. The East Bank's Ameria pump station is one of the largest in the world.

South

The facilities of the South region primarily serve the areas of Maadi, Old and New Helwan City, and Tebeen. Wastewater services in the Helwan region begin in Maadi, where the East Bank collection system ends. The South region serves far more industrial customers than the other two regions, as the South area initially was developed as an Industrial Zone. Some of the industries conducting business in Helwan are iron and steel foundries, cement factories, military factories, and automotive plants.

The South region collection and treatment system consists of:

- One wastewater treatment plant (secondary treatment)
- One main collector
- Seven main pump stations
- Six subsidiary pump stations.

The new South region collection system is based on a main collector running from north to south alongside the Nile, and a series of intermediate pump stations. A series of branch sewers will drain westward from the main industrial zones to this main collector. Four lift pump stations along the main collector will pump the flows to the Helwan wastewater treatment plant (WWTP).

The Helwan WWTP is an activated sludge plant. The sludge is dried on drying beds and the effluent is reclaimed for use in a spray irrigation system.

There also are several private industrial treatment plants planned for development in the South region. Although these private facilities will operate externally to the GOSD, the prices they charge to their customers in the future will impact the GOSD's pricing policies.

Major Wastewater System Facilities

Exhibit I-1, on the following page, lists the major treatment plants and pump stations for the three regional service areas. The exhibit also includes the year in which each facility began or will begin service. As shown in **Table I-1** below, the total design treatment capacity by 1996 will be approximately 3.5 million cubic meters per day.

Table I-1
Planned Wastewater Treatment Plant Design Capacity

Name	Level of Treatment	Design Capacity (m^3/day)	Start-Up Year
West Bank			
Abu Rawash	Primary[a]	400,000	1992
Zenein	Primary and secondary	330,000	1990
East Bank			
Berka	Primary and secondary	600,000	1995
Gabal el Asfar	Primary and secondary	1,000,000	1996
Shoubra El Kheima	Primary and secondary[a]	600,000	1994/96
South			
Helwan	Primary and secondary	350,000	1992
Total		3,280,000	

(a) Commissioned as primary treatment plant; construction of secondary treatment units suspended or estimated completion unknown.

Exhibit I-5, at the end of this section, is a map showing the system's major facilities. Most of the system's facilities, 19 of the 24, were completed after 1990, and operate at approximately one-third to one-half of their design capacity.

Major GOSD Wastewater Facilities

Region	Wastewater Treatment Plants Name (Design Capacity m³/day)	Year Operational	Pumping Stations Name	Year Operational
West Bank	1. Abu Rawash (400,000)	1992	1. Abu Rawash	1992
			2. Boulac	1992
	2. Zenein (330,000)	1990	3. Cheops	1993
			4. El Ahram	1960
			5. Embaba	1992
			6. Giza	1930
			7. GOSD No.4	1992
			8. GOSD No. 5	1992
			9. Junction	1960
			10. Pyramids	1992
			11. South Muhiet	1992
			12. Zenein (Inlet)	1992
East Bank	3. Berka (600,000)		13. Ameria	1992
	Primary	1990		
	Secondary	1995	14. Ein Shams	1914
	4a. Gabal El Asfar	1915	15. Khalag	1994
	4b. Gabal El Asfar (1,000,000)	1996	16. Koussous	1992
	5. Shoubra El Kheima (600,000)			
	Primary	1994		
	Secondary	1996		
South	6. Helwan (350,000)	1992	17. Helwan	1992

Only two of the treatment plants currently provide secondary treatment of wastewater; Zenein on the West Bank and Helwan in the South. The Gabal el Asfar and Shoubra el Kheima plants will provide secondary treatment when they are commissioned in 1996. Overall, the system discharges approximately 2.7 million cubic meters (500 million gallons) of wastewater per day.[8]

The improvement and rehabilitation of the Greater Cairo Wastewater System has been undertaken in two major projects, with substantial funding provided by the USAID. The majority of funds for the first project, Cairo Sewerage I, were spent on rehabilitating the existing major facilities and wastewater collection system. Funds for the second major project, Cairo Sewerage II, are primarily focused on expanding the treatment, collection, and disposal of the wastewater system.

The total capital costs of Cairo Sewerage I and II are approximately LE 5.6 billion. Of this total, approximately LE 2.9 billion was spent on Cairo Sewerage I. The balance of LE 2.7 billion will be spent for Cairo Sewerage II.[9]

3. Wastewater Flows

Estimates of wastewater flows by customer class are not available. Estimates of water flows are available, and are used in this report as an indirect measure of the load each customer class places on the wastewater system. Approximate annual water flows of the six customer classes appear in **Table I-2.**

Table I-2
Estimated Water Flows
by Customer Class FY 92/93
(Cubic Meters 000s)

Customer Class	Flow
1. Domestic	854,433
2. Government	249,269
3. Small Factories and Shops	68,389
4. Large Industrial Factories	25,072
5. Tourism and Investment	13,034
6. Worship and Charities	10,368
7. Sports Clubs and Embassies	7,118
Total	1,227,683

8 Source: AMBRIC, *Greater Cairo Wastewater Project, System Load Review, Volume III Appendices*, February 1991.

9 Sources: AMBRIC, *Organization for the Execution of the Greater Cairo Wastewater Project, Five Year Plan (1992-1997)* and *Plan of the Fiscal Year 1992-95*. The total authorization of funding for the Cairo Wastewater II Project was approximately $816 million, or approximately LE 2.7 billion.

B. Organization Overview

The General Organization for Sanitary Drainage for Greater Cairo was established in 1981 by Presidential Decree No. 133/81. The Presidential Decree granted the GOSD the following responsibilities:

- ❒ Manage, operate, and maintain sewerage and wastewater facilities in greater Cairo
- ❒ Furnish general plans for wastewater projects in the Greater Cairo area
- ❒ Provide network research and feasibility studies for wastewater projects, and issue technical specifications for bids
- ❒ Issue general policies for the GOSD
- ❒ Establish contracting guidelines for local and expatriate consulting firms
- ❒ Issue training programs to improve the management and operations capabilities of GOSD employees.

1. Organization Structure, Policies, and Procedures

External Organization

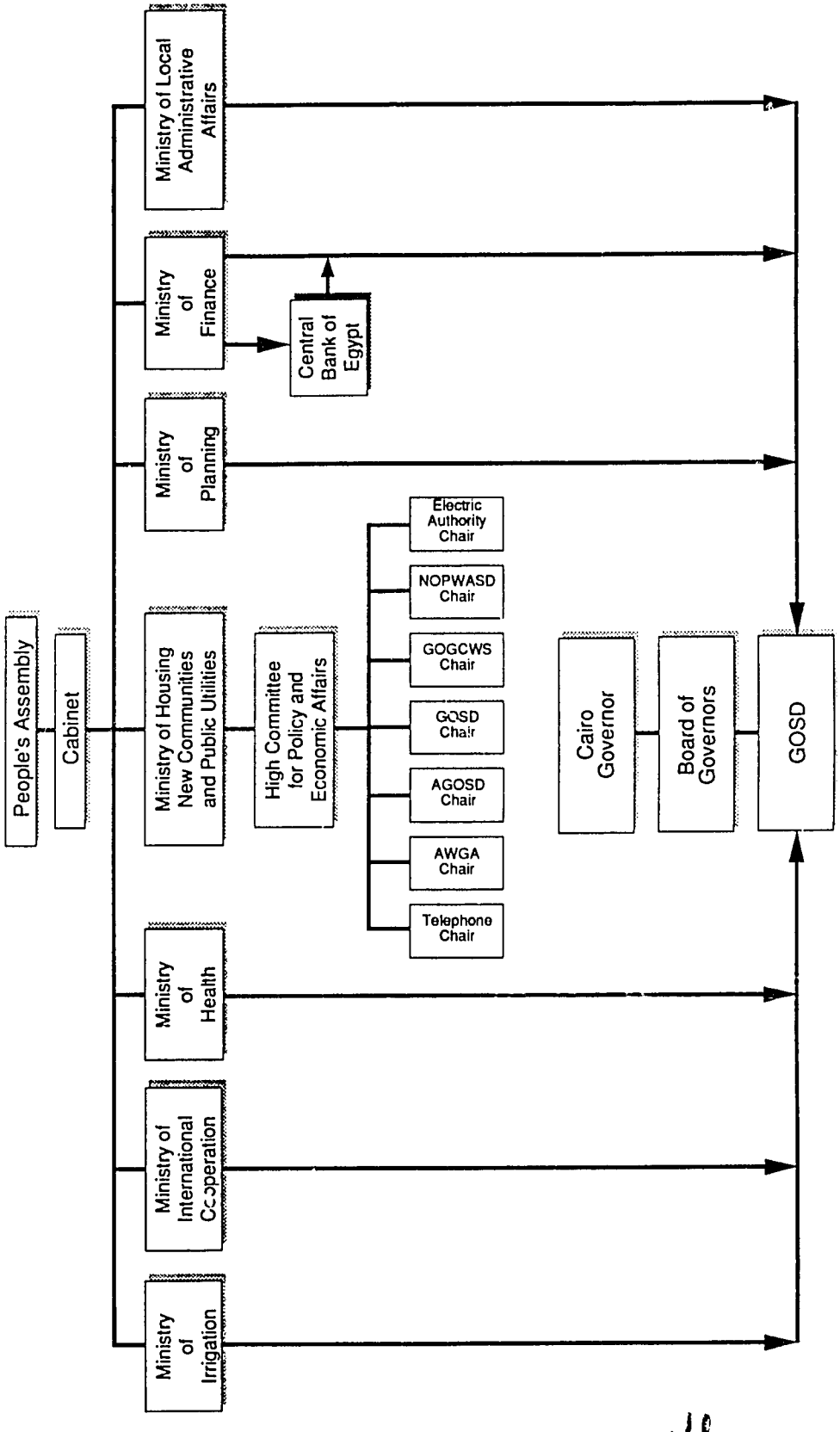
The Presidential Decree established the GOSD as a separate and independent wastewater authority from the National Organization for Potable Water and Sanitary Drainage (NOPWASD). However, the GOSD remains dependent on several other key government authorities for policy guidance, investing in and planning of the greater Cairo wastewater system. The GOSD budget, investments, wastewater surcharges, staffing levels, and salary and wage levels also must be reviewed and approved by both local and GOE authorities.

Exhibit I-2, following this page, illustrates the GOSD's relationship with local and federal authorities. Basically, the GOSD is granted limited autonomy. The GOSD's organization, policies, and procedures remain centrally planned and controlled by a number of local and national organizations.

Exhibit I-3, following Exhibit I-2, lists each entity that impacts the manner in which the GOSD conducts business. A brief description of how each entity affects the GOSD follows below.

1. **Local Governorates** enjoy a certain degree of freedom within the policy making framework for wastewater charges. In the past, local governorates in Egypt have rejected national tariff rate policies and set their own. Local governorates also control the ownership of right of way and fixed assets which affects system expansion. The Chairman of the GOSD reports directly to the Governor of Cairo. The governorates of Giza and Kalioubia also are involved in local planning coordination.
2. **National Investment Bank (NIB) of the Ministry of Planning (MOP)** reviews, negotiates, and approves GOSD capital outlay funds for the rehabilitation and improvement of the wastewater system.
3. **Ministry of Finance (MOF)** establishes national budgetary guidelines and reviews, negotiates, and approves funds for GOSD salaries, operations and maintenance expenses, and debt service payments.
4. **Ministry of International Cooperation** negotiates soft loan agreements with foreign donors interested in funding projects related to public services, including GOSD projects.
5. **Central Bank of Egypt** receives and maintains, on a quarterly basis, all of GOSD funds transferred by the MOF.

Relationship of GOSD with Government of Egypt and Local Government Hierarchy



Major Entities Impacting GOSD Operations

Egyptian Government

1. Local Governorates
2. National Investment Bank of the Ministry of Planning
3. Ministry of Finance
4. Ministry of International Cooperation
5. Central Bank of Egypt
6. Ministry of Local Administrations
7. Central Agency for Organization and Administration
8. Ministry of Housing, New Communities, and Public Utilities
9. High Committee for Policy and Economic Affairs
10. Ministry of Health
11. Ministry of Irrigation

Funding Sources

12. General Organization for Greater Cairo Water Supply
13. United States Agency for International Development
14. The World Bank
15. Foreign Government Lenders and Donors

Suppliers

16. Egyptian Electric Authority
17. Organization for the Execution of the Greater Cairo Wastewater Project, or Cairo Wastewater Organization

Users

18. Citizens of Greater Cairo
19. Commercial and Industrial Users

6. **Ministry of Local Administration (MLA)** oversees the allocation of per diem expenses issued to GOSD employees for reimbursement of transportation expenses related to relocation assignments.

7. **Central Agency for Organization and Administration (CAOA)** establishes national personnel policies (e.g., wages, salaries, and raises for government authorities).

8. **Ministry of Housing, New Communities, and Public Utilities (MHPU)** is responsible for planning land use and industrial development in the Greater Cairo area. MHPU's major focus is managing public housing programs and building new communities. The MHPU impacts the GOSD by providing technical oversight to the High Committee for Policy and Economic Affairs (which establishes tariff policies), and reviewing and approving proposed Presidential Decrees drafted by the GOSD.

9. **High Committee for Policy and Economic Affairs (HCPEA)** establishes national tariff policies and prices charged for public services such as telephones, electricity, water services, and wastewater services.

10. **Ministry of Health** issues guidelines, standards (including maximum strength), and sample tests for customers' wastewater discharge levels.

11. **Ministry of Irrigation** monitors the effluent of the GOSD's wastewater treatment plants and determines if a plant's effluent can be discharged into the canals and drains throughout the Greater Cairo area.

12. **General Organization for Greater Cairo Water Supply (GOGCWS)** bills and collects wastewater surcharges from its water customers and transfers these revenues to the GOSD.

13. **United States Agency for International Development (USAID)** provides substantial funding, management skill, and technical guidance to the Arab Republic of Egypt for developing and operating an efficient wastewater sector, particularly in Greater Cairo.

14. **The World Bank** reviews and comments on the overall direction and progress of the Arab Republic of Egypt's wastewater sector and USAID initiatives. The World Bank also is a potential source of funds.

15. **Foreign Government Lenders and Donors** provide funds for wastewater development at below market interest rates.

16. **Egyptian Electric Authority** provides the GOSD with electricity at below market rates. Electricity is the single largest cost of the wastewater system.

17. **Organization for the Execution of the Greater Cairo Wastewater Project, or Cairo Wastewater Organization (CWO)** is responsible for the construction of new Cairo wastewater facilities. The primary difference between responsibilities of the GOSD and the CWO is that the CWO constructs new wastewater facilities, while the GOSD operates and maintains the wastewater system. However, the GOSD also assists with planning the implementation of new facilities, including extensioin of service to unsewered areas and expansion and improvements of existing facilities and conveyence systems.

18. **Citizens of Greater Cairo** represent the single largest number of customer connections of any customer class.

19. **Commercial & Industrial Users** typically discharge the greatest volume per account and highest strength wastewater flows.

Internal Organization

The GOSD employs approximately 10,800 people. Many of these employees have professional qualifications in civil, electrical, and mechanical engineering, and others are employed in legal, accounting, public relations, and public management positions. Approximately 16 percent of the workforce are employed in wastewater treatment plants and 15 percent work in the major pump stations. Another 39 percent of GOSD employees are in sewer maintenance positions and subsidiary pump stations. The remaining 30 percent are in administration. **Exhibit I-4**, on the following page presents the current organizational structure of the GOSD.

2. Goals and Objectives

Through the ISC, the GOSD has set the following goals for improving its organizational effectiveness and the public's perception of its wastewater services:

- To develop experienced management, administrative, and technical staff
- To establish appropriate staffing levels
- To establish administrative, financial, and control systems
- To realign GOSD policies to reflect a more commercial orientation
- To improve sewerage treatment capabilities
- To attain financial autonomy by fiscal year 1996/97.

To attain these organizational goals, the GOSD is seeking amendments to Presidential Decree No. 133/81, which will allow it to operate outside of the complex framework of central and local governments. A draft of the proposed Presidential Decree was prepared by the GOSD and submitted to the MHPU. The MHPU approved the draft and sent it to the Council of State for review. Signing was scheduled for June 1993; however, a delay of some months is now expected. The GOSD anticipates that the proposed Presidential Decree adopting the requested amendments will be issued sometime in 1993.

The GOSD expects that the Presidential Decree will significantly impact its organization by granting the following responsibilities:

- The ability to set tariffs and retain revenues in amounts necessary to recover salaries and operations and maintenance costs
- The ability to have an independent budget and annual Final Accounts, to retain monthly revenues for self financing GOSD expenditures, and to carry forward annual surpluses from year to year
- The ability to charge fees for consultancy and technical assistance provided to the private sector
- The ability to set organization, personnel, procurement, and selling policies free from Government of Egypt regulations.

As discussed earlier, all of the responsibilities noted above are currently micro-managed by local and central government authorities.

In addition to the changes sought in the Presidential Decree, the GOSD also is modifying its approach to managing the organization. CH2M Hill/OMI is

General Organization for Sanitary Drainage for Greater Cairo

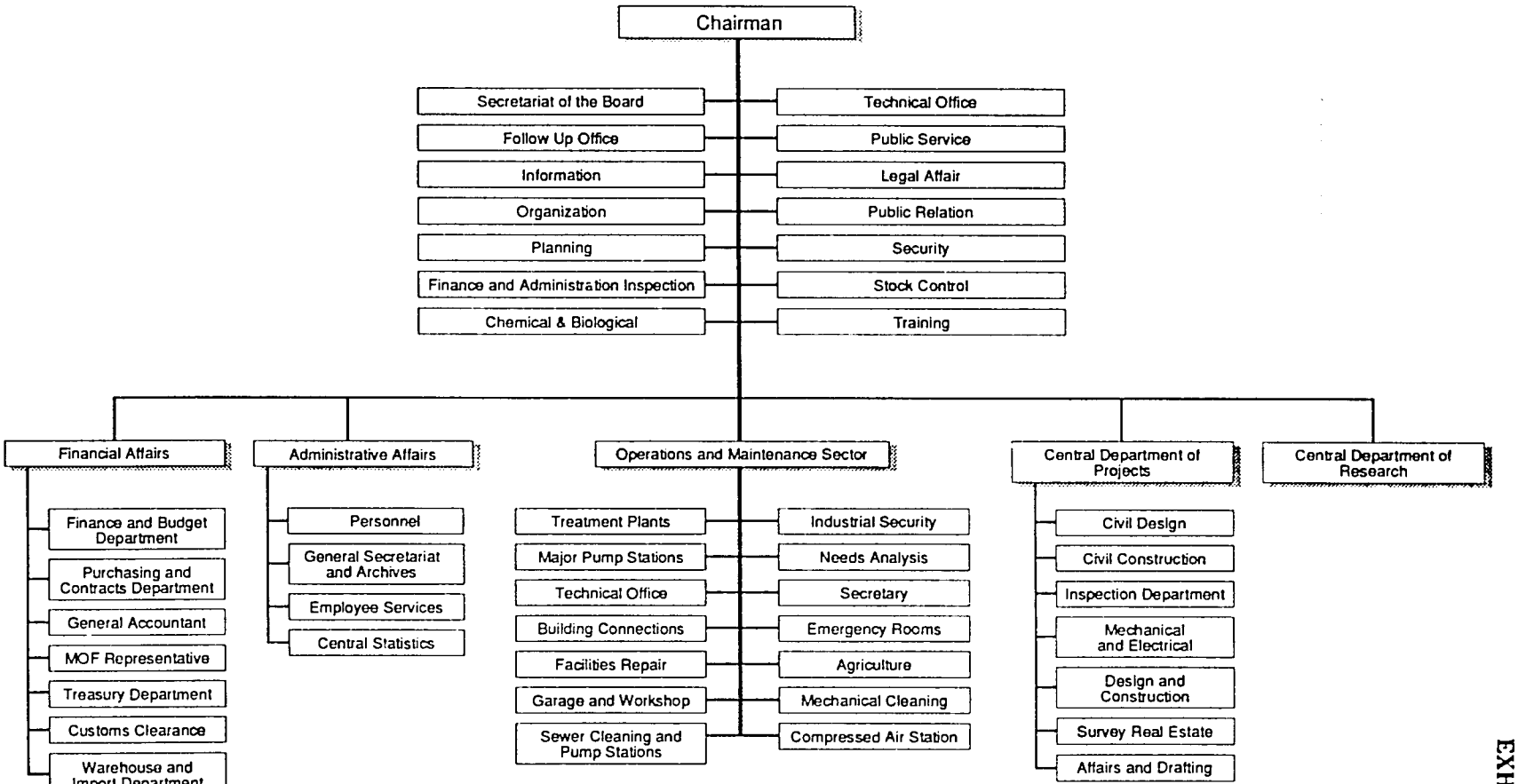


EXHIBIT I-4

assisting the GOSD to analyze alternative organization structures which will help the GOSD to provide competitive and acceptable wastewater services. The three guiding principles of the proposed organizational changes are that:

- ❒ The organization is decentralized
- ❒ Decision making and planning are pushed down into the organization
- ❒ Revenues are generated and released to recover salaries and operations and maintenance costs.

Under the proposed changes, and consistent with the three guiding principles, the Greater Cairo wastewater system will be restructured into more independent departments which operate as cost centers. One proposal is to re-organize the GOSD into regional or functional cost centers. The proposed cost centers would track costs for either support or operations and maintenance activities. Direct and indirect costs would be captured and reported for each cost center. The costs include salaries, benefits, utilities, repair and replacement, capital improvements, and equipment purchases.

Operating performance measures also would be tracked and reported, and include operation and maintenance costs per cubic meter of wastewater discharge. The proposed accounting system would allow the GOSD to track and allocate costs by facility and activity, something which is impossible to do now. Management reports would be prepared which allow the GOSD to:

- ❒ Monitor and control costs
- ❒ Maintain buildings and equipment
- ❒ Improve the financial operating performance of the system
- ❒ Improve and develop new methods of operations
- ❒ Allocate people and equipment resources efficiently
- ❒ Determine cost-of-service by function
- ❒ Establish cost-of-service user charges.

C. Financial Overview

The GOSD is a government service organization and is subject to numerous accounting laws and regulations of the Government of Egypt (GOE). These regulations dictate the specific financial procedures, methods, and activities that the GOSD must adhere to in preparing its financial reports and budgets. The remainder of this subsection describes the processes by which the GOSD receives revenues and budgets and plans for its annual expenditures.

1. Current Water Surcharge for Wastewater Services

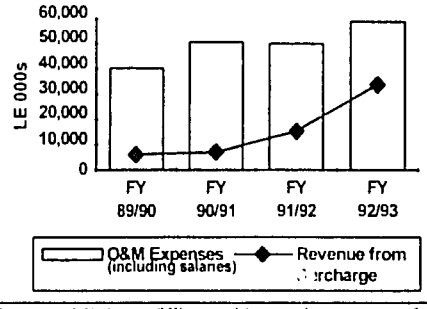
At present, the GOSD is not granted the ability to set its own wastewater tariff rates. National tariffs are established by the High Committee for Policy and Economic Affairs (HCPEA).

The wastewater charge now in effect is a percent surcharge on each customer's water bill. Since July 1992, the surcharge billed to *domestic* water customers has been 20 percent of their bill for potable water consumption. Since July 1992, all other water customers have been assessed 50 percent of their water bill.

From 1985 to July 1992, the wastewater surcharge for all water customers was 10 percent of the water bill. This surcharge is set by the High Committee for Policy and Economic Affairs. According to the HCPEA, the purpose of the 1992 increase was to initiate the first in a series of gradual surcharge increases to ensure adequate amounts were collected to recover all salary and O&M costs. However, the 1992 surcharge does not yield sufficient revenues to recover O&M costs.

Figure I-2 illustrates the gap between revenues generated by the surcharge on water bills, and the GOSD's reported operations and maintenance costs for the last three fiscal years. Even after adding revenues from secondary services (discussed later in this section), the GOSD's deficits for the last three years have ranged from LE 23 million to LE 37 million.[10] These deficits have been funded with GOE subsidies, various loans, and foreign grants.

Figure I-2
Historical O&M Expenditures and Revenues from Surcharges
(LE 000)



Sources: Ministry of Finance Memo, *Comparison of Revenues & Expenditures, Fiscal Years 1987/88 to 1991/92* and GOGCWS Collection Data, Fiscal Year 1992/93.

At present, the GOSD does not have a billing and collection function. Rather, the GOSD relies on the General Organization for Greater Cairo Water Supply to issue water bills, process payments, process wastewater surcharges included on each water bill, and transfer full and correct wastewater revenues to the GOSD.

The process by which GOGCWS bills, collects, and transfers money to the GOSD begins when water customers are sent bills for the amount of water consumed in the prior two-month period (i.e., bills are issued bi-monthly). The bill for

[10] Revenues from secondary services, which are discussed later, somewhat improve the GOSD's financial condition. Annual revenues from these services have ranged from LE 6.0 million to LE 11.7 million over the last three years.

wastewater services is a fixed percentage of the total amount billed to customers for water services. The amount each customer is charged for wastewater services depends upon three factors:

- Total volume of water consumed in the two-month period
- Rate at which water use is charged per volume of water consumed
- The surcharges established for wastewater services.

Wastewater bills are calculated irrespective of the strength of wastewater discharged and not directly on the quantity of wastewater discharged.

The proportion of water bills actually collected from domestic and government customers is 72 percent of the total amount billed by GOGCWS. Approximately 90 percent of total billings to domestic customers (i.e., residential households) are collected, while only 27 percent of billings to government customers are collected. Collection rates for the other five customer classes are unknown. The collection rates for domestic and government are based on information obtained from the GOGCWS on total water billings and receipts for fiscal year 1992/93.

Periodically, the GOGCWS sends to the GOSD's Financial Affairs Department a check for the total amount received from the surcharges on water consumption. The GOSD does not control the timing or level of these cash receipts.

The GOSD's financial stability is weakened further, because it is unable to retain the revenues transferred from the GOGCWS. In accordance with Government of Egypt (GOE) policies, the GOGCWS transfers revenues from the wastewater surcharge to the GOSD. The GOSD then retains ten percent of these funds, and must transfer the remaining 90 percent to the Ministry of Finance. Also, the GOSD does not track the amount actually billed by the GOGCWS, nor is the GOSD provided information by GOGCWS on the amounts billed customers and owed to the GOSD. The GOSD believes that in some cases, the amount received from the GOGCWS is less than the amount the water utility collected from wastewater surcharges.

Managing GOSD finances is hindered because the GOSD does not know how much money it is owed from GOGCWS. All billing and collection activities are handled at GOGCWS and are not audited by the GOSD.

Other characteristics of the wastewater surcharge that impact the GOSD's potential for financial autonomy include:

- A national tariff is not responsive to the specific characteristics and costs of the GOSD's wastewater system
- The GOSD has no authority to encourage customers to pay their bills
- The goal of recovering only operations and maintenance costs ignores the need for capital costs and interest expense for the expansion, repair, or replacement of the GOSD's facilities.

In addition to collecting, treating, and dispersing wastewater, the GOSD also provides several secondary services geared towards specific classes of customers with particular needs. Revenues generated from secondary services include:

- **Connection Fees** – There are four categories of connection fees related to the construction of new lateral connections to the wastewater system. The majority of revenues generated from connection fees are derived from a ten percent supervision fee (of estimated connection construction costs) which is charged to recover the costs of reviewing construction work performed by private contractors.

Other connection fee revenues are generated from a flat fee of LE 50 which is charged to all new wastewater customers, a ten percent surveying fee, and several other fees that the GOSD imposes if it is contracted to perform the actual construction of the connection.

- **Administrative Charges** – the GOSD generates additional revenues by assessing a ten percent fee on all secondary services. For example, an additional ten percent fee is charged on top of a penalty on users for damaging wastewater system assets. The fee is charged to recover the GOSD's costs of processing the penalties.
- **Other Revenues** – The majority of other revenues is attributable to penalties. Penalties are imposed by the GOSD on customers either for illegally discharging wastewater or damaging the wastewater system's infrastructure. Penalties also are imposed on contractors for construction delays. Additional sources of other revenues are generated from the rental and repair of equipment, such as submersible pumps and back hoe loaders, the sales of bid documents, sales of sludge and crops, the rent of GOSD owned apartments, and fees from providing transportation services to GOSD employees.

Revenues earned by the GOSD's secondary services for the last three fiscal years are shown in **Table I-3**, below. As shown by Table I-3, the GOSD's revenues from these other services fluctuate widely from year to year.

Wastewater surcharges received by the GOSD in fiscal year 1992/93 were approximately LE 33.7 million. Adding revenues of LE 11.7 million from secondary services, total fiscal year 1992/93 revenues were LE 45.4 million. Approximately one quarter of total revenue was derived from the GOSD's secondary services in fiscal year 92/93. However, it will be difficult for the GOSD to continue to increase secondary revenues at the same rate as the utility's operating costs are projected to increase. The majority of the GOSD's costs will need to be derived through wastewater surcharges.

Table I-3
Revenues Generated from GOSD Secondary Services
(LE 000s)

Secondary Service	FY 1990/91	FY 1991/92	FY 1992/93
Connection Fees	LE 1,290	LE 5,001	LE 6,705
Administration Charges	2,361	1,065	903
Other Revenues	2,332	688	4,124
Total	LE 5,983	LE 6,754	LE 11,732

2. Budgeting Process

In accordance with GOE policies, the GOSD's budget, like all budgets for Egypt's government units, is divided into four major sections:

- *Bab 1- Wages.* Wages are the sum of salaries, benefits, and allowable bonuses
- *Bab 2- Goods and Services.* Goods and services primarily consists of fuel and lubricants, spare parts and commodities, and debt service interest payments
- *Bab 3- Capital Projects.* Capital projects include budgeted amounts for new or existing operations and maintenance projects
- *Bab 4- Debt Service.* This final account consists of debt service principal repayments on GOE or foreign country loans.

Unable to generate sustainable revenues on its own, the GOSD is dependent on the Government of Egypt and foreign countries to fund all four budget accounts. As a result, different departments of the GOE review, annually negotiate, and approve the GOSD's four Bab accounts.

The process by which the GOSD prepares the Bab 1, 2, and 4 budgets is discussed below. The process the GOSD uses for budgeting Bab-3 is described in the next sub-section, Financial Planning.

The budgeting process for Bab 1, 2, and 4 is overseen by the MOF. At the beginning of each fiscal year (July 1), the MOF establishes a set of guidelines, procedures, and timetables for submitting the four Bab budgets to the GOSD's Finance and Budgeting Department. For example, one year's guidelines may ask for budgeted amounts for the upcoming one year while another year's guidelines may ask for a five-year budget. The MOF expects to receive the completed budget in approximately two to seven months, depending upon their chosen timetable for that year.

The GOSD's Finance and Budgeting Department ultimately is responsible for compiling the summary Bab budgets. Various departments within the GOSD provide data and support services to assist in preparing the budgets.

The Finance and Budgeting Department summarizes this data, and submits a budget to the Chairman of the GOSD and ultimately to the GOSD's Board of Directors for review and approval. After their review, the GOSD submits copies of draft budgets to the finance departments of the local governorates for the next round of consultation and review.

After local governorates complete their review, draft Bab 1, 2, and 4 budgets are sent to the MOF and the Secretariat General of Local Government. In addition, the GOSD sends a copy of Bab 1 (wages) to the CAOA. The MOF will consult the Secretariat General to prioritize the allocation of funds available for local services. The CAOA will be consulted for national salary, wage, and bonus policies, and any resulting budgetary constraints.

Ultimately, the GOSD, the Secretariat General, the CAOA, and the Ministry of Finance negotiate these draft budgets until a total amount is agreed upon. The amounts budgeted for Bab 4, Principal Payments on Loans, are not subject to negotiation. When these four bodies agree upon the amounts, they are sent to the GOE's Board of Governors for approval and then to the People's Assembly for ratification.

After approval of the National Budget by the Central Government, the GOSD is notified of their budget allocations. Typically, the amounts awarded to the GOSD are less than what the GOSD requested and remarkably similar to the allocations received in prior years.

The allocations for the Bab accounts become available to the GOSD in twelve installments beginning in July of the new fiscal year. One-twelfth of the agreed upon sum is deposited into the GOSD's account each month. Monthly surpluses are transferred to the MOF and recorded as credits, while monthly deficits are funded by the MOF and recorded as debits. At the end of each year the GOSD's account with the MOF is settled to reflect the actual costs for that year.

3. Financial Planning

The responsibility of financial planning for the Greater Cairo wastewater system is shared between two organizations. Primary responsibility for planning and budgeting capital outlays to rehabilitate, maintain, and construct facilities has rested with GOSD. Cairo Wastewater Organization (CWO) has

had responsibility for planning and budgeting capital outlays for new facilities that have been constructed as part of the internationally-funded Greater Cairo Wastewater Program.

The process for budgeting Bab 3 - Capital Projects is overseen by the MOF, but the Ministry of Planning (MOP) also plays a key role. Similar to the MOF, the MOP sends out detailed procedures and forms at the beginning of each fiscal year. MOP guidelines, however, are specifically geared toward capital expenditures.

The GOSD's Projects and Planning departments determine the funds needed by major rehabilitation projects intended to commence or continue during the upcoming year or five-year period. The Projects and Planning departments determine the level of funding necessary to rehabilitate or significantly improve existing capital projects in the following categories:

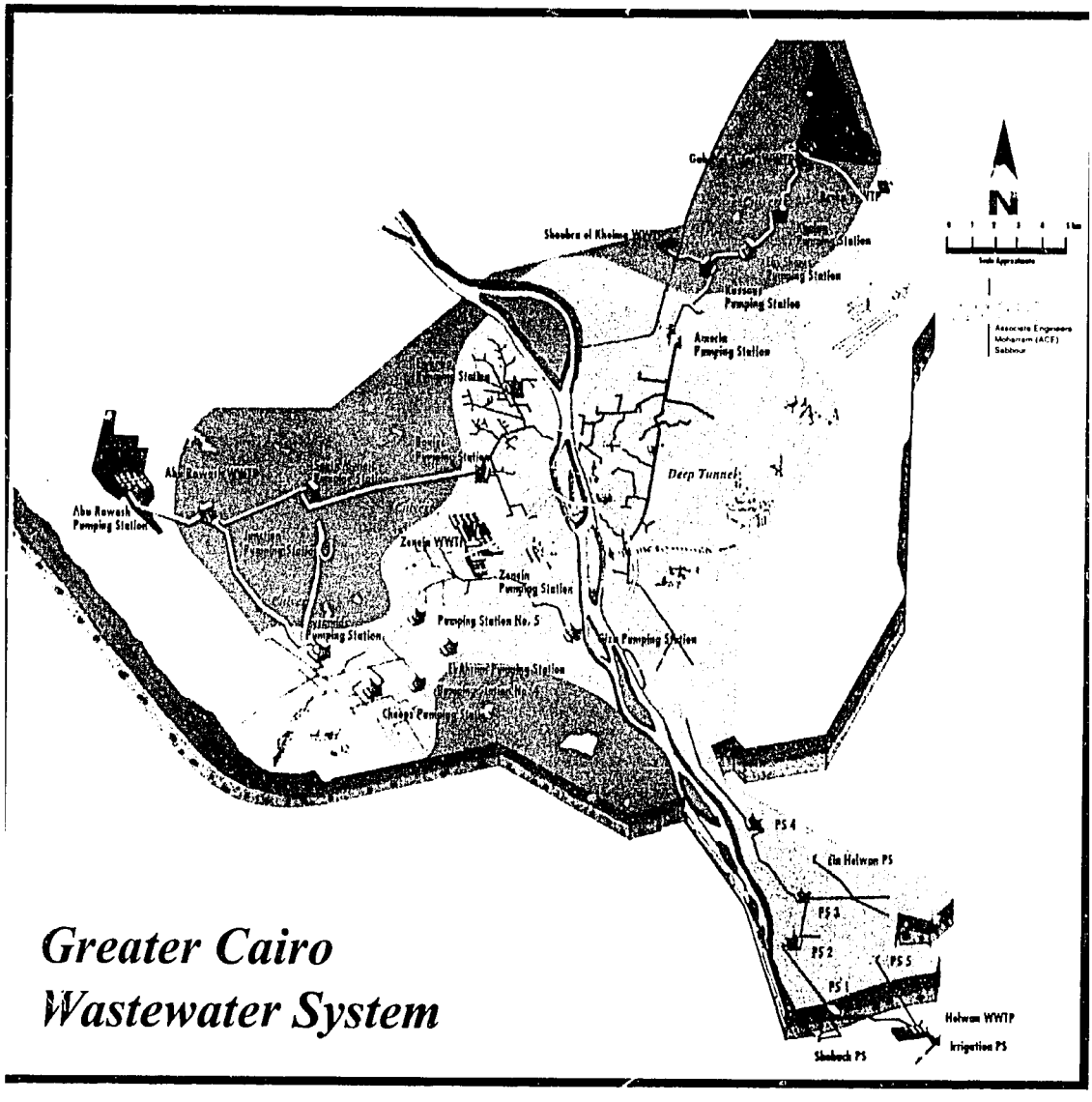
- Land
- Construction
- Equipment
- Transport vehicles
- Moving equipment
- Furniture
- Imported parts and consumables.

The Projects and Planning departments determine the total amount of funds needed in each of these categories before submitting the Bab 3 budget. However, the CWO prepares projections of capital outlay requirements only for the next year, and in total for the next five years. The GOSD prepares capital outlay projections for only the next two years, and in total for five years.

When all the data are summarized, they are reviewed for consistency by the Chairman of the GOSD and then by the Board of Directors. The GOSD then submits copies of the draft capital projects budget to the finance departments at the local governorates for their consultation and review. After local government review, the draft capital projects budget is sent to the MOP and the Secretariat General of Local Government. The MOP's National Investment Bank (NIB) plays a review and consulting role for capital projects similar to the role played by CAOA for salaries (Bab 1).

After the internal review, the MOP's NIB begins the process of consultation between the MOF and the Secretariat General of Local Governorates. After negotiation, the three bodies agree how to allocate the GOSD's requested capital projects from a combination of GOE social funds and grants provided from donor countries.

After approval of the National Budget by the Board of Governors and the People's Assembly, the GOSD is notified of its capital projects allocations. As is the case with the GOE's funding of salaries and operations, the GOSD typically receives less funding for capital projects than requested. The allocations become available in twelve equal installments starting in July.


Greater Cairo
Wastewater System
N
Deep Tunnel
Abu Rawash Pumping Station
Zenein Pumping Station
Pumping Station No. 5
Sitra Pumping Station
Kassaay Pumping Station
Amreia Pumping Station
Ezbet El Nakhl Pumping Station
Cheoop Pumping Station
PS 4
El Helwan PS
PS 3
PS 2
PS 5
PS 1
Helwan WWTP
Irrigation PS
Shoubrah PS

57

SECTION II

METHODOLOGY USED TO DETERMINE WASTEWATER RATES

ERNST & YOUNG

Section II. Methodology Used to Determine Wastewater Rates

Under the current wastewater surcharge, domestic customers are charged 20 percent of their water bill for wastewater service, while all other customers are assessed 50 percent of their water supply tariff. The wastewater surcharge is not based on the costs of providing wastewater service. In order for the GOSD to become financially autonomous, wastewater charges should be sufficient to recover the sewer utility's salaries, operations costs, and maintenance capital project costs.

This report recommends wastewater charges to help the GOSD become financially autonomous by fiscal year 1998/99. These charges were developed based on an analysis of operating costs of the GOSD, and an estimation of the demand for wastewater services. In order to make such estimates, a number of assumptions were made. These assumptions are presented in this section.

We also present the methodology used to compute wastewater charges for the GOSD. This includes a description of how revenue requirements are determined, the allocation of these requirements to different classes of customers, and the development of wastewater charges for appropriately charging customers.

This section is organized as follows:

- *General Rate Study Assumptions*
- *Major Cost Assumptions*
- *Major Revenue Assumptions*
- *Determination of Revenue Requirements*
- *Allocation of Revenue Requirements to Functional Cost Categories and Customer Classes*
- *Calculation of Charges*
- *Development of System and Regional Charges.*

During the course of this study, a number of assumptions were made which have an impact on the analytical results of the study and influence the recommended charges and five year financial plan. The most significant assumptions are discussed in the first three subsections. The remaining subsections briefly describe how charges are calculated.

A. General Rate Study Assumptions

1. Financial Autonomy

It is assumed that, beginning on 1 July 1998, all GOSD salaries, operations costs, maintenance capital project costs, and operating reserves will be recovered through wastewater charges. This is the definition of financial autonomy assumed in this report. It also is assumed that all other capital costs will not be fully recovered through wastewater charges until at least fiscal year 2004/05.

2. Time Frame

Charges are calculated on a fiscal year basis, beginning 1 July 1994, for a five year period ending 30 June 1999. Rate increases are assumed to be in effect at the beginning of each fiscal year. The five year financial plan presented in this report is for the same five fiscal years (i.e., 1994/95 through 1998/99).

3. Wastewater Surcharge on Water Bill

This report presents the recommended wastewater charges expressed as piastres per cubic meter of water flow. The purpose is to provide a charge for wastewater that is independent of the water charge. An independent wastewater charge allows valid comparisons with the current, effective wastewater charge per flow. Revenues from these wastewater charges are assumed sufficient to recover salaries, operations costs, and maintenance capital project costs, as they are phased in over the five year period.

Following guidelines suggested by USAID and the GOSD, this report also estimates the required wastewater user charge expressed as a percentage of the water supply charge. To determine wastewater surcharges, the recommended wastewater charges per cubic meter are divided by the water charges.

Water revenues are estimated for each of the five years based on projected water flows. Water charges per cubic meter for the seven customer classes are assumed to remain constant at the fiscal year 1992/93 level during the five year rate study. As water charges and water consumption change, the recommended wastewater surcharges will have to be revised.

The existing rate structure for water is assumed as the rate structure for wastewater. The current water, and therefore wastewater, rate structure is a uniform rate structure for each non-domestic customer class; water charges do not vary based on water consumption. For domestic customers only, a two-block progressive rate structure exists; water use is charged at a higher rate if the customer consumes above a specified volume during a billing period.

Although the baseline wastewater charges presented in this report use the existing water rate structure described above, recommendations are made to modify the rate structure in the long-term. The proposed changes are to allow for additional blocks within specific classes of water customers or ultimately to have the GOSD perform its own billing and collection function with the ability to set its own independent wastewater charges. Doing so would allow the implementation of a true lifeline charge.

4. Regional Charges

The primary goal of this report is to recommend wastewater charges for the entire GOSD utility as a single system. The recommended charge for each customer class is the same across all service regions of the utility.

Wastewater charges also are determined for two regional service areas: the West and East Banks of the Nile River. The South Region (served by the Helwan

wastewater treatment plant) is included as part of the East Bank.

In order to develop wastewater charges for each region, estimates of direct costs for all facilities and sewer maintenance organizational units in the region are added to a proportional share of GOSD administrative costs. The GOSD administrative costs are allocated to each region based on each region's proportional share of total operations and maintenance costs, including salaries of plant personnel. Also, GOSD capital costs are allocated to each region based on each region's proportional share of capital outlay requirements.

5. Customer Usage/Growth

The GOSD does not track wastewater flows generated by specific customer classes. Because of this, in order to determine the wastewater charge per cubic meter of water flow, the proportion of water usage which is discharged as wastewater is assumed the same for each of the seven customer classes (domestic, government, small factories and shops, large industrial factories, tourism and investment, worship and charities, and sports clubs and embassies).

In reality, the proportion of water usage that is discharged as wastewater is different for each customer class. An engineering study should be conducted to determine the differences among customer classes, and the proposed wastewater charges should be adjusted based on the findings of the study.

Projected Number of Customers

The number of wastewater customers is assumed to equal the number of water customers for the seven customer classes (domestic, government, small factories and shops, large industrial factories, tourism and investment, worship and charities, and sports clubs and embassies). The number of water customers by customer class in fiscal year 1992/93 was provided by the GOGCWS.

The number of West Bank domestic water customers is assumed to increase during the five year period based on the estimated increase in number of house connections provided in the June 1987 GKW Consult report: *ARE General Organization for the Greater Cairo Water Supply, Study of Water Supply for the City of Giza*. The number of East Bank domestic water customers is assumed to increase based on the estimated increase in sewered population provided in the February 1991 AMBRIC report: *Greater Cairo Wastewater Project System Load Review, Volume 3 - Appendices*. Increases in domestic customers on the West and East Banks are assumed to reflect: (1) population increases, and (2) expansion of the wastewater system to unserved areas.

Customers for three of the customer classes (government, small factories and shops, and large industrial factories) are assumed to increase based on the estimated percentage increases in sewered hectares for each customer class, provided in the February 1991 AMBRIC report. Tourism and investment customers are projected to increase based on the assumption that the number of hotel rooms in Cairo will double over the next 30 years. Finally, worship and charity customers are assumed to increase minimally during the five year projection, while sports clubs and embassy customers are assumed not to change from the 1992/93 number of water customers.

Projected Water Flows

Projected wastewater revenue requirements are divided by projected water flows to estimate projected wastewater charges per cubic meter of water flow. Baseline water flows are estimated for fiscal year 1992/93. Water flows by customer class for one billing

cycle (May and June, 1993) were provided by the GOGCWS. Total fiscal year 1992/93 water flows for domestic accounts and government accounts also were provided by the GOGCWS. Fiscal year 1992/93 water flows for the other five customer classes are assumed to reflect the relationship between domestic water flows and water flows of the other five customer classes in May and June, 1993.

Average water flows per customer are assumed to remain constant during the five year projection for the seven customer classes. Therefore, projected increases in water demand are based on the assumed growth in number of customers in each customer class.

6. Proposed Reorganization

Under the Cairo Sewerage II ISC, CH2M Hill/OMI is developing a new organization structure for the GOSD. The new organization has different staffing levels, responsibilities, and reporting relationships than the current organization. The expected lower staffing levels will be attained primarily through attrition.

It is assumed that the new organization structure will be implemented in fiscal year 1994/95. However, because GOSD will not be reducing staff in the short-term, the staffing levels are assumed not to differ significantly from current staffing levels during the five years of the rate study.

7. Pricing Objectives

In addition to financial autonomy and other assumptions previously discussed, other significant pricing objectives considered in the development of wastewater charges include:

- *Impact on Customer Classes* -- Charges are adjusted to reduce the economic impact on customer classes. Increases in domestic wastewater charges are not to exceed 50 percent annually.
- *Compliance with Egyptian Laws* -- The rate study and five year financial plan are prepared consistent with Egyptian Laws and Presidential Decrees.
- *Ability to Pay* -- The recommended charges provide lower income domestic customers a reduced wastewater charge and provide for cross-subsidization of customer classes based on ability to pay.
- *Understandability* -- Considering the size and complexity of the sewer utility, the charges are designed to be understandable by customers and the GOSD.
- *Simplicity in Updating* -- A computer model is provided with this report to allow the GOSD to update assumptions and charges without significant complication and effort.

A system of charges designed to meet one objective will not necessarily be the best for meeting other objectives. In some instances, the different objectives are conflicting. In developing the GOSD wastewater charges, we used our best professional judgment in considering the implicit trade-offs associated with the above objectives.

8. Reliance on Financial and Engineering Data

A significant amount of financial and technical engineering data have been incorporated in developing this study. Ernst & Young has relied on CH2M Hill/OMI and GOSD personnel to provide these financial and technical engineering data.

Estimates of capital and operating costs, required for completing this wastewater rate study, were substantially

incomplete. Capital expenditure estimates for the last two fiscal years of this five year rate study are not available. Operating costs are primarily based upon June, 1993 revised estimates to a report by AMBRIC titled: *Wastewater Service Charge Study for the Greater Cairo Wastewater Project* (October, 1992). These AMBRIC estimates used the estimated costs of only two West Bank wastewater treatment plants and one major pump station to estimate all treatment plant and major pump station costs.

For the five year rate period, all water customers are assumed charged for wastewater service. However, some water customers may not be connected to the wastewater system and should not be assessed a wastewater charge. Therefore, with regard to this assumption, the projections of wastewater user charge revenue may be slightly overstated.

All cost and revenue projections presented in this report should not be construed as actual outcomes. There usually will be differences between projected and actual results because events and circumstances do not occur as expected, and these differences may be material. We have no responsibility to update this study and plan for events and circumstances occurring after the date of this report.

B. Major Cost Assumptions

1. Salary Costs

Baseline salaries are first estimated for fiscal years 1992/93 and 1993/94. Estimated fiscal year 1993/94 salaries then are projected forward into each of the five fiscal years for which charges are developed. Salaries for fiscal years 1992/93 and 1993/94 are estimated from: (1) staffing levels for GOSD under the current organization, (2) the number of employees in each pay grade, (3) the estimated average annual salary for each pay grade, and (4) estimated GOSD salary expenditures in fiscal years 1992/93 and 1993/94.

Staffing levels for GOSD and average annual salaries for each pay grade are estimated by CH2M Hill/OMI. Estimates of the number of employees are for the current organization, and not for the planned reorganization.

The number of employees is estimated for each current organizational unit of GOSD. For any new wastewater treatment plant or pump station assumed to begin operation during the five year rate study, estimated staffing to operate these new facilities are added to the base year staffing levels, beginning in the initial year of operation.

Because GOSD salaries are based on pay grades and not on personnel classifications, the next step is to estimate the number of employees by pay grade. The percentage of employees in each of the six pay grades was estimated by CH2M Hill/OMI based on reports from the GOSD. This estimate is then assumed to be constant across all GOSD organizational units. The number of employees in each pay grade, for each GOSD facility and organizational unit, is calculated as the number of employees in the unit times the assumed, fixed percentage of employees in each pay grade.

Finally, total salaries for each facility and organizational unit are estimated as the number of employees in each pay grade times the annual average salary (including bonuses) for each pay grade. Salaries for each of the two regions also are estimated, and are based on the estimated number of employees in each region, by pay grade.

The actual mix of employees by pay grade for any single facility or organizational unit will differ from the overall average assumed for this study because pay grades are based on education and length of service with the GOSD, not on specific position classifications or functions. As a result, this assumption of a constant mix of employees by pay grade might not result in accurate salary costs for a specific facility or organizational unit, or even for a single regional service area.

2. Price Escalation

The general inflation rate for Cairo is assumed to be 10 percent per year, based on data from the Central Agency for Public Mobilization and Statistics. Unsubsidized electricity prices also are assumed to increase 10 percent per year. Salary costs are projected to increase at a rate of seven percent per year, based on proposed salary increases.

3. Electricity Prices

Currently, the price paid by the GOSD for electricity use is lower than the actual cost of supplying the electricity. However, the Egyptian Electricity Authority would not provide data regarding full-cost electricity rates.

The unsubsidized price of electricity was estimated at approximately 20 piastres per kilowatt hour (kwhr) in 1989.[1] This

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1 Adler, Robert W., *A Survey of the Economics of Electrical Energy in Egypt*, 22 April 1990, pp 10, USAID/Egypt

price then is assumed to have increased to 29 piastres in fiscal year 1992/93 based on Egypt's general rate of inflation (10 percent annually). This price is assumed to continue to increase 10 percent annually for the five years of the rate study.

It is assumed that an unsubsidized price for electricity will be phased in during the first four years of the rate study. By fiscal year 1997/98, it is assumed that the full, unsubsidized price of electricity consumption, 47 piastres per kwhr, will be paid by the GOSD.

The estimated subsidized electricity price paid by the GOSD in fiscal year 1992/93 was 18 piastres per kwhr. The price assumed recovered through wastewater charges in the first year of the rate study is approximately 20 piastres per kwhr (in fiscal year 1992/93 piastres). Thus, the electricity price assumed in the five year rate study begins approximately 11 percent higher than the GOSD's estimated fiscal year 1992/93 electricity price.

4. Commodity Prices

Prices for petroleum, diesel fuel, oil, lubricants, and chlorine are taken from a June 1993 update to the October 1992, AMBRIC report: *Wastewater Service Charge Study for the Greater Cairo Wastewater Project*. The per unit prices estimated for fiscal year 1992/93 are shown in **Table II-1**. Per unit prices for future years are assumed to equal the fiscal year 1992/93 amounts increased by the assumed general rate of inflation (10 percent annually).

Table II-1
Commodity Prices

Commodity	Price per Unit Fiscal Year 1992/93 (LE)
Petroleum	1.00/liter
Diesel Fuel	0.35/liter
Oil	1.60/liter
Lubricants	2.00/kg
Chlorine	1,500/ton

5. Quantities of Commodities and Consumables

Quantities of electricity, petroleum, diesel fuel, oil, lubricants, and chlorine consumed at each wastewater treatment plant and pump station also are taken from the update to the October 1992, AMBRIC report: *Wastewater Service Charge Study for the Greater Cairo Wastewater Project*. Appendix D in Volume II of this report provides the quantities of consumables assumed for each GOSD major facility.

In order to assess the validity of electricity consumption in the AMBRIC report, estimated GOSD electricity consumption in fiscal year 1992/93 was developed based on data provided by the GOSD. The GOSD's estimate of total electricity consumption is approximately 15 percent lower than the estimated electricity consumption reported in the AMBRIC report. However, the GOSD cannot provide electricity consumption estimates by facility and, as a result, the AMBRIC estimated electricity consumption is assumed for this study.

6. Capital Improvement Expenditures

The GOSD is facing major capital expenditures over the next seven years. Estimates of capital requirements were provided by the Organization for the Execution of the Greater Cairo Wastewater Project (CWO) and by the GOSD.

The CWO provided total expected capital outlays for construction of major facilities that are part of the internationally-funded program. The GOSD provided total expected capital outlay for all other projects

and equipment, including gravity lines and vehicles. Combining estimates from both organizations provides total capital requirements for the wastewater system.

The estimates provided by both organizations were for the five year period, fiscal year 1992/93 through 1996/97. However, CWO provided expenditures by year for only the first fiscal year, 1992/93; expenditures for the remaining four years are not identified by year. For this report, it is assumed that CWO capital expenditures for the four fiscal years through 1996/97 are equal to one-fourth of the four-year estimate provided by the CWO.

The GOSD provided expenditures by year for only the first two fiscal years. For the remaining three years (which are the first three years of the rate study), expenditures are not identified by year by the GOSD; only a three-year total is provided. Therefore, it is assumed that GOSD capital expenditures in the first three years of the rate study are constant, at one-third of the total three-year estimate provided by the GOSD.

Neither the CWO nor the GOSD provided capital expenditures for the last two fiscal years of the rate study, 1997/98 and 1998/99. For this report, it is assumed that capital expenditures in each of the last two fiscal years are equal to the annual expenditures in each of the first three fiscal years. Therefore, capital requirements in each of the five years of the rate study are constant.

Estimated new capital outlay requirements for each year are presented in the Capital Improvement Plan in Section VIII-*Five Year Financial Plan*. However, no capital costs are included in the wastewater service charges during the five year rate study, except maintenance capital project costs and operating reserves (discussed below).

7. Maintenance Capital Project Costs

The GOSD should ensure that it generates sufficient funds to: (1) maintain the fixed assets of the GOSD in an operating condition, (2) ensure financial resources are available for necessary replacements (such as for emergency conditions or system failures), and (3) upgrade the fa ilities when equipment and buildings need to be replaced. Doing so ensures that the plant and equipment reach their useful service life and that customers pay their fair share of maintaining the wastewater system.

Costs of maintenance capital projects are assumed entirely funded by the GOE for the first three years of the rate study. In fiscal year 1997/98, four percent of these costs are assumed recovered by wastewater charges. All maintenance capital projec: costs are assumed recovered by wastewater charges beginning in fiscal year 1998/99.

The estimated amount of funding needed each year is assumed equal to two percent of the estimated replacement value of existing facilities built since 1984 and all new facilities completed during the five year rate study. The value of facilities built before 1984 are not included in the calculation of maintenance capital project costs because the value of these facilities is not known.

The replacement value of capital is assumed to equal the expenditures on land, construction, equipment, and other fixed assets incurred by the CWO and GOSD for the Cairo Sewage I and II projects. Non-capital expenditures (i.e., studies, interest expense, etc.) are not included in the replacement value of capital. In fiscal year 1992/93, the replacement value of capital was approximately LE 4.8 billion based on data provided by the CWO and GOSD. Capital expenditures made during the five

year rate study then are added to the fiscal year 1992/93 replacement value of capital to estimate replacement value of capital in each future year.

8. Operating and Debt Service Reserves

The GOSD currently does not maintain any reserve accounts. The management of cash flow requires an operating reserve to ensure funds are available for short-term needs.

For this study, it is assumed that the GOSD maintains an operating reserve equal to two months estimated expenditures, and that operating reserves will be recovered through wastewater charges beginning in fiscal year 1997/98. It is assumed that the GOE will fund all operating reserves prior to fiscal year 1997/98 and will transfer the balance of prior year operating reserves to the GOSD in fiscal year 1997/98. Because existing GOSD debt is fully subsidized by the GOE, we assume no need for a debt service reserve fund for the five years of the rate study.

9. Prior Year Operating Deficits

If total GOSD revenues from wastewater charges and other operating revenues are not sufficient to recover all system costs, a deficit occurs. In the projections presented in this report, this deficit is assumed to be covered by funding from GOE and/or foreign sources and is not carried forward to the next year.

C. Major Revenue Assumptions

Certain assumptions were made regarding factors affecting GOSD revenues, including collection charges, low-income lifeline charges, industrial high strength surcharges, and various other revenues. These are presented below.

1. Collection Rates

The proportion of wastewater bills that are paid by customers (i.e., the collection rate) is a major factor in determining wastewater charges. Low collection rates require higher wastewater charges in order to recover total costs from a lower number of paying customers. These paying customers end up subsidizing non-paying customers through higher charges.

Information provided by the GOGCWS indicated that approximately LE 95.3 million was billed for water consumed by domestic customers in fiscal year 1992/93, and LE 40.5 million was billed for water consumed by government agencies during fiscal year 1992/93. Also, data were provided by the GOGCWS that indicated LE 85.0 million was paid by domestic customers in fiscal year 1992/93, and LE 11.1 million was paid by government agencies during this same period. Without adjusting for the timing of payments from one year to the next, the resulting collection rates for domestic and government customers are 89 percent and 27 percent, respectively.

Data are not available regarding the amount paid for water services in fiscal year 1992/93 by the other five customer classes (small factories and shops, large industrial factories, tourism and investment, worship and charities, and sports clubs and embassies). However, these five customer classes only account for ten percent of total fiscal year 1992/93 water flows; collection rates could vary widely for each of these classes and not have a significant impact on total water and wastewater revenues.

It is assumed that the collection rate for three of the customer classes (small factories and shops, large industrial factories, and worship and charities) is 50 percent, and the collection rate for the other two customer classes (tourism and investment, and sports clubs and embassies) is 80 percent. Thus, the average collection rate (weighted by total water flows) for the six non-government customer classes (domestic, small factories and shops, large industrial factories, tourism and investment, worship and charities, and sports clubs and embassies) is assumed to be 80 percent for the five year rate study.

The collection rate for government customers is assumed to gradually increase from 30 percent in fiscal year 1994/95 to 80 percent in fiscal year 1998/99, under the assumption that the Ministry of Finance will provide additional funding to these agencies to pay for water and wastewater services. The additional government funding could be generated from decreased direct government subsidies to the GOSD.

If GOSD does not reach these collection rates, the recommended wastewater charges would have to be increased. Specifically, if the collection rate for government agencies does not increase, the charge to these and other customers would need to be increased if the GOSD is to become financially autonomous.

2. Lifeline Charges

Lifeline wastewater charges represent the maximum amount that low income households can afford to pay for wastewater services. Because of the substandard metering capabilities of the GOGCWS, and because the GOSD cannot easily identify which domestic wastewater customers are low income, this study assumes that lifeline charges are

incorporated into the existing wastewater rate structure. That is, the recommended charges for both consumption blocks of domestic customers are set at a level lower than what would technically be required to recover all wastewater system costs allocated to domestic customers. Charges for other classes of customers are increased to provide this subsidy.

In order to provide a subsidy to domestic customers, an assumption must be made of the demand for water and wastewater services from each of the two domestic consumption blocks. That is, an estimate must be made of what proportion of total domestic customer water demand (and, hence, wastewater generation) is from the lower block (60 cubic meters or less for a two month billing period), and what proportion is from the second block (greater than 60 cubic meters). An analysis of total water flow and water billings indicated that approximately 60 percent of total demand comes from customers consuming 60 cubic meters or less in a two month period, and 40 percent comes from customers consuming more than 60 cubic meters in a two month period.

In addition to considering the amount that households could afford to pay for wastewater services, the subsidized domestic charges also incorporate the annual maximum increase in charges that domestic customers could realistically accept. For this study, it is assumed subsidized domestic charges could increase a maximum of no more than 50 percent per year without having a detrimental impact on domestic customers.

3. Industrial High Strength Surcharge

The industrial high strength surcharge is the charge imposed on industrial users who discharge wastewater into the system that is of greater strength than the average strength of domestic wastewater. The surcharge is designed to recover the additional costs associated with treating the higher strength wastewater. The pollutants for which the surcharge is assessed are:

- BOD (biochemical oxygen demand)
- TSS (total suspended solids).

The industrial high strength surcharge is determined based on an analysis of treatment and disposal costs at the six wastewater treatment plants. This included an estimation of average daily flows of wastewater at each plant, the concentration of BOD and TSS in the wastewater, the proportion of pollutants removed (plant efficiency), and an allocation of unit process costs (e.g., preliminary treatment, sludge thickening, and sludge disposal) to pollutants or to flow. The result is an estimated cost to remove a kilogram of each pollutant from the wastewater. This cost estimate becomes the recommended industrial high strength surcharge.

Revenue from the industrial high strength surcharge is assumed equal to the additional kilograms of pollutants generated by industry multiplied by the cost per kilogram to remove the pollutants. A full discussion of the calculation of the industrial high strength surcharge and projected revenues generated is provided in Section VI - *Recommended Other Service Charges*.

4. Various Other Revenues

The GOSD generates revenue from sources other than wastewater charges. These other revenues are deducted from the projected costs of the GOSD to determine net revenue requirements. The following are sources of other revenue included in the rate study:

- Connection Fees
- Administrative Fees
- Other Revenues.

The largest non-service charge revenue is connection fees, which are comprised of supervision fees and survey fees. These revenues are generated from new connections. These fees are assumed to increase based on the projected increase in number of connections.

The GOSD currently charges an administrative fee of 10 percent on all other GOSD fees. These fees are assumed to remain equal to 10 percent of the projected other fees during the five year rate study.

Other revenues consist of revenues from sludge sales, crop sales, rental and repair of equipment, sale of bid documents, penalties for construction delays, and miscellaneous revenues. Sludge sales are assumed to increase at the rate of growth of sludge production during the five year projection. Revenues from crop sales and rental and repair of equipment are projected to increase five percent per year.

Revenues from sale of bid documents are assumed to increase 15 percent per year based on historical increases from fiscal year 1990/91 through 1992/93. Also, penalties for construction delays are assumed to increase at five percent per year. Finally, miscellaneous revenues are assumed to remain constant at LE 3.5 million during the five year rate study based on historical data regarding these revenues.

Also, once financially autonomous, the GOSD intends to generate additional revenues, as follows:

- *Reclaimed Water Sales* -- Sale of effluent which is used for irrigation purposes
- *Engineering Services* -- Review of designs of wastewater systems to be installed by developers
- *Maintenance Services* -- Maintenance of wastewater pipes, connections, and pre-treatment wastewater facilities for hotels, apartment buildings, factories, and industrial plants
- *Training Services* -- Instruction to wastewater operators from other parts of Egypt on operation and maintenance and management of wastewater collection and treatment systems
- *Sale of Assets* -- Sale of equipment that will not be used by the GOSD
- *Increased Fees* -- Increased fees for equipment rental (i.e., jet trucks, submersible pumps, catch basin trucks, back hoe loaders, air compressors, etc.), sludge sales, and crop sales.

For this study, estimated revenues to be generated from these potential new activities could not be quantified, and the estimated timing as to when these revenues would be realized could not be determined. Also, additional costs would be incurred in generating several of these revenues and these costs could not be quantified. Therefore, neither the costs nor revenues from these new activities are included in the calculation of wastewater charges. However, non-service charge revenues are not the primary source of income for the GOSD, and it is assumed that these other revenues would not have a significant impact on the wastewater charges.

Exhibit II-1, on the next three pages, provides a summary of the assumptions discussed in this section. The remaining sections of this report present more detailed information about projections of wastewater demand, salary and operations costs, and GOSD revenues, using these baseline assumptions. All of these assumptions are used to develop the GOSD proposed wastewater charges presented in Section V - *Recommended Wastewater Rates*.

Wastewater Rate Study Assumptions

	Fiscal Year				
Model Years	1994/95	1995/96	1996/97	1997/98	1998/99
Escalation					
General Inflation Rate	10%	10%	10%	10%	10%
Labor Rates	7%	7%	7%	7%	7%
Electricity	10%	10%	10%	10%	10%
Asset Values	0%	0%	0%	0%	0%
Prices					
Unsubsidized Electricity (LE/kwhr)	0.35	0.39	0.43	0.47	0.52
Petroleum (LE/liter)	1.21	1.33	1.46	1.61	1.77
Diesel (LE/liter)	0.43	0.47	0.52	0.57	0.63
Oil (LE/liter)	1.94	2.13	2.34	2.57	2.83
Lubricants (LE/kg)	2.42	2.66	2.93	3.22	3.54
Chlorine (LE/ton)	1,815	1,997	2,197	2,417	2,659
Annual Salary by Grade (LE)					
First	9,175	9,817	10,504	11,239	12,026
Second	7,835	8,383	8,970	9,598	10,270
Third	6,262	6,700	7,169	7,671	8,208
Fourth	4,821	5,158	5,519	5,905	6,318
Fifth	3,952	4,229	4,525	4,842	5,181
Sixth	3,415	3,654	3,910	4,184	4,477

Wastewater Rate Study Assumptions
(Continued)

	Fiscal Year				
	1994/95	1995/96	1996/97	1997/98	1998/99
Percent of GOSD Administrative Costs Allocated to:					
West Bank	51%	45%	34%	34%	34%
East Bank	49%	55%	66%	66%	66%
Reserve Requirements					
Maintenance Capital Projects (Percentage of Asset Value)	2%	2%	2%	2%	2%
Months of Operating Reserves	2	2	2	2	2
Months of Debt Service Reserves	12	12	12	12	12
Interest Rates					
Loan Interest Rates	15%	15%	15%	15%	15%
Government Loan Interest Rates	4%	4%	4%	4%	4%
Collection Rates (a)					
Non-Government Customers	80%	80%	80%	80%	80%
Government Customers	30%	45%	55%	70%	80%
Percent of Domestic Water Flows in Each Block					
1. Domestic					
0-60 cubic meters	60%	60%	60%	60%	60%
>60 cubic meters	40%	40%	40%	40%	40%
Other Assumptions:					
Replacement Value of Existing Capital Stock (LE 000s)	5,716,255	6,167,767	6,619,279	7,070,791	7,522,303
Number of Billing Periods per Year	6	6	6	6	6

(a) Proportion of water bills paid by customers.

Wastewater Rate Study Assumptions
(Continued)

	Area	
	West Bank	East Bank
Annual Percent Change in Number of Customers		
1. Domestic (b)	3.6%	3.0%
2. Government	0.0%	0.2%
3. Small Factories and Shops	1.6%	1.0%
4. Large Industrial Factories	0.0%	1.2%
5. Tourism and Investment	2.0%	2.0%
6. Worship and Charities	2.0%	1.0%
7. Sports Clubs and Embassies	0.0%	0.0%
Annual Percent Change in Water Flows (c)		
1. Domestic	3.6%	3.0%
2. Government	0.0%	0.2%
3. Small Factories and Shops	1.6%	1.0%
4. Large Industrial Factories	0.0%	1.2%
5. Tourism and Investment	2.0%	2.0%
6. Worship and Charities	2.0%	1.0%
7. Sports Clubs and Embassies	0.0%	0.0%

(b) Increases due to population growth and connection of existing buildings.
(c) Increases due to growth in number of customers.

D. Determination of Revenue Requirements

Revenue requirements represent the required level of user charge revenues necessary to recover annual salary and operations costs of the GOSD. Identifying the appropriate amount of revenue requirements is necessary in order for the GOSD to become financially autonomous.

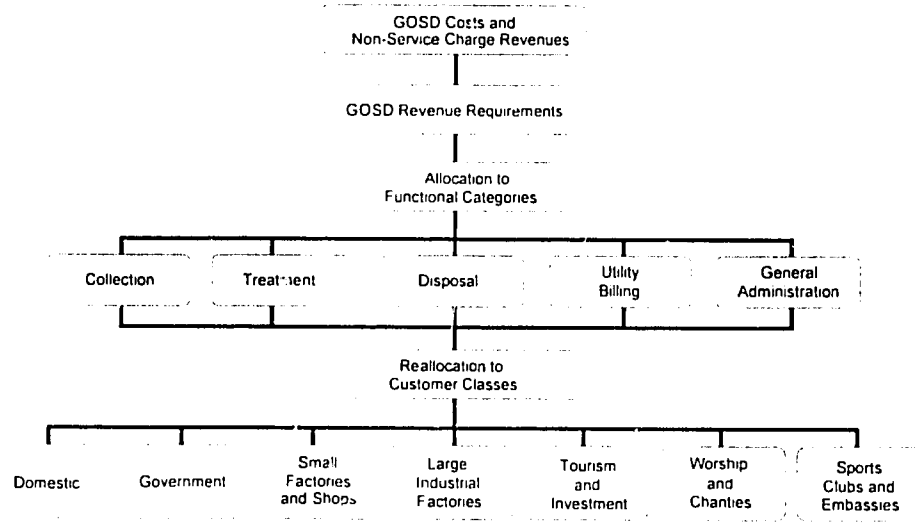
Figure II-1, below, illustrates the process used to calculate wastewater charges. Revenue requirements are provided for each of the five fiscal years, 1994/95 through 1998/99. Projected revenue requirements for each fiscal year then are allocated to one of five functional cost components (collection, treatment, disposal, utility billing, or general administration) based on system characteristics.

Functional revenue requirements are reallocated to individual customer classes based on factors that differentiate the cost of providing service to the different types of customers. Computed wastewater charges then are adjusted in order to allow for: (1) cross-subsidization of domestic customers by other customer classes, (2) equity among similar customer classes so that charges for selected classes are approximately the same by fiscal year 1998/99, (3) increases in domestic wastewater charges of no more than 50 percent per year, (4) a limit on domestic wastewater revenues of no more than 50 percent of total wastewater revenues, (5) levelized increases in charges from year to year, and (6) rounding of surcharges to the closest five percent. These adjusted wastewater charges, then, are designed to recover total GOSD revenue requirements.

1. Cash-Needs Approach

The projected cash flow of the GOSD, based on estimates of salaries and operations costs, is used as the basis for establishing wastewater charges. This cash

Figure II-1
Calculation of Wastewater Charges



needs approach assumes that revenues of the utility must be sufficient to cover all cash needs (including any debt repayment obligations) as they come due. Under the cash needs approach, capital requirements are based on annual principal and interest payments and reserve requirements rather than amortization or depreciation schedules.[2]

The first step in determining revenue requirements is to identify all annual GOSD costs. These costs then are offset by revenues from sources other than wastewater service charges. The resulting amounts represent GOSD revenue requirements.

2. Operations and Maintenance Costs

Operations and maintenance costs include all ongoing and recurring costs for the collection system, pump stations, and wastewater treatment plants. Examples of major categories of O&M costs include salaries, wages and bonuses, electricity, chemicals, fuels, lubricants, materials, and supplies. A major maintenance cost not included is the cost for maintenance capital projects. These critical maintenance expenditures are included under capital costs.

In the transition to financial autonomy, it is assumed that all non-salary operations costs are recovered first through the wastewater charges. Then salary costs are phased in and recovered through wastewater service charges. By fiscal year 1997/98, all salaries and operations costs are assumed recovered through wastewater service charges.

Table II-2, on the top of the next page, provides a summary of how costs are phased in during the five year rate study.

For this study, salaries are separated from other operations costs. Doing so allows salaries to be phased in at a different rate than operations or capital costs, while reducing the impact of large increases in wastewater service charges.

3. Capital Costs

Capital costs include the annual expenditures incurred in financing capital projects and required reserve fund contributions. Specifically, capital costs consist of:

- Expenditures for maintenance capital projects
- Financing costs (principal and interest payments) for new capital projects
- Financing costs (principal and interest payments) on loans for existing capital projects
- Debt service reserve fund contributions for new and existing capital projects.

The GOSD does not have the ability to issue bonds to fund capital projects. All capital funding is through grants from the Government of Egypt or foreign donors, or through government loans.

However, many of these donors prefer to reduce or discontinue providing capital funding until the GOSD can recover salaries and operations costs from wastewater user charges. Also, the GOSD has proposed recovery of all capital costs by the year 2005. At that time, the GOSD will need the ability to: (1) obtain capital funding through conventional loans or government loans, (2) recover annual principal and interest payments, and (3) maintain adequate reserves.

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[2] However, as noted earlier, revenue requirements do not include capital costs during the five year rate study, except for maintenance capital project costs and operating reserves beginning in fiscal year 1997/98

Table II-2
Percentage of Full GOSD Costs Recovered Through Wastewater Charges
(Assumes Financial Autonomy in Fiscal Year 1998/99)

	Fiscal Year				
	1994/95	1995/96	1996/97	1997/98	1998/99
Salaries	0%	0%	0%	100%	100%
Operations					
Electricity	68%	87%	92%	100%	100%
Other Operations	80%	90%	92%	100%	100%
Capital					
Maintenance Capital Projects	0%	0%	0%	4%	100%
Operating Reserves	0%	0%	0%	100%	100%
Other Capital	0%	0%	0%	0%	0%

The annual costs incurred in meeting these obligations will be phased in beginning in fiscal year 1997/98, when four percent of maintenance capital project costs and all operating reserves are assumed recovered through the wastewater charges. All maintenance capital project costs are recovered through wastewater charges beginning in fiscal year 1998/99. No principal or interest payments are recovered through wastewater charges during the five year rate study.

4. GOSD Indirect Administrative Salaries

In addition to direct costs of each wastewater facility, the GOSD provides a number of support services. These services include finance, personnel administration, procurement, payroll, and various other functions related to the overall operations of the GOSD. These indirect administrative personnel costs are assumed recovered through wastewater charges by fiscal year 1997/98.

5. Revenue Offsets

Revenues from sources other than the wastewater service charge are used to offset costs in order to determine the net cost of providing service to wastewater customers. These revenues include connection fees, administrative fees, other revenues, and industrial high strength surcharges.

E. Allocation of Revenue Requirements to Functional Cost Categories and Customer Classes

After determining net revenue requirements, it is necessary to allocate net revenue requirements to functional cost of service categories. Each pool of functional costs (net revenue requirements) then is allocated to each class of wastewater customer.

The functional cost categories used to establish the wastewater charges include:

- Collection
- Treatment
- Disposal
- Utility Billing
- General Administration.

The first three functional cost categories represent the operations of the wastewater system. Salaries, O&M, and capital costs of all wastewater facilities are allocated to either collection, treatment, or disposal.

Costs of billing and collection are allocated to utility billing. These costs do not vary by wastewater usage. However, billing and collection of wastewater bills are assumed to be performed by the water utility (GOGCWS) and not charged to the GOSD. For the five year rate study, it is assumed that the GOSD will have no costs for these activities.

Finally, indirect administrative salary costs of the GOSD include all non-operating personnel costs except utility billing costs. Because the GOSD will have no utility billing costs for the five year rate period, all non-operating personnel costs are allocated to general administration.

Functional costs then are allocated to each customer class. Collection and disposal costs are allocated to each customer class based on projected water usage of each customer class. Treatment costs are allocated based on both projected water usage and estimated wastewater discharge strength of each customer class.

Utility billing costs (if there are any in the future) are allocated based on proportion of water customers, and general administration costs are allocated based on each class of customer's projected water usage. The sum of collection, treatment, disposal, utility billing, and administration costs allocated to each customer class represents the total revenues that must be collected from the customer class.

F. Calculation of Charges

Wastewater charges are determined as annual wastewater revenue requirements divided by projected annual water flows (in cubic meters). Adjustments then are made to the computed charges based on the following:

- ❒ Policy decisions as to the level of cross-subsidization among customer classes
- ❒ Equity considerations among customer classes
- ❒ The ability of each customer class to pay the proposed wastewater charges
- ❒ Similar customer classes are charged similar wastewater charges
- ❒ Domestic wastewater charge increases of no greater than 50 percent per year
- ❒ The desire to smooth rate increases from year-to-year
- ❒ Rounding of surcharges to the nearest five percent in order to allow the water utility to bill for wastewater services.

The results are the recommended wastewater charges, which are different for each customer class.

Because wastewater charges are assessed as a surcharge on the water bill, revenue requirements for each customer class are divided by projected water revenues to determine wastewater surcharges. These computed surcharges are adjusted based on the reasons listed above, and the result is a percentage surcharge on the water bill.

G. Development of System and Regional Charges

Both system charges and regional charges are presented in this report. System charges are charged to each customer class, assuming the GOSD maintains one schedule of wastewater charges, regardless of customer location.

Regional charges could be assessed if the GOSD was assumed operated as two semi-autonomous regional utilities (the West Bank and East Bank). Regional charges would be sufficient to recover salaries and operations costs of facilities in the region, plus GOSD indirect administrative costs allocated to the region. A region's operations costs include the costs for: (1) operating pump stations and wastewater treatment facilities in the region, and (2) maintenance of the collection system incurred in the region but not associated directly with a pump station or treatment plant. The GOSD's indirect administrative costs are assumed allocated to each region based on the region's proportional share of direct O&M costs. Also, GOSD's total capital costs are assumed allocated to each region based on the region's proportional share of capital outlay requirements.

The regional charges presented are not entirely reliable. The regions are not separate and distinct wastewater systems. Wastewater flows from the East Bank are diverted into the West Bank system through the Siphon pump station. Also, data are not available as to water flows by customer class in each region.

Because the system-wide charges are based on a number of simplifying assumptions, refining these to regional charges may not be accurate. As a result, the estimated regional charges might not result in financially independent regions, although the system-wide charges are designed to recover system-wide costs and meet the overall objective of financial autonomy.

SECTION III

SYSTEM DEMAND

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Section III. System Demand

The wastewater rate structure was determined by the limitations of assuming the continuation of charging for wastewater services as a surcharge on water billings. In order to develop the wastewater surcharge, it is necessary to estimate the quantity of water consumed by each class of customer and to project this consumption for each of the five fiscal years of the rate study. This section presents estimates of the number of water accounts, annual water flows, and water flows per account for each of the seven classes of water customers.

This section also presents estimates of the amount which domestic customers can afford to pay for wastewater services. This information is used to assess the impact of the recommended wastewater charges on customers and what portion of domestic customers can absorb different rates.

Finally, this section presents a brief discussion of how customers may react to an increase in wastewater charges. The purpose of this discussion is to comment on the possibility that some customers may not use the wastewater system if the price charged is too high.

This section is organized as follows:

- *Water Customer Classes*
- *Water Flows by Customer Class*
- *Ability and Willingness to Pay for Wastewater Services*
- *Wastewater Services Price Sensitivity.*

A. Customer Demand Characteristics

This subsection presents a summary of classes of water customers, estimated water flows by class of customer, and the prices charged for water use. It concludes with an estimation of the average bill for water and sewer services for each class of customer.

1. Water Customer Classes

The GOGCWS defines a customer as a connection. For example, if only one connection serves a large apartment building, the owner of the building is the customer, not the tenants of the building. The GOGCWS classifies their customers in eight major classes and several other sub classifications. Seven of these classes use the sewer system and are billed for wastewater services.

The seven relevant customer classes are:

- **Domestic** customers are either owners of large apartment buildings, multi-family homes, and villas, or single family dwellings
- **Government** customers are local and national government factories, offices, and institutions (e.g., automotive plant, airline, and confectionery processor)
- **Small Factories and Shops** are distinguished from other businesses by the size of their water supply pipes (30 millimeters or less). Included in this class are restaurants, coffee shops, fuel stations, second and third class hotels, private schools, health insurance hospitals (government), garages, mills, and bakeries
- **Large Industrial Factories** are businesses which have water supply pipes greater than 30 millimeters. These customers include iron and steel foundries, chemical, cement, and military factories, automotive plants, and textile and mining companies.
- **Tourism and Investment** customers include first class hotels, tourism businesses, investment companies, entertainment clubs, and private hospitals
- **Worship and Charities** consist of mosques, churches, and charitable societies
- **Sports Clubs and Embassies** include sports clubs, youth activity centers, public recreation facilities, and foreign embassies.

According to the GOGCWS, in fiscal year 1992/93, there were a total of 479,731 water customers. The distribution of these customers is provided in **Table III-1**.

Table III-1
Number of Water Customers
FY 1992/93

	Customer Class	West	East[a]	Total
1.	Domestic	128,000	309,172	437,172
2.	Government	2,800	6,731	9,531
3.	Small Factories and Shops	8,350	20,080	28,430
4.	Large Industrial Factories	80	205	285
5.	Tourism and Investment	165	398	563
6.	Worship and Charities	970	2,326	3,296
7.	Sports Clubs and Embassies	140	314	454
	Total	140,505	339,226	479,731

(a) Includes South Region

2. Number of Accounts and Water Flows by Customer Class

The assumptions for the number of West Bank and East Bank water customers and water flows were discussed in Section II-*Methodology Used to Determine Wastewater Charges*. It should be reiterated that the assumptions for domestic growth rates account for population growth and the expansion of the sewer system into currently non-sewered areas. Growth in water flows and number of customer accounts for each customer class are assumed to be constant over the period of the five year rate study. The resulting estimates of annual growth in water customers and water flows are presented in **Table III-2**.

Table III-2
Projected Annual Growth in Customer Accounts and Water Flows for Fiscal Years 1994/95 - 1998/99

	Customer Class	West Bank	East Bank
1.	Domestic	3.6%	3.0%
2.	Government	0.0%	0.2%
3.	Small Factories and Shops	1.6%	1.0%
4.	Large Industrial Factories	0.0%	1.2%
5.	Tourism and Investment	2.0%	2.0%
6.	Worship and Charities	2.0%	1.0%
7.	Sports Clubs and Embassies	0.0%	0.0%

Exhibit III-1, on the following page, presents the estimated number of accounts, water flows by customer class, and average water flows per account for the Greater Cairo wastewater system. **Appendix B** of this report provides these projections for the West Bank and East Bank. Overall, average annual growth in total system-wide water flows during the five years of the rate study is estimated to be approximately 2.4 percent per year.

Domestic customers account for 70 percent of water and, therefore, wastewater demand in fiscal year 1992/93. This relationship varies somewhat over the five year period of the rate study, because of the different assumed growth rates for each customer class. New demand for wastewater services also will be fueled by residential areas currently served by centrally located water standpipes. These areas will be connected to the water and sewer system over the next ten years. Demand also will increase due to Egypt's high birth rate of 3.2 percent.[1] Finally, approximately ten percent of Cairo's population growth is estimated to be from Egyptians migrating from rural areas.[2]

According to Taylor Binnie & Partners' 1992 report: *METAP, Cairo Industrial Effluent Control Study*, no new permits will be issued by the Ministry of Planning for new factories in Greater Cairo. The same report further estimates that industrial pollution loads will not increase in the next ten years within Greater Cairo and that industrial activity would slowly move out of Cairo. These observations are incorporated into our growth assumptions for industrial water flows. Future industrial demand is not likely to result from new development but from increased wastewater flows from Cairo's existing industries.

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1 Source: CAPMAS, *Statistical Year Book, June 1992*. The 1990 birth rate in the Greater Cairo area.

2 Source: Shorter, Frederic, *Cairo's Leap Forward, People, Households, and Dwelling Space, Cairo Paper in Political Science* 1989, Table 5, page 20.

System–Wide Water Demand Characteristics

Item	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Number of Water Accounts							
1. Domestic	437,172	451,055	465,382	480,168	495,427	511,174	527,425
2. Government	9,531	9,544	9,557	9,571	9,585	9,599	9,613
3. Small Factories and Shops	28,430	28,765	29,104	29,447	29,794	30,145	30,501
4. Large Industrial Factories	285	287	289	292	295	298	301
5. Tourism and Investment	563	574	585	596	607	620	633
6. Worship and Charities	3,296	3,338	3,381	3,425	3,470	3,515	3,560
7. Sports Clubs and Embassies	454	454	454	454	454	454	454
Total Number of Water Accounts	479,731	494,017	508,752	523,953	539,632	555,805	572,487
Annual Water Flows (Cubic Meters 000s)							
1. Domestic	854,433	881,567	909,569	938,467	968,290	999,068	1,030,831
2. Government	249,269	249,621	249,974	250,327	250,681	251,036	251,392
3. Small Factories and Shops	68,389	69,193	70,008	70,833	71,668	72,513	73,369
4. Large Industrial Factories	25,072	25,288	25,507	25,729	25,953	26,180	26,410
5. Tourism and Investment	13,034	13,294	13,560	13,831	14,108	14,390	14,677
6. Worship and Charities	10,368	10,502	10,638	10,776	10,916	11,058	11,202
7. Sports Clubs and Embassies	7,118	7,118	7,118	7,118	7,118	7,118	7,118
Total Water Flows	1,227,683	1,256,583	1,286,374	1,317,081	1,348,734	1,381,363	1,414,999
Average Annual Water Flows per Account (Cubic Meters)							
1. Domestic	1,954.45	1,954.46	1,954.46	1,954.46	1,954.46	1,954.46	1,954.46
2. Government	26,153.50	26,154.76	26,156.12	26,154.74	26,153.47	26,152.31	26,151.25
3. Small Factories and Shops	2 405.52	2,405.46	2,405.44	2,405.44	2,405.45	2,405.47	2,405.46
4. Large Industrial Factories	87,971.93	88,111.50	88,259.52	88,113.01	87,976.27	87,852.35	87,740.86
5. Tourism and Investment	23,150.98	23,160.28	23,179.49	23,206.38	23,242.17	23,209.68	23,186.41
6. Worship and Charities	3,145.63	3,146.20	3,146.41	3,146.28	3,145.82	3,145.95	3,146.63
7. Sports Clubs and Embassies	15,678.41	15,678.41	15,678.41	15,678.41	15,678.41	15,678.41	15,678.41

EXHIBIT III-1

3. Water Charges and Estimated Water and Wastewater Bills

The water rate for each customer class is different, and, with one exception, the rate charged within a customer class is the same charge at all levels of consumption. For domestic customers only, water use is charged at a higher rate if the customer consumes above a specified volume during the billing period.

Water customers are billed once every two months for water use in the prior two month period. A wastewater surcharge is added to the bi-monthly water bill. For domestic customers, the surcharge is 20 percent of the amount billed for water. For all other customers, the surcharge is 50 percent of the water bill. The rates now charged for water consumption are provided in **Table III-3**.

Table III-3
Current Water Rates and Effective Wastewater Charges
FY 1992/93

	Customer Class	Charge Per Cubic Meter (Piastres) Water	Wastewater
1.	Domestic (0-60 cubic meters for two months)	10.0	2.0
	Domestic (>60 cubic meters for two months)	13.0	2.6
2.	Government	20.0	10.0
3.	Small Factories and Shops	23.0	11.5
4.	Large Industrial Factories	31.0	15.5
5.	Tourism and Investment	55.0	27.5
6.	Worship and Charities	8.0	4.0
7.	Sports Clubs and Embassies	13.0	6.5

Wastewater charges are currently less than one half water rates. This substantial difference is one indication of how low current charges are.

Exhibit III-2, following this page, depicts the wastewater charges by customer class. The customer classes are shown from left to right in increasing order of total annual water flows for fiscal year 1992/93.

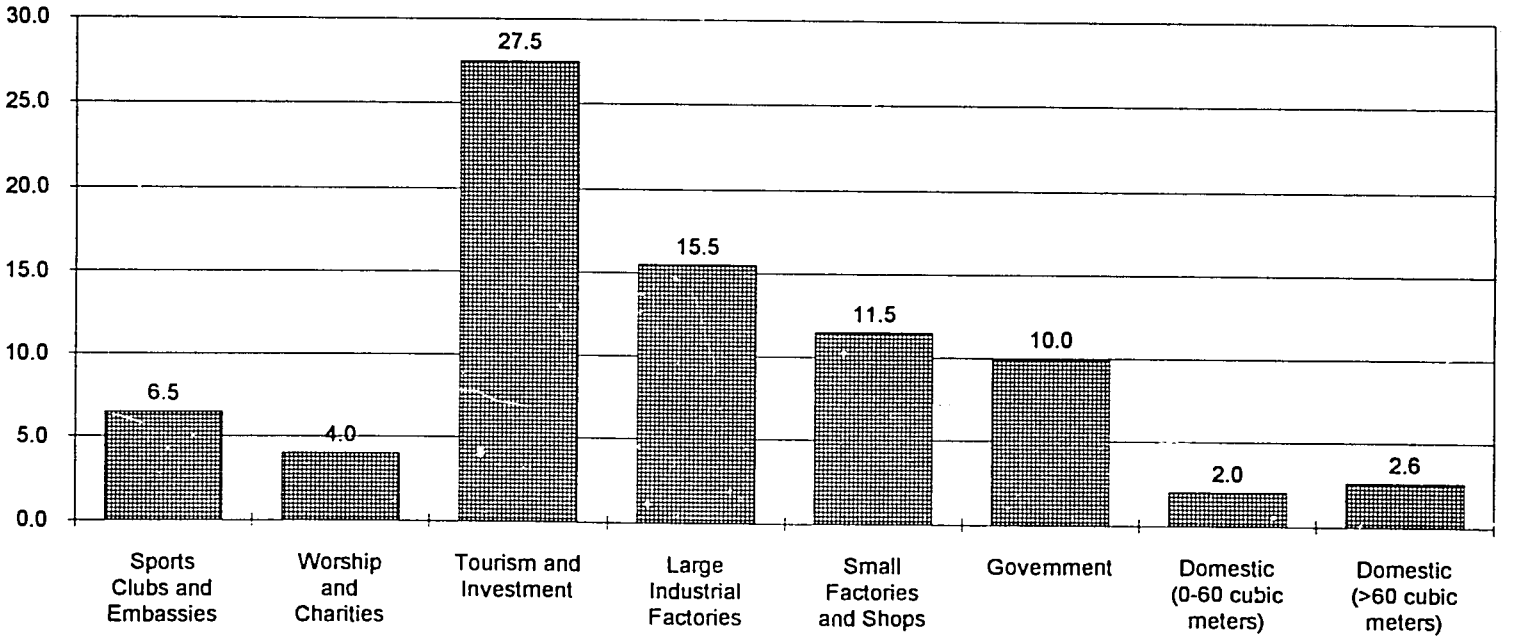
It is not clear what the rationalization is for these established charges. Wastewater charges, at present, are not based on the cost of providing service to the customer and are not based on average or expected peak wastewater flows a customer may generate. Charges also do not directly consider the potential impact a customer has on the system and do not reflect the capacity built into the system to handle potential peak demands from customers. There also is no apparent relationship between charges and total annual wastewater flows for a customer class.

The 20 percent and 50 percent surcharges effectively redistribute the burden of paying for wastewater services from domestic customers to all other customers. If there was any relationship between costs of water service and water charges, it is lost in the implementation of wastewater surcharges.

The largest single class of customers is domestic customers. A progressive (or inclining) two-block rate structure is established for these customers. However, the charges for the two blocks are significantly below most residents' ability to pay (as discussed later in this section). Very large residential users pay the same charge as an average user of the system, though it would be expected that larger domestic users could afford to pay a higher charge.

Current Wastewater Charges

(Piastres/Cubic Meter)



Customer Classes Listed in Increasing Order of Total Annual Water Flow
(not to scale)

EXHIBIT III-2

Tourism and Investment has the highest effective charge of all classes of customers. Tourism and Investment accounts for just one percent of total wastewater flows; the political decision to have tourism customers pay a relatively high charge actually provides very little subsidy to other wastewater system users.

Based on the assumptions provided previously in this section, an analysis was performed to estimate the average water and sewer bill for each class of customer. **Exhibit III-3**, on the next page, shows the results of this analysis for fiscal year 1992/93.

The average bi-monthly wastewater bill for households consuming less than 60 cubic meters of water is LE 1.00 for two months. Domestic customers consuming greater than 60 cubic meters of water pay an average wastewater bill per household of LE 2.31 during the same period.

A plan to increase the wastewater surcharge from 20 percent to 35 percent has not been implemented. The increased surcharge was recently approved by the High Committee but has yet to be approved by the Board of Governors.

Average Bi–Monthly Water and Wastewater Bills

Fiscal Year 1992/93

Customer Classification	Potable Water Rate (PT/Cubic Meter)	Average Water Use Per Account (Cubic Meters)	Average Water Bill (LE) Per Account	Average Wastewater Bill (LE) Per Account	Average Wastewater Bill (LE) Per Household
1. Domestic					
(0–60 cubic meters for billing period per flat)	10	200 (a)	20.00	4.00	1.00
(> 60 cubic meters for billing period per flat)	13	410 (a)	46.10 (b)	9.22	2.31
2. Government	20	4,359	871.80	435.90	
3. Small Factories and Shops	23	401	92.23	46.12	
4. Large Industrial Factories	31	14,662	4,545.22	2,272.61	
5. Tourism and Investment	55	3,858	2,121.90	1,060.95	
6. Worship and Private Charities	8	524	41.92	20.96	
7. Sports Clubs and Embassies	13	2,613	339.69	169.85	

(a) Domestic customers may fall in either of the two rate categories (i.e., 0–60 cubic meters per bi–monthly period or above 60 cubic meters) for any given billing period. Therefore, estimates provided in this exhibit of domestic customer billings are for illustrative purposes only, and do not reflect actual domestic water or wastewater bi–monthly billings.
The average bi–monthly consumption per domestic account is 326 cubic meters (see Exhibit III–1). For this example, it is assumed that 40 percent of all domestic water customers use an average of 50 cubic meters of water per household (flat), per bi–monthly billing period.
It is also assumed that there are, on average, four flats per domestic connection.
The total average use for accounts consuming less than 60 cubic meters is, therefore, 200 cubic meters per billing period. The remaining 60 percent of domestic customers are assumed to consume an average of 410 cubic meters of wastewater each billing period. ((40% times 200 cubic meters) + (60% times 410 cubic meters)) = 326 cubic meters (see Exhibit III–1).

(b) The first 60 cubic meters of water use per flat is charged at 10 piastres per cubic meter.

B. Ability and Willingness to Pay for Wastewater Services

When the GOSD proposes new wastewater surcharges to support a financially autonomous utility, it should be sensitive to the customers' ability and willingness to pay these higher charges. Low income customers may either be unable to afford the new charges or be unwilling to pay the expected large increase in charges. Even customers who can afford to pay the higher charges may resist the increases for political or cultural reasons.

The problem is how to provide wastewater services at a price which will recover the utility's costs yet be within a range that customers can afford and are willing to pay. One solution is to develop a highly subsidized charge for low income households. This is a charge based on a minimum level of service necessary to maintain health and sanitation, but discounted so that low income households can afford to pay some but not all of their share of system costs. A discussion of what Greater Cairo residents can afford to pay is presented in this subsection.

Another solution is to more slowly increase the charges each year to avoid rate shock. Though customers may be willing to pay the wastewater bill, they may object to large, one year increases in the wastewater bill. Smoothing the rate increases over the five year rate study, so that the increase in charges each year is more constant, is taken into consideration in Section IV- *Revenue Requirements*.

1. Identification of Low Income Customers

The subject of income distribution is viewed by the GOE as highly sensitive. As a result, detailed statistics of domestic income in Cairo and Egypt are not readily available. No official GOE surveys are specifically designed for measuring income levels, poverty, characteristics of poor households, or income disparity. A single academic study that derives low income information based on official GOE income statistics for all of Egypt is relied upon for this rate study.[3]

The GOE's Central Agency for Public Mobilization and Statistics (CAPMAS) is the official source of "average annual income per capita" data for all of Egypt. The annual income figures that the CAPMAS reports, however, are not income figures, but are average annual expenditures that an Egyptian household is believed to incur each year.

With respect to low income households, the CAPMAS expenditure statistics are considered good estimates of income. Typically, expenditures by poor households are nearly equal to income levels due to low savings and investment rates of poor households. For more affluent households, the CAPMAS statistics understate actual income levels. The academic study mentioned above derived estimations of per capita expenditures using results of CAPMAS's 1992 report: *1990/91 Household Survey, Income and Expenditure Survey Preliminary Statistics*. The study found that approximately 19.5 percent of Cairo households have annual per capita incomes that are below the poverty level of LE 722.60, compared with 29.2 percent for all of Egypt. Assuming that this distribution is the same as the income distribution of the sewered population served by the GOSD, approximately 20 percent of the GOSD's residential customers have incomes below the poverty level.

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[3] Source: El-Laithy, Heba and Kheir-El-Din, Hanna, *Assessment of Poverty in Egypt Using Household Data*, Cairo University, August 1993 draft.

2. Ability to Pay for Wastewater Services

The ability of the GOSD's domestic customers to pay for wastewater services is essential to determining how much to subsidize the low income domestic customer. World Bank reports state that in other developing countries, poor families appear willing to pay up to three percent of total household income for both water and wastewater services, if provided with satisfactory services.[4] This guideline, and the report on average annual per capita expenditures in Egypt are used to determine a maximum affordable wastewater bill.

Exhibit III-4, following this page, shows what a maximum affordable wastewater bill would be in fiscal year 1992/93. The lowest income households (10 percent of households) could theoretically afford a bi-monthly wastewater bill of LE 7.00 in fiscal year 1992/93. This is seven times the current average wastewater bill of LE 1.00 for a household consuming 50 cubic meters per two-month period.

Because low income families generally live in smaller homes with inadequate or substandard plumbing, they normally use much less water and generate less wastewater than more affluent customers use. A common estimate of water consumption for low income households in developing countries is about 10-15 cubic meters of water per month.[5] If it is assumed that an average of 15 cubic meters of water is consumed each month, or 30 cubic meters for a two-month billing period, and that the maximum affordable bi-monthly bill is LE 7.00, then Cairo's lowest income households would be able to pay up to 23.3 piastres per cubic meter for wastewater services.[6] The lowest-income households could, theoretically, afford a charge that is 11.7 times greater than the charge per cubic meter now charged to domestic households consuming 30 cubic meters or less of water every two months.[7]

The analysis of the ability to pay and the average bi-monthly wastewater bill of domestic customers illustrates characteristics of the current wastewater charges and billing structure. Low and middle income households pay a higher percentage of total income for wastewater services than higher income households. **Table III-4**, following Exhibit III-4 shows the ability of households to pay higher wastewater charges.

4 Source: The World Bank, *Arab Republic of Egypt, Water and Wastewater Sector Study*, page 48, April 27, 1992.

5 Source: Black & Veatch International, *Revenue Requirements and Cost of Service Rates for the General Organization for Greater Cairo Water Supply*, page 10-2, March 1983. According to Black & Veatch, The World Health Organization confirms 10 cubic meters to be within its upper range of minimum water requirements.

6 The calculation is as follows: LE 7.00 divided by 30 cubic meters.

7 The calculation is as follows: PT 23.3 divided by PT 2 (the current wastewater rate).

Ability of Households to Pay Wastewater Bills

Fiscal Year 1992/93
(LE)

Distribution of Urban Households (Deciles)		Average Annual Per Capita Income in FY 90/91 (a)	Average Annual Household Income in FY 90/91 (b)	Average Annual Household Income in FY 92/93 (c)	Average Bi-Monthly Household Income in FY 92/93 (d)	Maximum Affordable Wastewater Bill Per Household in FY 92/93 (e)
Low Income	1. First 10 percent	477.90	2,390	2,736	456	7
	2. Second 10 percent	616.50	3,083	3,530	588	9
	3. Third 10 percent	725.70	3,629	4,155	693	10
Middle Income	4. Fourth 10 percent	841.10	4,206	4,815	803	12
	5. Fifth 10 percent	969.80	4,849	5,552	925	14
	6. Sixth 10 percent	1,030.10	5,151	5,897	983	15
	7. Seventh 10 percent	1,241.30	6,207	7,106	1,184	18
High Income	8. Eighth 10 percent	1,642.00	8,210	9,400	1,567	24
	9. Ninth 10 percent	2,286.70	11,434	13,091	2,182	33

(a) Source: El Laithy, Heba and Kheir-El-Din, Hanna, Assessment of Poverty in Egypt Using Household Data, Table 1, page 2, August, 1993 draft. The per capita income levels are averages for all urban areas in Egypt, not just in Cairo. The same report concluded that 19.5 percent of Cairo households have annual per capita income below the poverty level of LE 722.60 (Table 2, page 9).

(b) Ibid. It is assumed that there are, on average, five people per household.

(c) The assumed inflation rate of GOSD salaries (seven percent) is used to escalate estimated fiscal year 1990/91 household annual income to fiscal year 1992/93.

(d) Bills are sent out every two months.

(e) The World Bank estimates that households in developing countries are willing to pay up to three percent of their income for water and wastewater services. Assuming that the costs of providing water and wastewater services are equal, households in developing countries are willing to pay up to 1.5 percent of their income for wastewater services.

EXHIBIT III-4

Table III-4
Average Wastewater Bill as a Percent of Bi-Monthly Income and Maximum Affordable Wastewater Bill FY 92/93

Income Level[a]	Average Bill (LE)	Percent of Bi-Monthly Household Income[b]	Percent of Maximum Ability to Pay[c]
1. Low	1.00	0.17%	11.5%
2. Middle	2.31	0.24%	15.7%
3. High	2.31	0.12%	8.1%

(a) It is assumed that low income households consume less than 60 cubic meters of water per month and are, therefore, charged LE 1.00 at present for wastewater. It also is assumed that middle and high income households consume greater then 60 cubic meters of water each billing period and therefore, both have, on average, a bi-monthly wastewater bill of LE 2.31.

(b) The calculation for middle income, for example, is as follows: LE 2.31 divided by LE 974. LE 974 is the average bi-monthly income of deciles 4-7 in FY 92/93.

(c) The calculation for high income, for example, is as follows: LE 2.31 divided by LE 28.5. LE 28.5 is the average maximum affordable wastewater bill per household of deciles 8 and 9 in FY 92/93.

Based on these conclusions, essentially all Cairo households are able to pay more for wastewater services than they currently pay. Cairo's middle and high income families are certainly able to pay a greater percentage of their income. However, even though all households are able to pay higher charges, the issue of whether they are willing to pay higher charges must be assessed.

3. Willingness to Pay for Wastewater Services

Any assessment of a customer's willingness to pay for wastewater services should consider the Egyptian's dependence on government to fund basic services. As evidenced by the food riots in the late 1970s, anti-government factions have fervently demonstrated against even small increases in the price of basic goods and services.

It should not be expected that Cairo residents would readily accept significant increases in their wastewater bill. Even though the total wastewater bill necessary to reach financial autonomy might be well within a household's ability to pay, the willingness to accept large increases is probably low for poor income households. Some consideration should be made to mitigate any large increases in proposed charges for lower income households.

One appropriate method of determining willingness to pay for sewerage services would be to survey the explicit opinions of Cairo's households. The scope of this rate study did not include such a survey. In the absence of an opinion survey, the following observations are made to determine the willingness of Cairo's residents to pay increased charges.

- The ability to pay analysis illustrates that in 1992/93, Cairo's poorest households (the first decile) could afford to pay from seven to 12 times more than the current average wastewater bill they are charged, depending on how much water they use and wastewater they generate.
- Cairo's middle and high income families should be aware that the current fees they are charged are extremely low in comparison to their income. In 1992/93, Cairo's middle income and high income households could pay from six to 12 times more than the average wastewater bill they currently pay.[8]

8 The calculations are as follows: LE 14.5 and LE 28.5 divided by LE 2.31. LE 14.5 and LE 28.5 are the average maximum affordable wastewater bills in FY 1994/95 for the middle (deciles 4-7) and upper (deciles 8 and 9) income levels.

- Through the ISC, the GOSD is undertaking many initiatives to become a more efficient organization. By FY 1994/95, Cairo's populace should begin to perceive the GOSD as more efficient and more capable of providing good service at a reasonable cost. This perception would occur as the GOSD actually delivers good service and through public relations efforts on the part of the GOSD. Wastewater rates could be more progressive and designed to account for ability to pay. Effective metering and clear billing and collection practices would address the inequities resulting from the current practice of estimating water consumption.

- Investment in Cairo's wastewater facilities has reduced the incidence of parasitic diseases, including infectious hepatitis, typhoid, and paratyphoid, thus reducing health maintenance costs.

In comparison with prices for other goods, a maximum affordable wastewater bill of LE 7.00 for two months appears reasonable. For example, the LE 7.00 is the cost of four packages of Egyptian made cigarettes or less than four, two-liter bottles of soft drinks.[9] Given the comparative costs of these widely consumed goods, it seems likely that many households would be willing to pay the small price for the health and sanitation benefits resulting from wastewater collection, treatment, and disposal, services.

9 Assumes one pack of cigarettes costs LE 1.75 in FY 1992/93 and the price of a two liter bottle of soft drink costs LE 1.90 in FY 1992/93.

C. Wastewater Service and Price Sensitivities

In forecasting the demand for wastewater services, or in determining a customer's willingness to pay, it also is necessary to consider how an increase in wastewater charges may impact the volume of wastewater services demanded. The price elasticity of demand indicates the extent to which the quantity purchased of a good or service decreases as the price of the good or service increases. This relationship is widely recognized by economists as true for non-essential or non-life sustaining goods and services. However, when applied to essential services such as water and wastewater, the price elasticity of demand is less clear.

As prices increase, the quantity of wastewater services that customers demand declines until a minimum quantity necessary to maintain health and sanitation levels is reached. Successive price increases beyond this level have less and less impact on quantity demanded. At present, the GOE is promoting various social programs to communicate appropriate health and sanitation standards for Cairo's households.

Non-price factors such as legislation also impact the price elasticity of demand. All new buildings in the Greater Cairo area are presently required to pay wastewater connection fees before building permits are issued. New housing and industries effectively become captive customers who pay for wastewater services based on water flows regardless of whether they discharge any wastewater. As a result, it is unlikely that new customers would pay a second wastewater charge to receive wastewater services provided by the private sector.

There are no GOE laws requiring existing buildings to connect to the wastewater system. There also are no laws prohibiting existing customers from disconnecting. The GOE's Ministry of Health strongly urges existing customers and unconnected residents and businesses in sewered areas to connect and remain connected to the sewer system.

Informal field surveys by CH2M Hill/OMI indicate that private sector septic tank removal costs average between eight to ten Egyptian pounds per cubic meter. This is at least 52 times greater than the charge now charged by the GOSD. Realistically, existing customers would probably not substitute private sector wastewater services for GOSD services given the very low wastewater charges expected to be charged by the GOSD. Also the lack of space to construct septic tanks in Cairo's densely populated urban areas makes substitution impractical and virtually impossible.

SECTION IV

REVENUE REQUIREMENTS

ERNST & YOUNG

Section IV. Revenue Requirements

The first step in developing wastewater charges is to identify costs that must be recovered by appropriate service charges. Recovering adequate costs ensures the financial sufficiency of the utility.

This section presents the projected GOSD expenditures for fiscal years 1994/95 through 1998/99. Costs each year are presented by line item (salaries, operations and maintenance, and capital).

The GOSD non-service charge revenues also are projected for fiscal years 1994/95 through 1998/99. These non-service charge revenues, which include connection fees and administrative fees, then are subtracted from projected costs to determine net revenue requirements that must be recovered through wastewater charges.

This section presents the results of these calculations and is organized as follows:

- *Utility Expenditures*
- *Non-Service Charge Revenues*
- *Summary of Projected Revenue Requirements.*

The summaries of projected revenue requirements presented in this section are the result of estimating costs for each of the six wastewater treatment plants and seventeen major pump stations operated by the GOSD. Appendices in Volume II of this report present detailed cost projections for each of these facilities. **Appendix C** contains assumed staffing levels and salary costs for each facility. **Appendix D** presents assumed O&M costs (e.g., electricity and consumables) for each facility, including the prices paid for commodities. **Appendix E** presents a summary of each facility's salaries, O&M costs, and capital outlay requirements.

A. Utility Expenditures

The estimation of GOSD operating costs includes the following components:

- *Direct Facility Costs* -- These are direct salary and O&M costs to operate each of the six wastewater treatment plants and 17 pump stations
- *Subsidiary Pump Station and Sewer Maintenance Costs* -- These are direct salary and O&M costs for maintaining subsidiary pump stations and collection systems within each region
- *Indirect Administrative Salary Costs* -- Legal, personnel, finance, and payroll administration of the GOSD are included in these personnel costs
- *Capital Costs* -- These costs include maintenance capital costs, financing costs for new construction and equipment, debt service payments on existing loans, operating reserves, and debt service reserves.

1. Direct Facility Costs

Salaries and O&M costs for each facility are based on assumptions discussed in Section II-*Methodology Used to Determine Wastewater Rates*. **Exhibit IV-1**, on the next page, is a summary of projected direct costs for each wastewater treatment plant and major pump station in the West Bank, East Bank, and South Region. Detailed estimates of direct costs for each facility, showing staffing levels, salaries, electricity consumption, and other costs, are provided in Appendices C, D, and E.

Direct facility costs increase an average of 22 percent per year during the five year rate study. The majority of the increase (61 percent) is attributable to East Bank wastewater treatment plants. Costs on the East Bank increase over 40 percent in fiscal year 1995/96 when the Berka wastewater treatment plant begins secondary treatment, and almost 84 percent in fiscal year 1996/97 when the new Gabal el Asfar wastewater treatment plant begins operation. Also, in fiscal year 1996/97, the Khalag pump station begins pumping wastewater to the new Gabal el Asfar wastewater treatment plant, resulting in additional East Bank expenditures.

2. Subsidiary Pump Station and Sewer Maintenance Costs (Direct Regional Salary and Operating Costs)

In addition to direct facility costs, there are costs of operating subsidiary pump stations and costs of sewer maintenance staff that clean and maintain the collection system within a region. These subsidiary pump station and sewer maintenance costs account for a large portion of a region's salary costs (approximately 66 percent in fiscal year 1994/95) and a small portion of a region's operations and maintenance costs (less than one percent in fiscal year 1994/95). The costs of regional subsidiary pump stations and sewer maintenance are added to direct facility costs to estimate total direct costs of each region.

South Region direct facility and direct regional costs are added to East Bank costs in order to determine total East Bank costs. South Region costs are added to East Bank costs because the number of customer water connections and water flows for the South Region are included with East Bank customer statistics, and are unable to be separated from total East Bank customer statistics. Thus, in order to develop regional wastewater charges, South Region costs are added to East Bank costs.

Annual Direct Costs by Facility

(LE 000s)

Facility	Fiscal Year				
	1994/95	1995/96	1996/97	1997/98	1998/99
West Bank					
Wastewater Treatment Plants					
Abu Rawash	14,067	15,473	16,975	18,583	20,408
Zenein	15,360	16,996	18,680	20,418	22,495
Major Pump Stations					
Abu Rawash	3,024	3,644	4,367	5,196	6,262
Boulac	2,553	2,947	3,372	3,842	4,419
Cheops	667	747	842	947	1,067
El Ahram	1,250	1,436	1,637	1,862	2,108
Embaba	1,139	1,280	1,429	1,581	1,777
Giza	1,843	2,023	2,212	2,408	2,637
GOSD No. 4	798	911	1,042	1,193	1,379
GOSD No. 5	838	935	1,042	1,167	1,317
Junction	3,181	3,792	4,496	5,295	6,314
Pyramids	1,406	1,644	1,927	2,247	2,660
South Muheit	2,488	2,898	3,355	3,865	4,498
Zenein	2,108	2,389	2,703	3,040	3,442
Total West Bank Facilities	50,722	57,115	64,079	71,644	80,783
East Bank					
Wastewater Treatment Plants					
Berka	14,930	32,394	35,602	38,920	42,870
Gabal el Asfar	8,890	9,823	58,577	64,089	70,659
Shoubra el Kheima	9,977	11,008	12,081	13,197	14,513
Major Pump Stations					
Ameria	8,788	9,731	10,691	11,665	12,852
Ein Shams	2,633	2,891	3,158	3,434	3,759
Khalag	0	0	7,725	8,436	9,308
Koussous	8,204	9,110	10,026	10,951	12,089
Total East Bank Facilities	53,422	74,957	137,860	150,692	166,050
South Region					
Wastewater Treatment Plants					
Helwan	14,133	16,155	18,358	20,753	23,667
Major Pump Stations					
Helwan	5,957	6,584	7,225	7,881	8,671
Total South Region Facilities	20,090	22,739	25,583	28,634	32,338
Total Direct Facility Costs	124,234	154,811	227,522	250,970	279,171

3. Indirect Administrative Salary Costs

Indirect administrative salary costs consist of all personnel costs of the GOSD not directly related to providing wastewater service in a region. Indirect administrative salaries account for approximately 29 percent of total salary costs in fiscal year 1994/95. Projected administrative salaries are allocated to the West Bank and the East Bank based on the proportion of total direct costs incurred in each region.

4. Capital Costs

The GOSD five year capital improvement plan is presented in Section VIII of this report. Capital costs consist of maintenance capital projects, new capital projects, existing capital projects, operating reserves, and debt service reserves.

Maintenance Capital Projects

The GOSD should ensure that the plant and equipment reach their useful service life and that customers pay their fair share of maintaining the wastewater system. To do this, maintenance capital project costs would be recovered through wastewater charges along with salaries and operations costs. Maintenance capital project costs are assumed to equal two percent of the replacement value of new facilities.

The replacement value of only new facilities is used because no estimates are available on the value of the system that existed prior to 1984. Thus, the estimated capital outlays incurred under Cairo Sewerage I and II contracts are used to develop annual maintenance capital project costs.

The replacement value of new facilities (e.g., those projects brought on-line as a result of Cairo Sewerage I and II funding projects) is estimated to be approximately LE 4.8 billion in 1992/93. This amount is projected to increase during the five year rate study because of additional capital expenditures to be incurred each fiscal year for new facilities.

New Capital Projects

New capital project outlays are projected to be incurred during the five years of the rate study. These new capital projects are assumed funded through government loans, foreign government grants, and GOE subsidies.

Approximately 20 percent of new capital project outlays are funded through government loans. The remaining new capital project outlays are funded through foreign government grants and GOE grants. New capital project expenditures represent the funding costs of 20 percent of the new capital project outlays.

It is assumed that the interest rates on loans to finance these new capital projects would be four percent, and the term of the loans would be 20 years. New capital project costs are the principal and interest payments required to fund 20 percent of new capital project outlays during the five year rate study. This represents a proper recognition of costs for long-term capital facilities.

Because funding for new capital projects is primarily furnished through grants by the GOE and foreign donors, and debt service payments from government loans are paid by the GOE, no new capital project costs are recovered by wastewater charges during the five years of this rate study. Eventually, all new capital project costs are to be recovered through wastewater charges by fiscal year 2004/05.

Existing Capital Projects

Information provided by the GOSD indicated that principal and interest payments on outstanding GOSD loans are approximately LE 1.2 million per year (applying June 1993 currency exchange

charges). These loans are below market rate loans from foreign governments that have an average interest rate of approximately four percent.

Because these loans are funded by the GOE, no existing capital project costs are recovered through wastewater charges during the five year rate period. As with new capital project costs, existing capital project costs are to be recovered through wastewater charges by fiscal year 2004/05.

Operating Reserves

The GOSD should maintain adequate operating reserves. Operating reserves guarantee that the GOSD maintains enough cash to ensure short term needs are met. Operating reserves are maintained at two months of operating costs.

Debt Service Reserves

Debt service reserves represent one year of principal and interest payments on new capital project costs and existing capital project costs. Normally, these reserves would be necessary for the GOSD to: (1) have enough funds to pay debt service if revenues are not as high as projected or expenditures exceed projections, and (2) establish the GOSD as credit-worthy so that in the future, the GOSD can obtain funding from different capital markets at the lowest possible interest charges.

However, because existing GOSD debt service is funded by the GOE, no debt service reserves are required during the five year rate study. Debt service reserves are to be recovered through wastewater service charges by fiscal year 2004/05.

5. Projected Full Costs

The sum of direct facility costs and regional subsidiary pump station and sewer maintenance costs represents the full cost for each region. Then, indirect administrative salaries and capital costs are added to direct costs of both West and East Banks to estimate system-wide full utility costs.

Exhibit IV-2, on the next page, presents the projected full utility costs by line item for fiscal years 1994/95 through 1998/99. These costs represent projected total expenditures for the GOSD, regardless of how the costs are funded.

6. Discussion of Results

Salary Costs

Salary costs are projected to increase an average of eight percent per year during the five year projection period. Assuming GOSD employees receive a seven percent annual cost of living increase, the remaining one percent increase in salary costs is a result of higher staffing levels.

Staffing levels are projected to increase in fiscal year 1995/96 as the Berka wastewater treatment plant begins secondary treatment. The number of employees at the Berka wastewater treatment plant is projected to increase 50 percent as a result of adding secondary treatment.

Staffing levels increase in fiscal year 1996/97 because of additional staffing required to operate the new Gabal el Asfar wastewater treatment plant and Khalag pump station. An additional 345 positions, added to the 311 currently employed at the old Gabal el Asfar wastewater treatment plant, are projected to be required to staff these two facilities. **Appendix C,** in Volume II of this report, presents assumed annual staffing levels of each facility.

Operations and Maintenance Costs

Operations and maintenance costs are projected to increase an average of 24 percent annually during the five year rate study. Increases in costs are primarily due to projected changes in quantities of consumables used at each facility as a

System–Wide Full Utility Costs by Line Item

(LE 000s)

Cost Category	Fiscal Year				
	Projected				
	1994/95	1995/96	1996/97	1997/98	1998/99
Salaries					
Direct Project Salary Costs	13,762	15,669	18,646	19,952	21,348
Direct Regional Salary Costs	26,264	28,102	30,069	32,174	34,426
Indirect Administrative Salary Costs	15,967	17,084	18,280	19,560	20,929
Total Salary Costs	55,993	60,855	66,995	71,686	76,703
Operations and Maintenance					
Direct Project Operating Costs					
Electricity	76,045	95,289	142,158	157,629	177,083
Fuels, Lubricants, and Chemicals	13,817	21,182	34,879	38,369	42,218
Spare Parts and Other Consumables	19,179	21,097	30,073	33,079	36,387
Other Direct Project Operating Expenses	1,433	1,576	1,766	1,942	2,137
Direct Regional Operating Expenses	802	883	971	1,068	1,175
Total Operations and Maintenance Costs	111,276	140,027	209,847	232,087	259,000
Capital Costs					
Maintenance Capital Projects	114,325	123,355	132,?86	141,416	150,446
New Capital Projects	6,851	13,702	20,553	27,404	34,255
Existing Capital Projects	1,230	1,230	1,230	1,230	1,230
Reserve Fund Contributions:					
Operating	2,669	5,416	12,461	4,276	5,092
Debt Service	8,081	6,851	6,851	6,851	6,851
Total Capital Costs	133,156	150,554	173,481	181,177	197,874
Total Expenditures	300,425	351,436	450,323	484,950	533,577

result of increased demand placed on the wastewater system, and estimated operations and maintenance costs for new facilities. **Appendix D,** in Volume II of this report, presents assumed quantities of consumables of each facility.

The largest increase in O&M costs occurs during the first three years of the rate study. Costs are projected to increase 26 percent in fiscal year 1995/96 as the Berka wastewater treatment plant begins secondary treatment. Almost LE six million (21 percent) of the increase is a result of chlorine costs for secondary treatment at the Berka wastewater treatment plant. Another LE 10 million (35 percent) of the increase is a result of electricity required at the Berka wastewater treatment plant.

Operations and maintenance costs are projected to increase 50 percent in fiscal year 1996/97 as the new Gabal el Asfar wastewater treatment plant and Khalag pump station begin operations. Of the LE 69.8 million increase in O&M costs in fiscal year 1996/97, approximately LE 47.3 million (68 percent) can be attributed to the new Gabal el Asfar wastewater treatment plant. The majority of the increase in expenditures at the Gabal el Asfar facility is for electricity (LE 29 million) and chlorine (LE 11 million).

The Khalag pump station begins operation in fiscal year 1996/97, with O&M costs (excluding salaries) of LE 7.2 million. Nearly all (90 percent) of Khalag pump station's O&M costs are for electricity.

Electricity accounts for approximately 45 percent of all salary and operating costs in fiscal year 1994/95. It is not surprising that electricity is the largest operating cost, given the large size and number of major pump stations and wastewater treatment plants in operation.

Fuels, lubricants, and chemicals are projected to increase at a greater rate than electricity (an average of 32 percent per year versus 24 percent). This increase reflects additional secondary treatment performed at more wastewater treatment plants, resulting in a greater proportion of expenditures on chlorine.

Capital Costs

Maintenance capital project costs are estimated at LE 114 million of the LE 133 million in capital costs in fiscal year 1994/95. Maintenance capital project costs increase approximately seven percent during each year of the five year rate study due to assumed commissioning of new facilities.

7. Adjusted Costs

Though this report examines alternative target dates for GOSD financial autonomy in Section VIII-*Five Year Financial Plan*, the baseline assumption assumes financial autonomy is to be attained beginning in fiscal year 1998/99. Because of this, not all costs will be recovered through wastewater service charges prior to that year. Instead, costs will be phased in during the five year projection period as GOE funding to the GOSD is reduced. The percentages of each cost item (salaries, O&M costs, maintenance capital project costs, operating reserves, and other capital costs) recovered annually through wastewater user charges during the five year rate study were previously presented in Table II-2 in Section II-*Methodology Used to Determine Wastewater Rates.*

Operations and maintenance costs (excluding salaries) are recovered through wastewater charges initially, followed by salaries, and then operating reserves by fiscal year 1997/98. Four percent of maintenance capital project costs also are recovered in fiscal year 1997/98 and all maintenance capital project costs are recovered in fiscal year

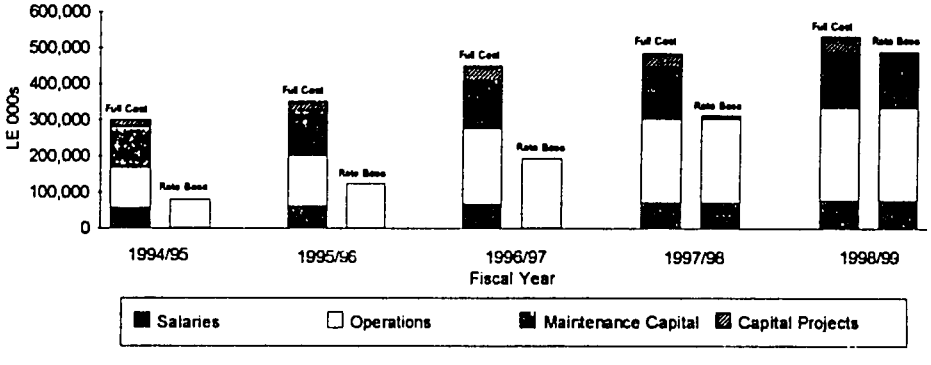
1998/99. Other capital costs (new capital project costs, existing capital project costs, and debt service reserves) are assumed not to be recovered through wastewater revenues during the five year rate study.

Exhibit IV-3, on the next page, presents the projected GOSD expenditures assumed to be recovered through wastewater revenues; all remaining costs are assumed funded by the GOE or foreign donors. Expenditures funded through wastewater charges are projected to increase an average of 57 percent a year during the five year rate study, from LE 80 million in fiscal year 1994/95 to over LE 491 million in fiscal year 1998/99.

The proportion of GOSD expenditures recovered through wastewater charges each fiscal year is based on assumptions that wastewater charges: (1) do not increase more than what customers can realistically be expected to bear in any one year, and (2) increase at approximately the same rate each year. As a result, the first year in which all salary costs, O&M costs, maintenance capital costs, and operating reserves are recovered through wastewater charges is fiscal year 1998/99.

Figure IV-1, below, graphically displays when GOSD expenditures will be recovered through wastewater service charges. In fiscal year 1994/95, the GOE and foreign donors fund approximately 77 percent of expenditures. By fiscal year 1998/99, all salaries, operations costs, maintenance capital project costs, and operating reserves are assumed recovered through wastewater service charges. The GOE and foreign donors fund projected capital project costs. By fiscal year 1998/99, the GOE and foreign donors fund eight percent of utility costs.

Figure IV-1
Transition of GOSD to an Autonomous Utility by Fiscal Year 1998/99



System–Wide Adjusted Costs by Line Item (a)

(LE 000s)

Cost Category	Fiscal Year				
	1994/95	1995/96	1996/97	1997/98	1998/99
Salaries					
Direct Project Salary Costs	0	0	0	19,952	21,348
Direct Regional Salary Costs	0	0	0	32,174	34,426
Indirect Administrative Salary Costs	0	0	0	19,560	20,929
Total Salary Costs	0	0	0	71,686	76,703
Operations and Maintenance					
Direct Project Operating Costs					
Electricity	51,711	83,187	130,786	157,629	177,083
Fuels, Lubricants, and Chemicals	11,054	19,064	32,088	38,369	42,218
Spare Parts and Other Consumables	15,343	18,988	27,667	33,079	36,387
Other Direct Project Operating Expenses	1,147	1,419	1,625	1,942	2,137
Direct Regional Operating Expenses	642	795	894	1,068	1,175
Total Operations and Maintenance Costs	79,897	123,453	193,060	232,087	259,000
Capital Costs					
Maintenance Capital Projects	0	0	0	5,657	150,446
New Capital Projects	0	0	0	0	0
Existing Capital Projects	0	0	0	0	0
Reserve Fund Contributions:					
Operating	0	0	0	4,276	5,092
Debt Service	0	0	0	0	0
Total Capital Costs	0	0	0	9,933	155,538
Total Adjusted Expenditures	79,897	123,453	193,060	313,706	491,241

(a) Adjusted based on autonomy assumptions.

B. Non-Service Charge Revenues

In order to determine revenue requirements, any non-service charge revenue received by the GOSD should be subtracted from estimated costs. Non-service charge revenues for the GOSD include:

- Connection Fees
- Administrative Fees
- Other Revenues (includes sludge sales, crop sales, rental and repair of equipment, and sale of bid documents)
- Industrial High Strength Surcharge
- Miscellaneous Revenues
- Capital Revenues.

Exhibit IV-4, on the next page, presents projected non-service charge revenues for fiscal years 1994/95 through 1998/99. Revenues are classified as either operating revenues or capital revenues: (1) operating revenues are generated from secondary services provided by the GOSD, and (2) capital revenues are generated from non-operating sources.

Connection fees account for approximately 60 percent of total non-service charge revenue. Much of this revenue is from new customers who are expected to be connected to the sewer system.

Administrative fees are a 10 percent charge on all other fees. Administrative fees increase during the five year rate study simply because other GOSD fees increase.

Revenues from sludge sales, crop sales, rental and repair of equipment, and sale of bid documents account for a very minor portion of the GOSD non-service charge revenues. These four revenue sources account for approximately two percent of total non-service charge revenues in fiscal year 1994/95, and are less than four-tenths of one percent of the revenues required to recover the unfunded portion of GOSD operations and maintenance costs in fiscal year 1994/95. By fiscal year 1998/99, these four activities account for less than one-tenth of one percent of the unfunded portion of GOSD expenditures.

Projected revenues from the industrial high strength surcharge are presented in Section VI - *Recommended Other Service Charges*. The industrial high strength surcharge is projected to first be assessed in fiscal year 1997/98 when revenues are estimated to be approximately LE 5.2 million.

Miscellaneous revenues are generated from fines for illegal connections, revenues from rental of flats, and various other activities that are not separately tracked by the GOSD. These revenues account for 29 percent of total non-service charge revenues in fiscal year 1994/95. However, these revenues are only four percent of revenues required to recover unfunded GOSD operations and maintenance costs in fiscal year 1994/95. By fiscal year 1998/99, these miscellaneous revenues are less than one percent of the revenues required to meet GOSD unfunded expenditures.

Capital revenues include penalties for delays and are assessed to contractors who do not complete construction projects on time. These revenues are a very minor portion (less than one percent) of total revenues.

Non-service charge revenues shown in Exhibit IV-4 are used to offset costs in order to determine revenue requirements. Operating revenues are subtracted from O&M costs, and capital revenues are subtracted from capital expenditures.

Non-service charge revenues represent only a small portion of total revenues required to recover GOSD unfunded expenditures and, as a result, have little impact on the wastewater charges. Several new, alternative revenue sources are

System-Wide Non-Service Charge Revenues

(LE 000s)

Revenues	Fiscal Year				
	1994/95	1995/96	1996/97	1997/98	1998/99
Operating Revenues					
Connection Fees	7,141	7,370	7,606	7,849	8,100
Administrative Fees	1,104	1,129	1,156	1,705	1,733
Other Revenues					
Sludge Sales	124	127	130	133	136
Crop Sales	36	38	40	42	44
Rental and Repair of Equipment	15	16	17	18	19
Sale of Bid Documents	97	112	129	148	170
Industrial High Strength Surcharge	0	0	0	5,213	5,213
Miscellaneous Revenues	3,500	3,500	3,500	3,500	3,500
Total Base Quantity Revenues	12,017	12,292	12,578	18,608	18,915
Capital Revenues					
System Development Charges	0	0	0	0	0
Penalties for Delays	123	129	135	142	149
Sale of Assets	0	0	0	0	0
Other Revenues	0	0	0	0	0
Total Capital Revenues	123	129	135	142	149
Total All Revenues	12,140	12,421	12,713	18,750	19,064

presented in Section VII-*Related Findings and Recommendations*. However, projections of these revenues are not prepared because little or no data exist on which to base the projections. Based on the magnitude of non-service charge revenues in typical, autonomous wastewater utilities, even these new revenue sources would not have a significant impact on wastewater charges once the GOE and foreign donor funding is eliminated.

C. Summary of Projected Revenue Requirements

Total GOSD revenue requirements are comprised of salaries, O&M costs, and capital costs, less non-service charge revenue offsets (operating revenues and capital revenues). **Exhibit IV-5**, on the next page, presents the projected GOSD revenue requirements for fiscal years 1994/95 through 1998/99 under the assumed autonomy date of fiscal year 1998/99.

Revenue requirements are developed assuming GOE and foreign donor subsidies would be gradually reduced and GOSD costs increasingly recovered through wastewater charges. By fiscal year 1998/99, all salaries, O&M costs, maintenance capital project costs, and operating reserves are assumed recovered from wastewater system users. Total revenue requirements in fiscal year 1998/99 are estimated at LE 472 million ($US 142 million).

Revenue requirements are projected to increase substantially each year as operations and maintenance costs are phased into the rate base. Also, the growth in demand and the commissioning of new facilities result in increased operations and maintenance costs for electricity, fuel, lubricants, and chemicals to collect, treat, and dispose of wastewater. As a result, the average annual compound rate of growth in revenue requirements assumed recovered through wastewater charges is 62 percent for the five year rate study.

Capital revenue requirements are negative in the first three years of the rate study because capital costs are not included in the rate base during these years. As a result, capital revenues (which are shown as offsets to capital costs) actually subsidize salary and O&M revenue requirements in this initial three year period.

System-Wide Revenue Requirements

(LE 000s)

Item	Fiscal Year				
	1994/95	1995/96	1996/97	1997/98	1998/99
Expenditures					
Salaries	0	0	0	71,686	76,703
Operations and Maintenance	79,897	123,453	193,060	232,087	259,000
Capital	0	0	0	9,933	155,538
Total Adjusted Costs	79,897	123,453	193,060	313,706	491,241
Revenue Offsets					
Operating Revenues	12,017	12,292	12,578	18,608	18,915
Capital Revenues	123	129	135	142	149
Total Revenue Offsets	12,140	12,421	12,713	18,750	19,064
Revenue Requirements					
Salaries	0	0	0	71,686	76,703
Operations and Maintenance	67,880	111,161	180,482	213,479	240,085
Capital	(123)	(129)	(135)	9,791	155,389
Total Revenue Requirements	67,757	111,032	180,347	294,956	472,177

108A

SECTION V

RECOMMENDED WASTEWATER RATES

ERNST & YOUNG

Section V. Recommended Wastewater Rates

Revenue requirements for each fiscal year are allocated to one of five functional cost components (collection, treatment, disposal, utility billing, or general administration) based on system characteristics. Functional costs (revenue requirements) then are reallocated to individual customer classes based on factors that differentiate the cost of providing service to the different types of customers.

Costs allocated to each customer class are divided by the projected water usage for that class to determine the wastewater charge per cubic meter of water flow. Computed wastewater charges then are adjusted based on policy decisions as to the level of cross-subsidization among customer classes, equity considerations as to the ability of each customer class to pay the proposed wastewater charges, the desire to smooth rate increases from year-to-year, and rounding of surcharges to the nearest five percent. The result is a wastewater charge per cubic meter for each customer class. These adjusted wastewater charges are designed to recover total GOSD revenue requirements.

The recommended wastewater charges also are determined as a percentage surcharge on the water bill. To determine the surcharge, the wastewater charge per cubic meter for each customer class is divided by the water charge per cubic meter. **Appendix F**, in Volume II of this report, presents the recommended wastewater charges as a percentage surcharge on the water bill.

This section presents the calculation of wastewater charges, as well as the estimated impact of the recommended wastewater charges on each customer class, and is organized as follows:

- *Allocation of Revenue Requirements to Functional Cost Categories*
- *Allocation of Functional Costs to Customer Classes*
- *Recommended System-Wide Wastewater Charges*
- *Customer Impacts*
- *Independent Regional Charges.*

A. Allocation of Revenue Requirements to Functional Cost Categories

In order to appropriately assign costs (revenue requirements) to customer classes, costs are first allocated to one of five functional categories:

- *Collection* -- Costs associated with the process of collecting wastewater and transporting it to a wastewater treatment plant
- *Treatment* -- Costs associated with removing pollutants from the effluent
- *Disposal* -- Costs associated with disposing of sludge and treated or untreated wastewater
- *Utility Billing* -- Costs for billing and collection activities required to obtain revenues from customers
- *General Administration* -- Administrative costs of the GOSD.

The percentages assumed for allocating costs to functional categories are presented in **Table V-1**, below. These percentages are developed based on characteristics of each facility, and are used to allocate salary, O&M, and capital revenue requirements presented in Section IV-*Revenue Requirements*.

1. Wastewater Treatment Plants

The costs of wastewater treatment plants are allocated to collection, treatment, or disposal based on two factors: (1) the level of treatment provided at the plant, and (2) whether the costs of operating a pump station are included in the costs of the treatment plant. As a result of differences in these

Table V-1
Assumed Percentages for Allocating Revenue Requirements to Functional Cost Categories

	Functional Cost Categories				
	Collection	Treatment	Disposal	Utility Billing	General Administration
Wastewater Treatment Plants					
West Bank					
Abu Rawash	0%	80%	20%	0%	0%
Zenein	0%	90%	10%	0%	0%
East Bank					
Berka	5%	90%	5%	0%	0%
Gabal el Asfar	0%	90%	10%	0%	0%
Shoubra el Kheima	0%	80%	20%	0%	0%
South					
Helwan	0%	90%	10%	0%	0%
Major Pump Stations	100%	0%	0%	0%	0%
Subsidiary Pump Stations and Sewer Maintenance	100%	0%	0%	0%	0%
Indirect Administration	0%	0%	0%	0%	100%

two factors among the six wastewater treatment plants, the costs of each wastewater treatment plant are individually allocated to the applicable functional cost categories. The allocation of each treatment plant's costs is discussed below.

Abu Rawash Wastewater Treatment Plant

The Abu Rawash wastewater treatment plant provides primary treatment, and the costs of the plant do not include the Abu Rawash pump station's costs. Thus, 80 percent of the plant's costs are allocated to treatment and 20 percent are allocated to disposal.

Zenein Wastewater Treatment Plant

The Zenein wastewater treatment plant provides both primary and secondary treatment, and the costs of the plant do not include the costs of the Zenein pump station. As a result of the higher level of treatment, 90 percent of the Zenein wastewater treatment plant's costs are allocated to treatment, and the remaining 10 percent of costs are allocated to disposal.

Berka Wastewater Treatment Plant

The Berka wastewater treatment plant currently provides primary treatment, and is to provide secondary treatment beginning in fiscal year 1995/96. Also, the costs of the plant include operation of the Berka pump station. As a result, five percent of the treatment plant's costs are allocated to collection (because of the pump station), 90 percent are allocated to treatment, and five percent are allocated to disposal.

Gabal el Asfar Wastewater Treatment Plant

The Gabal el Asfar wastewater treatment plant currently does not provide treatment. However, beginning in fiscal year 1996/97, the new Gabal el Asfar wastewater treatment plant is to provide both primary and secondary treatment. Also, the costs of the new plant do not include the costs of a pump station. As a result, 90 percent of the plant's costs are allocated to treatment, and 10 percent are allocated to disposal.

Shoubra el Kheima Wastewater Treatment Plant

The Shoubra el Kheima wastewater treatment plant is to provide primary treatment in fiscal year 1994/95, and secondary treatment in 1995/96. The costs of the plant do not include operating a pump station. Thus, 80 percent of the plant's costs are allocated to treatment, and the remaining 20 percent are allocated to disposal.

Helwan Wastewater Treatment Plant

The Helwan wastewater treatment plant provides both primary and secondary treatment. Also, the costs of the plant do not include the costs of the Helwan pump station. As a result, 90 percent of the plant's costs are allocated to treatment, and 10 percent of costs are allocated to disposal.

2. Major Pump Stations

The costs of major pump stations relate to pumping wastewater through the collection system to wastewater treatment plants. Thus, all major pump station costs are allocated to collection.

3. Subsidiary Pump Stations and Sewer Maintenance

Subsidiary pump stations and sewer maintenance costs relate to: (1) pumping wastewater through collection lines to major pump stations, and (2) maintaining the sewer collection system. As with the costs of major pump stations, all subsidiary pump station and sewer maintenance costs are allocated to collection.

4. Indirect Administration

All GOSD indirect administration costs are assigned to general administration. These costs are the salaries of GOSD personnel not directly providing wastewater services.

5. Discussion of Results

Exhibit V-1, on the next page, presents the GOSD revenue requirements allocated to functional cost categories. Treatment costs comprise the majority of costs during the five year rate study.

Treatment costs are a smaller percentage of O&M costs in fiscal years 1994/95 and 1995/96 than later fiscal years because the majority of wastewater treatment plants currently are not providing secondary treatment. Collection costs are a higher proportion of O&M costs in fiscal years 1994/95 and 1995/96 than later fiscal years due to the large pump stations required to transport wastewater to the treatment facilities over the vast sewer networks in the Cairo area. The relationship between collection and treatment O&M costs in fiscal years 1994/95 and 1995/96 is typical of wastewater systems in developing countries, where the initial focus of the system is on collection of wastewater and not on treatment.

As the GOSD increases treatment capabilities, the proportion of O&M costs allocated to treatment increases. This is exemplified in fiscal years 1996/97 through 1998/99, as the new Gabel el Asfar wastewater treatment plant begins operation. Treatment O&M costs increase from 54 percent of total O&M costs in 1994/95, to 62 percent of total O&M costs in 1998/99; an increase of 15 percent.

Allocation of Revenue Requirements to Functional Cost Categories

(LE 000s)

	Functional Cost Category					Total
	Collection	Treatment	Disposal	Utility Billing	General Administration	
Fiscal Year 1994/95						
Salaries	0	0	0	0	0	0
Operations and Maintenance	25,794	36,656	5,430	0	0	67,880
Capital	(47)	(66)	(10)	0	0	(123)
Total	25,747	36,590	5,420	0	0	67,757
Fiscal Year 1995/96						
Salaries	0	0	0	0	0	0
Operations and Maintenance	38,906	64,474	7,781	0	0	111,161
Capital	(45)	(75)	(9)	0	0	(129)
Total	38,861	64,399	7,772	0	0	111,032
Fiscal Year 1996/97						
Salaries	0	0	0	0	0	0
Operations and Maintenance	54,145	111,898	14,439	0	0	180,482
Capital	(41)	(83)	(11)	0	0	(135)
Total	54,104	111,815	14,428	0	0	180,347
Fiscal Year 1997/98						
Salaries	39,427	10,753	1,434	0	20,072	71,686
Operations and Maintenance	64,044	132,357	17,078	0	0	213,479
Capital	2,937	6,071	783	0	0	9,791
Total	106,408	149,181	19,295	0	20,072	294,956
Fiscal Year 1998/99						
Salaries	42,187	11,505	1,534	0	21,477	76,703
Operations and Maintenance	74,426	148,853	16,806	0	0	240,085
Capital	48,171	96,341	10,877	0	0	155,389
Total	164,784	256,699	29,217	0	21,477	472,177

EXHIBIT V-1

B. Allocation of Functional Costs to Customer Classes

Costs (revenue requirements) allocated to each functional cost category are reallocated to each of seven customer classes based on assumed differences in the cost of providing service to each customer class. Allocation from each functional category to a particular customer class is based on the following:

- *Collection* -- Proportion of estimated annual water flows of each customer class
- *Treatment* -- Relative strength of effluent discharged by each customer class and proportion of estimated annual water flows of each customer class
- *Disposal* -- Proportion of estimated annual water flows of each customer class
- *Utility Billing* -- Proportion of total customers in each class
- *General Administrative* -- Proportion of estimated annual water flows of each customer class.

A higher proportion of treatment costs is allocated to customers with higher strength discharge and higher wastewater flows. These customer classes are: government, small factories and shops, large industrial factories, and tourism and investment. It is assumed that the effluent from these four customer classes is twice the strength of effluent from domestic, worship and charities, and sports clubs and embassies.

It should be noted that the treatment allocation percentages do not fully reflect the much higher strength wastewater discharged by industrial customers. It is assumed that the relative strength of effluent from large industrial factories (including those operated by the government) is the same as that from small factories and shops, and tourism and investment, even though industrial factories typically discharge a much stronger effluent than these other three classes. The additional strength of discharge is accounted for by an industrial high strength surcharge, which is discussed in Section VI-*Recommended Other Service Charges*.

Exhibit V-2, on the next page, presents the proportion of each functional cost pool that is allocated to each customer class in fiscal year 1994/95. These percentages are applied to functional costs in fiscal year 1994/95 to determine costs of each customer class. For example, domestic customers are projected to account for approximately 909.6 million cubic meters of water flow in 1994/95.[1] This represents 70.71 percent of the approximately 1,286.4 million cubic meters of system-wide water flows in 1994/95. Thus, 70.71 percent of collection, disposal, and general administration costs are allocated to domestic customers in fiscal year 1994/95.

Exhibit V-3, on the page following Exhibit V-2, shows costs allocated to each customer class in fiscal year 1994/95. For example, approximately LE 25.7 million is allocated to the collection funtional cost category in fiscal year 1994/95.[2] Of this amount, 70.71 percent (LE 18.2 million) is reallocated to domestic customers based on fiscal year 1994/95 projected water flows. The allocation of costs for the remaining four fiscal years of the rate study are provided in **Appendix F**, in Volume II.

The majority (62 percent) of costs in fiscal year 1994/95 are allocated to the domestic customer class because domestic customers account for approximately 90 percent of the customers and 70 percent

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1 Section III - *System Demand*, Exhibit III-1, System-Wide Water Demand Characteristics

2 Exhibit V-1, Allocation of Revenue Requirements to Functional Cost Categories.

Percentage of Functional Costs Allocated to Each Customer Class

Fiscal Year 1994/95

Customer Class	Functional Cost Category				
	Collection	Treatment	Disposal	Utility Billing	General Administration
1. Domestic	70.71%	55.28%	70.71%	91.48%	70.71%
2. Government	19.43%	30.38%	19.43%	1.88%	19.43%
3. Small Factories and Shops	5.44%	8.51%	5.44%	5.72%	5.44%
4. Large Industrial Factories	1.98%	3.10%	1.98%	0.06%	1.98%
5. Tourism and Investment	1.05%	1.65%	1.05%	0.11%	1.05%
6. Worship and Charities	0.83%	0.65%	0.83%	0.66%	0.83%
7. Sports Clubs and Embassies	0.56%	0.43%	0.56%	0.09%	0.56%
Total	100.00%	100.00%	100.00%	100.00%	100.00%

EXHIBIT V-2

Allocation of Functional Costs to Customer Classes

Fiscal Year 1994/95
(LE 000s)

Customer Class	Functional Cost Category					Total
	Collection	Treatment	Disposal	Utility Billing	General Administration	
1. Domestic	18,206	20,227	3,832	0	0	42,265
2. Government	5,003	11,116	1,053	0	0	17,172
3. Small Factories and Shops	1,401	3,114	295	0	0	4,810
4. Large Industrial Factories	510	1,134	107	0	0	1,751
5. Tourism and Investment	270	604	57	0	0	931
6. Worship and Charities	214	238	45	0	0	497
7. Sports Clubs and Embassies	143	157	31	0	0	331
Total	25,747	36,590	5,420	0	0	67,757

of projected water (and wastewater) flows. The strength of effluent from domestic customers relative to four other classes lowers the overall allocation percentage to 62 percent.

Over one-quarter of costs are allocated to government customers. Small factories and shops account for over seven percent of projected 1994/95 costs, while the remaining four customer classes combined account for approximately five percent of total costs.

Two customer classes (worship and charities and sports clubs and embassies) are allocated the lowest proportion of costs because they account for a very small portion of customer accounts and water flows. Also, the strength of effluent discharged from these customers (as with domestic customers) is assumed the lowest of all customer classes.

Exhibit V-4, on the next page, presents the projected total costs to be recovered by wastewater charges, by customer class, for the five year rate study. Total costs for a customer class include collection, treatment, disposal, and general administration costs allocated to that class.

The increase in costs to be recovered by wastewater charges over the five year rate study is a result of: (1) a projected increase in water flows of each customer class, and (2) the increase in overall GOSD costs assumed funded through wastewater charges. Costs for each customer class represent the amount of revenues which need to be generated from wastewater charges, assuming no cross-subsidization among customer classes.

Domestic costs increase at a slightly higher rate than overall costs (64 percent versus 62 percent) because domestic water flows increase at a greater rate than overall water flows. The remaining six customer classes all increase at a slower rate than the increase in domestic costs, ranging from 58 percent (sports clubs and embassies) to 62 percent (tourism and investment).

System–Wide Costs by Customer Class (a)

(LE 000s)

Customer Class	Fiscal Year				
	1994/95	1995/96	1996/97	1997/98	1998/99
1. Domestic	42,265	69,244	112,475	190,815	305,553
2. Government	17,172	28,081	45,502	69,391	110,756
3. Small Factories and Shops	4,810	7,944	13,009	20,050	32,335
4. Large Industrial Factories	1,751	2,887	4,704	7,245	11,653
5. Tourism and Investment	931	1,553	2,564	3,978	6,477
6. Worship and Charities	497	795	1,271	2,106	3,320
7. Sports Clubs and Embassies	331	528	822	1,371	2,083
Total	67,757	111,032	180,347	294,956	472,177

(a) Costs to be recovered by wastewater charges.

C. Recommended System-Wide Wastewater Charges

Wastewater charges are determined by dividing costs to be recovered from wastewater charges by projected water flows for each customer class. The result is a per cubic meter charge for wastewater services.

Adjustments then are made to the computed wastewater charges in order to allow for: (1) cross-subsidization of domestic customers by other customer classes, (2) equity among similar customer classes so that charges are approximately the same by fiscal year 1998/99, (3) increases in domestic wastewater charges of no more than 50 percent per year, (4) levelized increases in charges from year to year, and (5) rounding of surcharges to the closest five percent. Cross-subsidization adjustments are based on several factors, including the current relationship between water charges of the different customer classes, the ability of each customer class to pay the recommended charges, and the desire to minimize the impact of recommended charges on each customer class.

1. Unadjusted Wastewater Charges

Table V-2, below, compares the computed wastewater charges (before adjustments) for each customer class to the current (fiscal year 1992/93) wastewater charges. These unadjusted wastewater charges are developed assuming autonomy in fiscal year 1998/99.

The unadjusted wastewater charges reflect recovery of the full cost of providing service to each customer class. Current wastewater charges per cubic meter do not reflect the cost of providing

Table V-2
Comparison of Fiscal Year 1992/93 Wastewater Charges to Fiscal Year 1998/99 Unadjusted Wastewater Charges
(Assumes Financial Autonomy in Fiscal Year 1998/99)

	FY 1992/93 Wastewater Charges (Piastres per Cubic Meter)	FY 1998/99 Unadjusted Wastewater Charges (Piastres per Cubic Meter)	Percent Increase in Wastewater Charges	Annual Compound Rate of Increase in Wastewater Charges
1. Domestic				
0-60 cubic meters	2.00	33.10	1,555%	60%
>60 cubic meters	2.60	43.03	1,555%	60%
2. Government	10.00	55.00	450%	33%
3. Small Factories and Shops	11.50	55.20	380%	30%
4. Large Industrial Factories	15.50	55.18	256%	24%
5. Tourism and Investment	27.50	55.00	100%	12%
6. Worship and Charities	4.00	37.04	826%	45%
7. Sports Clubs and Embassies	6.50	36.53	462%	33%

service to a customer class and, as a result, substantial differences exist between the current and unadjusted wastewater charges for each customer class.

Wastewater charges for domestic customers would require the largest increase because these customers are now heavily subsidized. Domestic customers currently are charged the lowest wastewater charge per cubic meter of all seven customer classes.

The difference between the current and unadjusted wastewater charges for worship and charities also is large. These customers currently are assessed the second lowest charge per cubic meter for wastewater, yet the estimated cost to serve these customers is about equal to sports clubs and embassies. Thus, like domestic customers, worship and charities are highly subsidized under the existing wastewater rate structure.

The difference between the current and unadjusted wastewater charge is not as great for government customers relative to some of the other customer classes. However, the effective wastewater charge paid by government customers in fiscal year 1992/93 is approximately 70 percent lower than the rate they are charged because only 30 percent of the bills are paid.

The unadjusted wastewater charge for government customers in fiscal year 1998/99 is 55.00 piastres per cubic meter . Expressed in fiscal year 1992/93 constant Egyptian pounds, the unadjusted charge is 36.65 piastres per cubic meter (discounted at seven percent). Because government customers pay only 30 percent of their bills, they effectively pay only three piastres per cubic meter, or eight percent of the full cost to serve them. Government customers have had the largest subsidy of any class for years.

Finally, the smallest difference between the current and unadjusted wastewater charges is for tourism and investment customers. These customers currently are assessed the highest wastewater charge per cubic meter of all seven customer classes.

2. Adjusted Wastewater Charges

When the GOSD proposes new wastewater charges, it should be sensitive to customers' ability and willingness to pay. Low income households may either be unable to pay the large increase in charges, or may resist the increases for political or cultural reasons.

To address such concerns, it is typical for a utility to institute a lifeline charge for low income individuals. Such a charge would provide for basic wastewater service at a rate below the amount necessary to recover costs of the basic service.

Implementing a lifeline charge requires identifying income levels of each account, or using metered water use as an indication of income levels (i.e., lower income households typically consume less water than more affluent households). Because there is insufficient metering of both water and wastewater use, it is difficult to enforce a lifeline charge based on the quantity generated.

Wastewater customers (for billing purposes) are building owners and not individual households. Income levels of individual households in the building are not known and there are different income levels in each building. Providing a lifeline charge just to low income customers would be difficult.

A lifeline charge would require a radical change to the existing rate structure, requiring a third, lower consumption block. It is difficult to determine which wastewater customers are low income.

Because of these difficulties, it is recommended that the first block of domestic customers (0 to 60 cubic meters

of water use per billing period) be substantially subsidized in lieu of a lifeline charge, and that the second block of customers (more than 60 cubic meters of water use per billing period) be partially subsidized. This essentially provides a lifeline charge to a much broader customer base.

In order to provide lower charges to domestic customers, additional revenues must be generated from other customer classes. The balance of revenues required to subsidize domestic customers is generated from higher charges proposed for government, small factories and shops, large industrial factories, and tourism and investment customers.

Exhibit V-5, following this page, illustrates these subsidies. For each customer class, three wastewater charges are shown:

- Current charges in fiscal year 1992/93
- Unadjusted charges required to recover all costs allocated to the class in fiscal year 1998/99. This unadjusted charge reflects the relative cost impact each customer class places on the wastewater system.
- Recommended charges, adjusted to provide a cross-subsidy to domestic customers in fiscal year 1998/99 and to reflect other adjustments discussed below.

A significant increase in current wastewater charges would be required to recover all the costs allocated to each class, particularly domestic customers. Without any cross-subsidy, the charge for a domestic customer in the first consumption block (0 to 60 cubic meters) would need to be increased from two piastres per cubic meter to 33.10 piastres per cubic meter.

Instead, the recommended 1998/99 wastewater charge for domestic customers in the lower consumption block is 16.50 piastres per cubic meter. The recommended 1998/99 charge for domestic customers in the higher consumption block is 24.70 piastres per cubic meter. These recommended charges provide an effective lifeline charge to a broader number of customers.

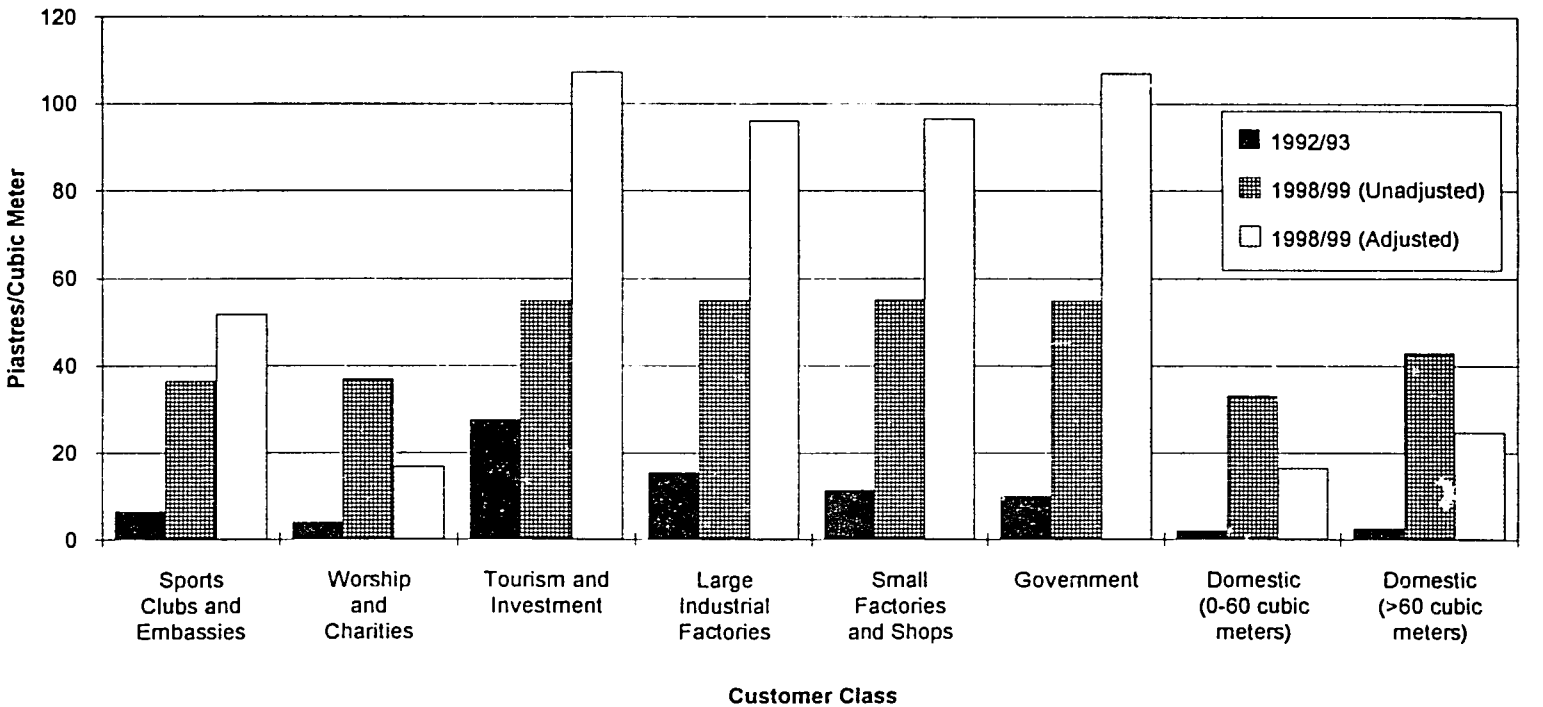
The subsidy for households in the higher consumption block is not as great as the subsidy provided households in the lower consumption block. Higher income households are expected to pay a greater share of their costs. Also, the relative difference in charges between the two consumption blocks is greater than under the current wastewater charge structure.

Government customers are expected to pick up a portion of the subsidy for domestic customers during the transitional stage, as are small factories and shops, large industrial factories, and tourism and investment customers. In the long term (10 years), the GOSD should gradually increase wastewater charges for domestic customers to full cost recovery. The GOGCWS also should consider a third block (e.g., 0 to 30 cubic meters of water use per billing period) to provide a true lifeline charge to lower income households.

Adjustments also are made to charges in order that certain customer classes have approximately the same charges by fiscal year 1998/99. The recommended wastewater charges for government and tourism and investment are approximately the same (107.00 and 107.25 piastres per cubic meter, respectively). These customers have the greatest ability to pay and should be expected to provide relief to domestic customers.

Current and Proposed Wastewater Charges

(Piastres/Cubic Meter)



Customer Classes Listed in Increasing Order of Total Annual Water Flow
(not to scale)

Similarly, the recommended charges for small factories and shops and large industrial factories are approximately the same (96.60 and 96.10 piastres per cubic meter, respectively). The cost to serve these two customer classes also is similar, as shown previously in Exhibit V-5.

The recommended wastewater charges also are designed to levelize or smooth the increases in wastewater charges each year. Fiscal year 1993/94 wastewater charges are assumed to be the same as fiscal year 1992/93 charges. As a result, the increase required in fiscal year 1994/95 is slightly larger than subsequent increases assumed during the five year rate period.

Exhibit V-6, on the next page, presents the proposed wastewater charges for each customer class during the five year rate study, assuming financial autonomy for the GOSD in fiscal year 1998/99. The total net increase in wastewater charges by fiscal year 1998/99 is presented in **Table V-3**, below. These increases are the average annual increases in wastewater charges required for the GOSD to become financially autonomous by fiscal year 1998/99.

Table V-3
Change in Wastewater Charges
(FY 1998/99 Compared with FY 1992/93)

Customer Class	FY 1992/93 (PT/m^3)	FY 1998/99 (PT/m^3)	Percent Increase
1. Domestic			
0-60 cubic meters	2.00	16.50	725%
>60 cubic meters	2.60	24.70	850%
2. Government	10.00	107.00	970%
3. Small Factories and Shops	11.50	96.60	740%
4. Large Industrial Factories	15.50	96.10	520%
5. Tourism and Investment	27.50	107.25	290%
6. Worship and Charities	4.00	16.80	320%
7. Sports Clubs and Embassies	6.50	52.00	700%

3. Projected Wastewater Revenues from Recommended Wastewater Charges

Domestic customers accounted for approximately 70 percent of water flows in fiscal year 1992/93, and approximately 43 percent of wastewater revenues. By fiscal year 1998/99, domestic customers are estimated to account for approximately 76 percent of water flows, and 35 percent of revenues.

The projected revenues from the recommended wastewater charges are shown in **Exhibit V-7**, following Exhibit 6. A comparison of estimated revenues by customer class is provided in **Exhibit V-8**, following Exhibit V-7. This exhibit also shows for each customer class the following:

- Revenues received in fiscal year 1992/93, based on current charges. These revenues reflect the fact that government customers pay only 27 percent of the amount billed; all other customers pay approximately 80 percent of the amount billed
- Revenues which would be generated in fiscal year 1998/99 if full cost-of-service charges were implemented (unadjusted)
- Revenues estimated for fiscal year 1998/99 based on recommended charges. By this year, the collection rate for all customers, including government, is assumed to be 80 percent.

The majority (80 percent) of wastewater revenues in fiscal year 1998/99 are projected to be from domestic and government customers. Wastewater revenues from government customers.

Recommended Wastewater Charges per Cubic Meter

(Piastres per Cubic Meter)

Customer Class	Fiscal Year				
	1994/95	1995/96	1996/97	1997/98	1998/99
1. Domestic					
0–60 cubic meters	3.50	5.00	7.50	11.00	16.50
>60 cubic meters	5.20	7.80	11.70	16.90	24.70
2. Government	20.00	30.00	46.00	69.00	107.00
3. Small Factories and Shops	20.70	29.90	44.85	67.85	96.60
4. Large Industrial Factories	26.35	35.65	49.60	69.75	96.10
5. Tourism and Investment	41.25	52.25	68.75	85.25	107.25
6. Worship and Charities	6.40	8.00	10.40	13.20	16.80
7. Sports Clubs and Embassies	11.05	16.25	24.05	37.70	52.00

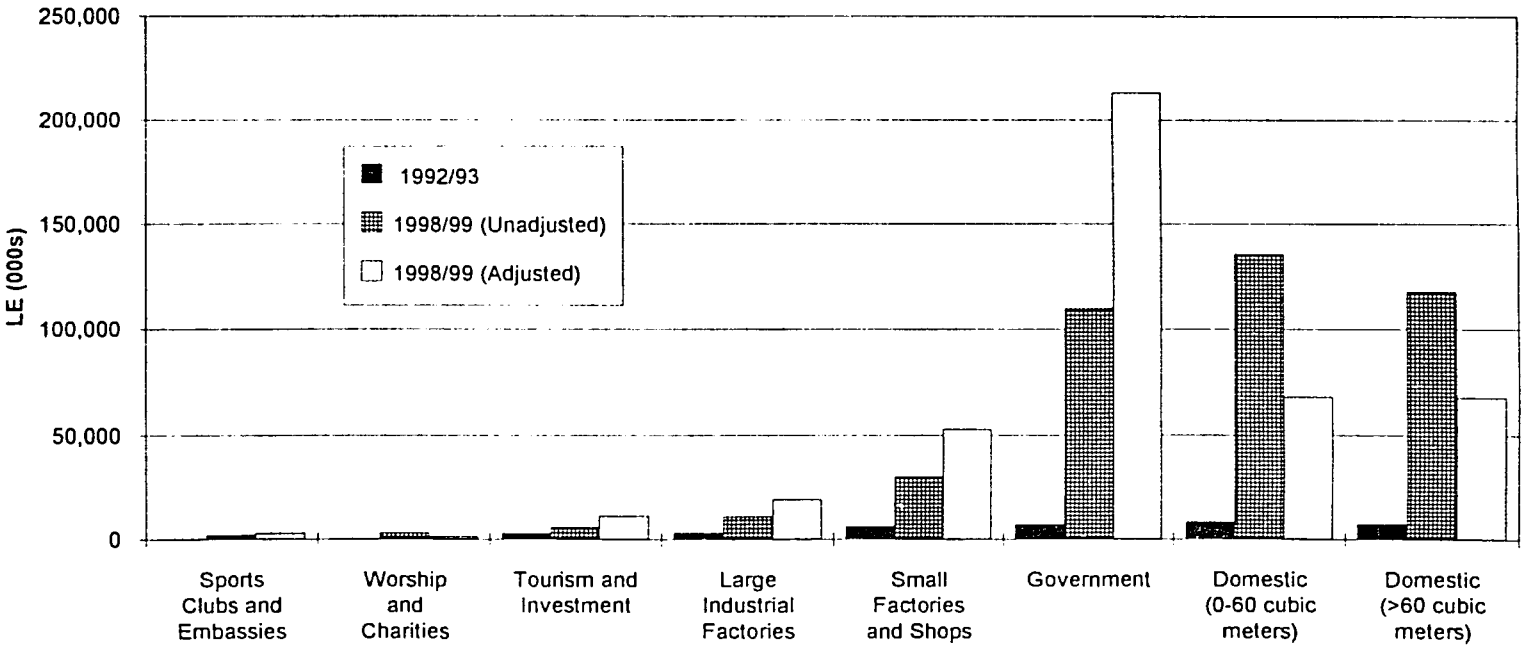
Wastewater Service Charge Revenues

(LE 000s)

Customer Class	Fiscal Year				
	1994/95	1995/96	1996/97	1997/98	1998/99
1. Domestic					
0–60 cubic meters	15,281	22,523	34,859	52,751	81,642
>60 cubic meters	15,135	23,424	36,253	54,031	81,476
2. Government	14,999	33,794	63,423	121,250	215,188
3. Small Factories and Shops	11,594	16,944	25,715	39,359	56,700
4. Large Industrial Factories	5,377	7,338	10,298	14,609	20,305
5. Tourism and Investment	4,475	5,782	7,759	9,815	12,593
6. Worship and Charities	545	690	907	1,168	1,506
7. Sports Clubs and Embassies	629	925	1,369	2,146	2,960
Annual Service Charge Revenues	68,035	111,420	180,583	295,129	472,370

Current and Proposed Wastewater Revenues

(LE 000s)



Customer Classes Listed In Increasing Order of Total Annual Water Flow
(not to scale)

EXHIBIT V-8

Wastewater revenues from government customers are projected to increase substantially during the five year rate study. A primary reason is that the collection rate for government is assumed to increase from 30 percent in fiscal year 1994/95 to 80 percent in fiscal year 1998/99. As a result of this increase in collection rates, and increases in wastewater charges and water flows, the average annual increase in revenues from government customers is projected to be 95 percent.

Wastewater revenues from domestic customers are projected to increase at an average of 52 percent per year due almost entirely to the increase in wastewater charges. Annual revenues from domestic customers are generally evenly divided between the two consumption blocks.

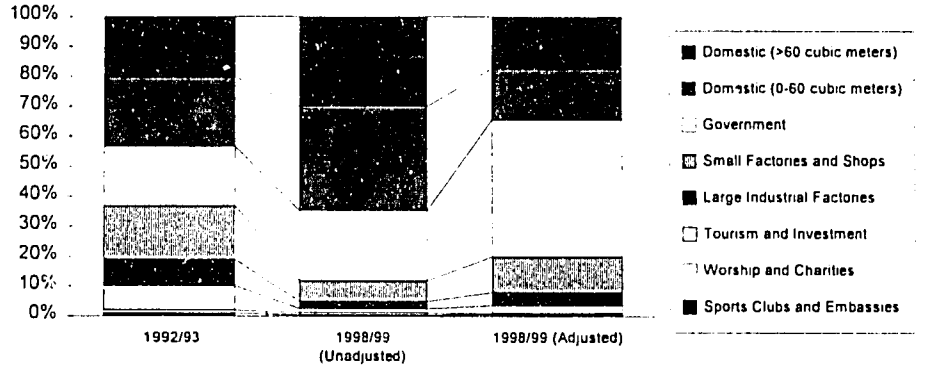
Figure V-1, below, shows which customer classes currently are subsidized and which customers will be subsidized under the recommended charges. The left bar shows what proportion of annual revenues are paid by each class. The middle bar shows who would pay under the unadjusted fiscal year 1998/99 wastewater charges, and is the benchmark for determining who is subsidizing whom. The right bar shows who would pay under the recommended adjusted charges.

Comparing the left bar to the middle bar shows who now pays less than their portion of total costs funded by the GOSD, and who pays more than their portion of total costs now recovered. Comparing the right bar with the middle bar shows who would pay less than their full share of true costs of service, and who would pay more than their full share under the recommended charges.

The composition of wastewater revenues in fiscal year 1992/93 reflects the assumed lower collection rate for government customers (27 percent) than the other six customer classes (80 percent). As a result, revenues from government customers in fiscal year 1992/93 are substantially less than what these customers should be charged for wastewater services.

Under a true cost of service model (as depicted by the middle bar), domestic customers would pay substantially more than they pay under the current wastewater rate structure or the proposed wastewater rate structure. In order to minimize the

Figure V-1
Composition of Wastewater Revenues



impact on domestic customers, it is recommended that government customers be charged more than the true cost of providing service to these customers. The amount of the government subsidy to domestic customers is projected to be approximately LE 105 million in fiscal year 1998/99. This represents an increase in government revenues of 95 percent over what they would pay under a true cost of service rate structure.

The large government subsidy to domestic customers is less than the current subsidy provided by the GOE directly to the GOSD. Some of the domestic subsidies are recovered through higher charges to the other customer classes. The amount of domestic subsidies should be reduced in the future years and the GOSD should move towards a true cost of service rate setting methodology. Once this has been achieved, the GOSD will no longer require any form of government subsidies .

Small factories and shops also help subsidize domestic customers. Small factories and shops are projected to pay approximately LE 24 million (75 percent) more in fiscal year 1998/99 than their fair share under a true cost of service rate structure.

Large industrial factories are projected to pay more than LE eight million (74 percent) more in fiscal year 1998/99 than what they would pay under a true cost of service rate structure, and tourism and investment customers are projected to pay slightly more than LE six million (95 percent). The total projected subsidies to be provided by these four customer classes amount to approximately LE 143 million in fiscal year 1998/99. All of these subsidies are used to off-set the costs of providing wastewater services to domestic customers.

The level of subsidy provided each of the two domestic consumption blocks is not the same. The lower consumption block is subsidized more than the higher consumption block, assuming households that consume more water generally have higher incomes and a greater ability to pay for wastewater services.

The subsidy to the lower consumption block is projected to be approximately LE 82 million in fiscal year 1998/99. This is 50 percent of what these customers would pay under a true cost of service rate structure.

The subsidy to the higher consumption block is projected to be approximately LE 61 million in fiscal year 1998/99, 43 percent of the amount that would be paid under a true cost of service rate structure. Thus, the lower consumption block is subsidized more than the higher consumption block under the proposed wastewater charges.

Finally, projected wastewater revenues from worship and charities and sports clubs and embassies remain insignificant during the five year rate study (approximately one percent of total wastewater revenues in fiscal year 1998/99). Thus, changes in the wastewater charges to these two customer classes have little impact on the financial viability of the GOSD.

D. Customer Impacts

The impacts of the proposed wastewater charges on the different customer classes are shown in **Exhibit V-9**, on the following page. Several aspects of potential customer impacts should be emphasized:

- *Domestic (0-60 cubic meters)* -- Domestic customers in the lower consumption block will see an average annual increase of 42 percent over their current bi-monthly wastewater bill. With approximately four households per connection, the proposed wastewater charges will result in an average bi-monthly wastewater bill of LE 8.25 per household in the lower consumption block. Assuming a discount factor of seven percent, a bill of LE 8.25 per household in fiscal year 1998/99 is equivalent to LE 5.50 per household in fiscal year 1992/93. Based on the average annual household income in fiscal year 1992/93 (Section III-*System Demand*), essentially all households have the ability to pay this bill.
- *Domestic (>60 cubic meters)* -- The proposed wastewater charges for the higher domestic consumption block result in an average increase of 44 percent per year in the bi-monthly wastewater bill. The fiscal year 1998/99 average bill *per account* (LE 81.59) is equal to an average bill *per household* of LE 20.40 in fiscal year 1998/99. This average bill is equal to LE 13.59 in fiscal year 1992/93 Egyptian pounds. Over half of the middle income households, and all high income households, would be able to afford this average bi-monthly wastewater bill.
- *Government* -- Government customers would incur the largest percentage increase over their current bi-monthly wastewater bill (an average increase of 48 percent per year). An average bill would increase approximately LE 4,228 in absolute terms (not discounted).
- *Small Factories and Shops* -- Small factories and shops would incur an increase of approximately LE 341 per billing period, which represents an average annual increase of 43 percent over their current wastewater bill.
- *Large Industrial Factories* -- Large industrial factories would incur the largest absolute increase (approximately LE 11,818 per billing period). This represents an average increase of 36 percent per year over the current bi-monthly wastewater bill.
- *Tourism and Investment* -- Tourism and investment customers would incur an increase of approximately LE 3,077 per billing period by fiscal year 1998/99. This equates to an average increase of less than 35 piastres per guest per night at a hotel with 300 rooms and an average occupancy rate of 50 percent.

Even though the magnitude of the wastewater charge increases are substantial, the end results are bills which appear to be potentially affordable (though this does not mean they are politically feasible). Current wastewater charges are extremely low, yet the health and convenience benefits gained by customers is great.

Estimated Impacts of Proposed Wastewater Charges on Bi-Monthly Wastewater Bill

Customer Class	Fiscal Year 1992/93				Fiscal Year 1998/99		Increase in Wastewater Bill
	Potable Water Charge (PT/Cubic Meter)	Average Bi-Monthly Water Use per Account (Cubic Meters)	Current Wastewater Charge (PT/CM)	Average Wastewater Bill per Account (LE)	Proposed Wastewater Charge (PT/CM)	Average Wastewater Bill per Account (LE)	
1. Domestic							
0-60 cubic meters	10	200	2.00	4.00	16.50	33.00	725%
>60 cubic meters	13	410	2.60	9.22	24.70	81.59	785%
2. Government	20	4,359	10.00	435.90	107.00	4,664.13	970%
3. Small Factories and Shops	23	401	11.50	46.12	96.60	387.37	740%
4. Large Industrial Factories	31	14,662	15.50	2,272.61	96.10	14,090.18	520%
5. Tourism and Investment	55	3,858	27.50	1,060.95	107.25	4,137.71	290%
6. Worship and Charities	8	524	4.00	20.96	16.80	88.03	320%
7. Sports Clubs and Embassies	13	2,613	6.50	169.85	52.00	1,358.76	700%

E. Independent Regional Charges

Wastewater charges also are estimated for two independent regions: the West Bank and East Bank. These charges are based on projected regional costs of wastewater treatment plants, major pump stations, subsidiary pump stations and sewer maintenance, plus a portion of total GOSD administrative costs.

Estimates of the number of domestic water customers are only available for the West Bank. The number of domestic customers on the East Bank is determined as the difference between total water customers served by the GOGCWS and the customers on the West Bank.

Estimates of the remaining six customer classes are not available by region. For this analysis, the number of non-domestic customers served by the GOGCWS is split between the two regions based on the percentage of domestic customers assumed in each region.

Water flows also are not available for each region. For this analysis, water flows per customer are assumed to equal the system-wide water flows per customer account, by class.

Because there are no reliable regional customer demand data, the regional wastewater charges presented in this section are not reliable. The regional charges presented in this section might not result in financial autonomy for either of the two regions.

Table V-4 presents estimated wastewater charges for each customer class, assuming the West Bank and East Bank regions operated independently. Regional cost data used to develop the charges are included in **Appendix G**, in Volume II of this report.

As with system-wide charges, the regional charges are adjusted in order to allow for cross-subsidization among the different customer classes, equity considerations, rate smoothing, and rounding of surcharges to the nearest five percent. The regional charges presented in Table V-4 reflect these adjustments.

The West Bank charges are slightly higher than the East Bank charges primarily because the West Bank has larger direct facility costs. However, the differences in charges are relatively minor, and, because of our lack of confidence in regional-specific demand data, no inferences can be made as to whether one region should have higher wastewater charges than the other.

Table V-4
Fiscal Year 1998/99 Regional Wastewater Charges
(Piastres per Cubic Meter)

Customer Class	West Bank	East Bank
1. Domestic		
0-60 cubic meters	17.50	16.00
>60 cubic meters	26.00	24.05
2. Government	112.00	105.00
3. Small Factories and Shops	102.35	95.45
4. Large Industrial Factories	102.30	96.10
5. Tourism and Investment	112.75	104.50
6. Worship and Charities	18.00	17.20
7. Sports Clubs and Embassies	56.55	55.90

SECTION VI

RECOMMENDED OTHER SERVICE CHARGES

ERNST & YOUNG

Section VI. Recommended Other Service Charges

The primary source of revenues to recover GOSD costs are wastewater surcharges. The initiation of an industrial high strength surcharge and the continued imposition of lateral connection fees are two other sources of revenue to the GOSD. This section presents projections of revenues from each of these fees in the following order:

- *Industrial High Strength Surcharges*
- *Sewer Lateral Connection Fees.*

A. Industrial High Strength Surcharges

Wastewater user charges are designed to recover a number of costs, including the treatment of wastewater. Treatment costs will vary depending on the level of pollutants in the wastewater. Although the greatest volume of wastewater is generated by the domestic customer class, the highest strength flows are generated by Cairo's private and public sector industrial companies. The burden which high strength wastewater places on a wastewater system is significant. High strength wastewater can damage sewage infrastructure, produce hazardous conditions for neighborhoods and sewage workers, interfere with biological treatment processes, and compromise the efficient reuse of sludge.

Current wastewater surcharges for large industrial factories do not recover these additional costs. The proposed wastewater rates are designed to recover average total treatment costs, not necessarily high strength treatment costs. A high strength surcharge based on the additional costs of treating higher strength wastewater flows would be equitable and provide funds to maintain the system. The high strength surcharge would be an addition to the proposed new wastewater user fees and would be imposed on those industrial customers discharging wastewater of greater strength than the average influent conveyed to the system's treatment plants.

Two generally accepted parameters of wastewater strength are biochemical oxygen demand (BOD) and total suspended solids (TSS). Both parameters are easily measured and reliably indicate wastewater strength. Each pollutant is explained below.

- **Biochemical Oxygen Demand (BOD).** The BOD of a wastewater sample indicates the amount of dissolved oxygen used by microorganisms in the biochemical oxidization of organic matter in a specified time (e.g., five days). BOD test results provide estimates of the biological strength of wastewater. Each wastewater treatment plant is designed to remove specific amounts of BOD concentrations. The Zenein treatment facility, for example, is designed for an influent wastewater strength of 400 milligrams per liter (mg/l). Higher concentrations of BOD increase the organic load on the activated sludge treatment units, and may cause reduced secondary treatment efficiency in removing organic pollutants.

- **Total Suspended Solids (TSS).** Sewage treatment is intended to remove solids from suspension. Measures of TSS represent the concentration of insoluble solids that either float or are suspended in wastewater. TSS concentrations which are greater than the design capacity of a wastewater treatment plant can cause blockages of pipes, overloads on the plant's physical and biological treatment facilities, and increases in solid waste disposal costs. TSS also is measured in mg/l.

The imposition of BOD and TSS surcharges is fiscally prudent and equitable, as well as consistent with GOE laws and ministerial pre-treatment requirements. Government of Egypt legislation currently defines specific limitations on BOD and TSS wastewater strengths that can be discharged into the Greater Cairo wastewater system. According to Law 93 of 1962, the maximum discharge strength for BOD and TSS is 400 and 500 milligrams per liter, respectively. Although Law 93 established these guidelines, it is rarely enforced and no penalties are assessed to industrial abusers. Therefore, a different method of calculating and collecting high strength fees is needed.

The following subsections explain the calculation of possible GOSD high strength surcharges and the potential revenues from implementing them.[1]

1. Cost of Removing Pollutants

Calculation of the high strength surcharge begins with determining what it costs to remove BOD and TSS. Normally, wastewater utilities track the costs of individual unit processes involved in treating wastewater flows, removing pollutants, and disposing of treatment byproducts. There are several unit processes which are fairly standard to primary and secondary treatment of wastewater:

- ☐ Preliminary Treatment
- ☐ Pumping
- ☐ Primary clarification
- ☐ Aeration
- ☐ Secondary clarification
- ☐ Disinfection/dechlorination
- ☐ Sludge thickening
- ☐ Digesting
- ☐ Sludge dewatering
- ☐ Effluent disposal
- ☐ Sludge disposal.

Although many of these processes are part of GOSD facilities, the GOSD does not record costs for any of these unit processes. The GOSD also does not track total costs for each treatment plant.

Therefore, GOSD treatment and disposal costs for fiscal year 1994/95 must be estimated from the projected direct costs for each wastewater treatment plant.[2] Except for the Berka plant, 100 percent of each plant's direct costs are allocated to treatment and disposal. The Berka plant includes a pump station at the front-end of the facility. Therefore, it is assumed that five percent of Berka's total direct facility costs are for pump station expenses and are excluded from its total treatment and disposal costs. **Table VI-1** presents the estimates of total GOSD treatment and disposal costs.

Table VI-1
Calculation of GOSD
Treatment and Disposal Costs
FY 1994/95
(LE 000s)

Facility	Direct Facility Cost	Treatment and Disposal Allocation Percent	Treatment and Disposal Cost
Primary			
1. Abu Rawash	14,067	100%	14,067
2. Berka	14,930	95%	14,184
3. Shoubra el Kheima	9,977	100%	9,977
Total Primary	38,794		38,228
Secondary			
1. Zenein	15,360	100%	15,360
2. Helwan	14,133	100%	14,133
Total Secondary	29,493		29,493
Total	68,467		67,721

To determine the cost to remove BOD and TSS, a portion of total treatment and disposal costs shown in Table VI-1 are first allocated to each unit process involved in

[1] The actual year in which the industrial surcharge is implemeted depends on many factors, including the initiation of an industrial waste metering program, dependable and accurate BOD and TSS sampling, accurate flow measurement programs, and enforcement of GOE legislation. The implementation date for the industrial surcharges is assumed for July 1, 1997.

[2] The old Gabal el Asfar treatment plant is not included in this analysis because wastewater flowing through the plant is not treated.

treatment and disposal. Then a portion of each unit process' costs is allocated to BOD and TSS, based on the impact each unit process has on removing pollutants.[3] Because a primary treatment plant's unit processes differ from those of a secondary treatment plant, different allocation percentages are used for GOSD's primary and secondary treatment plants. **Exhibit VI-I,** on the next page, presents an estimation of unit process costs for treating and disposing wastewater, and the allocation of these costs to flow, BOD, TSS, and other pollutants.[4]

Total costs for removing BOD and TSS is estimated at LE 44.9 million:

BOD	LE 22,845,000
TSS	22,054,000
Total	LE 44,899,000

It is important to note that the costs shown in Table VI-1 and Exhibit VI-1 do not include all costs normally required to operate and maintain primary and secondary wastewater treatment operations. Costs which are excluded from this analysis are:

- **Industrial waste monitoring**. This program would identify customers, measure flows and strength, assess the high strength surcharge, and monitor flows and strength on an ongoing basis. Industrial waste monitoring typically accounts for five percent of total treatment costs.[3]
- **Maintenance capital projects**. These projects maintain the assets of the GOSD in an operating condition, and upgrade facilities when plant and equipment need to be replaced. Annual costs for these ongoing projects are not available for just GOSD treatment plants. Based on estimates of total system-wide asset value, these maintenance costs could account for 40 percent of operating costs each year. However, because the GOSD could not estimate the individual asset value of any of the six treatment plants, these costs could not be included in the calculation of the high strength surcharge.

2. Amount of BOD and TSS Removed from Wastewater Flows

Estimates of kilograms of BOD and TSS removed at each wastewater treatment plant are derived from the product of three plant measures:

- Average annual cubic meters of influent wastewater flows
- Average influent strength of BOD and TSS
- Percent reduction in BOD and removal of TSS (plant efficiency).

Exhibit VI-2, following Exhibit VI-1, presents an estimate of total kilograms of BOD and TSS removed by GOSD treatment plants in fiscal year 1994/95. An estimated 79.9 million kg of BOD and 105.6 million kg of TSS are removed annually by the five treatment plants.

Flow, strength, and removal efficiency data for 1992/93 were provided by GOSD wastewater treatment plant managers. These estimates from plant managers vary significantly from plant to plant. Reported influent BOD strengths range from 179 mg/l to 350 mg/l for all treatment plants. Reported influent TSS strengths also vary greatly from 157 mg/l at Helwan to 400 mg/l at Abu Rawash. The strength of TSS is

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3 Source: Ernst & Young, *City of Santa Rosa Water and Wastewater Rate Study*, Exhibit V-4, page V-9, February 1988.

4 One common unit process (digesting) is not a process now used at any of the existing wastewater treatment plants. The pumping unit process is accounted for through the collection functional cost category and, as a result, pumping costs are not included in the treatment and disposal costs.

Estimated Annual BOD and TSS Treatment Costs

Fiscal Year 1994/95
(LE 000s)

Unit Process Costs						Allocation of Costs to Pollutants							
Unit Process	Percent of Primary Plant Costs	Percent of Secondary Plant Costs	Primary Plants (LE 000s)	Secondary Plants (LE 000s)	Total Costs (a) (LE 000s)	Flow		BOD		TSS		Other Pollutants	
						Percent	Cost	Percent	Cost	Percent	Cost	Percent	Cost
Preliminary Treatment	10%	5%	3,823	1,475	5,298	50%	2,649			50%	2,649		
Primary Clarification	11%	5%	4,205	1,475	5,680			25%	1,420	75%	4,260		
Aeration	0%	25%	0	7,373	7,373	20%	1,475	40%	2,949			40%	2,949
Secondary Clarification	0%	12%	0	3,539	3,539			50%	1,770	25%	885	25%	885
Disinfection/Dechlorification	0%	12%	0	3,539	3,539	100%	3,539						
Sludge Thickening	10%	5%	3,823	1,475	5,298			100%	5,298				
Sludge Dewatering	39%	21%	14,909	6,193	21,102			40%	8,441	50%	10,551	10%	2,110
Effluent Disposal	16%	8%	6,116	2,359	8,475	100%	8,475						
Sludge Disposal	14%	7%	5,352	2,065	7,417			40%	2,967	50%	3,709	10%	742
Total	100%	100%	38,228	29,493	67,721		16,138		22,845		22,054		6,686

(a) Total costs of GOSD treatment do not include maintenance capital projects or industrial waste monitoring costs.
Total unit process costs allocated to flow, BOD, TSS, and other pollutants do not equal direct facility costs (Table VI-1) due to rounding.

Estimated Annual Amount of BOD and TSS Removed

Fiscal Year 1994/95

Wastewater Treatment Plant	Average Flows		BOD			TSS		
	Cubic Meters Per Day	Cubic Meters Per Annum	Average Strength (mg/l) (c)	Percent Removal (c)	Annual Removal (kg)	Average Strength (mg/l) (c)	Percent Removal (c)	Annual Removal (kg)
Primary Wastewater Treatment Plant								
1. Abu Rawash (a)	235,000	85,775,000	350	51%	15,310,838	400	78%	26,761,800
2. Berka	325,000	118,625,000	276	37%	12,113,985	177	57%	11,968,076
3. Shoubra El Kheima (b)	278,000	101,470,000	313	44%	13,974,448	289	68%	19,940,884
Secondary Wastewater Treatment Plant								
1. Zenein	330,000	120,450,000	260	92%	28,811,640	332	96%	38,389,824
2. Helwan	165,000	60,225,000	179	90%	9,702,248	157	91%	8,566,524
Total BOD Reduced and TSS Removed					79,913,159			105,627,108

Conversion rates: 1,000 miligrams (mg) = 1 gram (g), 1,000 g = 1 kilogram (kg), 1,000 liters (l) = 1 cubic meter.

(a) The calculation of annual kg reduced for Abu Rawash is as follows: 85,775,000 cubic meters x 1,000 liters per cubic meter x 350 mg per liter x 51 x 1 kg per 1,000,000 mg = 15,310,838 kg.

(b) Primary treatment facilities at Shoubra el Kheima are still under construction. 1994 flows are derived from AMBRIC's February 1991 Report: System Load Review, Table D-6.

(c) BOD and TSS strengths and removal efficiencies were provided by GOSD plant managers. Shoubra el Kheima influent strength and efficiency percentages are calculated as the average of the strength and efficiencies of the two operating primary treatment plants.

reportedly lower than the strength of BOD at the Berka wastewater treatment plant, while at all other treatment plants, TSS strengths are higher than BOD strengths. Managers indicate that the cost of treatment per cubic meter of flow at Zenein is nearly half the cost per cubic meter at the Helwan wastewater plant. Before, the industrial surcharge is implemented, the GOSD should develop reliable information on the flow, strength, and removal efficiencies for each treatment plant.

3. Determination of the Industrial High Strength Surcharge

The cost to remove a kilogram of BOD and TSS is determined by dividing the estimated BOD and TSS removal costs (Exhibit VI-I) by the estimated annual kilograms of BOD and TSS removed (Exhibit VI-II). This calculation is presented in **Table VI-2.**

Table VI-2
LE Cost to Remove
BOD and TSS in FY 1994/95

	BOD	TSS
Annual Treatment Cost (LE)	22,845,000	22,054,000
Amount Removed (kg)	79,913,159	105,627,108
Removal Cost	**LE 0.29/kg**	**LE 0.21/kg**

Based on this analysis, the recommended surcharge for each kilogram of BOD and TSS that industrial users discharge above a system threshold limit is LE 0.29/kg for BOD and LE 0.21/kg for TSS.

4. Determining Threshold BOD and TSS Strengths

It is recommended that surcharges be assessed on wastewater which is of higher strength than the average system wide effluent strength. The overall system average for BOD and TSS provides the threshold amount, and is determined for this study by weighting each wastewater treatment plant's reported BOD and TSS strengths by its reported average wastewater flows. **Table VI-3** presents the estimation of system-wide BOD and TSS threshold limits. The BOD and TSS limitations that are defined by Law 93 are not used as threshold limits because they do not reflect the actual average influent strength at GOSD wastewater treatment plants, but are arbitrarily set. The high strength surcharge is designed to recover marginal costs of treating above average strength wastewater.

Table VI-3
BOD and TSS Threshold Limits
FY 1994/95

Facility	Average Flow (m^3/day)	BOD (mg/l)	TSS (mg/l)
Primary			
1. Abu Rawash	235,000	350	400
2. Berka	325,000	276	177
3. Shoubra el Kheima	278,000	313	289
Secondary			
1. Zenein	330,000	260	332
2. Helwan	165,000	179	157
Threshold Limit		**281**	**276**

5. Calculating an Industrial Customer's High Strength Surcharge

The BOD and TSS threshold limits establish benchmarks for which sampled industrial wastewater strengths are compared to determine high strength surcharges. For each industrial customer whose wastewater is sampled, the amount of the surcharge would be based on: (1) the amount by which an industrial user's discharges exceed BOD and TSS threshold limits, and (2) the total cubic meters of wastewater discharged. **Figure VI-I**, on the following page, shows how the industrial high strength surcharge is calculated for an individual industrial user.

Figure VI-1
Calculating an Industrial Customer's High Strength Surcharge

BOD: Measured flow in cubic meters x 1,000 liters/m³ x (Sampled BOD mg/l - 281 mg/l) x 1kg/1,000,000 mg x LE 0.29/kg

Plus,

TSS: Measured flow in cubic meters x 1,000 liters/m³ x (Sampled TSS mg/l - 276 mg/l) x 1kg/1,000,000 mg x LE 0.21/kg

Where:

Measured flow	=	Cubic meters of wastewater discharged in the billing period
Sampled BOD	=	Industrial user's BOD strength in mg/l or 281 mg/l, whichever is greater
Sampled TSS	=	Industrial user's TSS strength in mg/l or 276 mg/l, whichever is greater
LE 0.29	=	Industrial high strength surcharge for BOD (the cost to remove one kilogram of BOD)
LE 0.21	=	Industrial high strength surcharge for TSS (the cost to remove one kilogram of TSS)

For an industrial customer discharging 1,000 cubic meters in a billing period with a BOD strength of 550 mg/l, the industrial high strength surcharge for BOD would be LE 78.01. This calculation is shown below.

1,000 cubic meters
x 1,000 liters per cubic meter
x (550 mg/l - 281 mg/l)
x (1 kg/1,000,000 mg)
x LE 0.29 /kg
= LE 78.01

The BOD high strength surcharge of LE 78.01 would be added to the industrial user's wastewater bill.

6. Projected Annual Revenues from Industrial High Strength Surcharges

Wastewater flows from large industrial factories are estimated from projected average water flows (discussed in Section III- *System Demand*). Water flows in fiscal year 1994/95 are projected at 25,507,000 cubic meters. Assuming that, on average, 80 percent of total water flows are returned to the sewer by industrial customers, wastewater discharges by large industrial factories in fiscal year 1994/95 are estimated at 20,406,000 cubic meters.

Large industrial factories, however, account for only 25 percent of total industry in the Greater Cairo area. The remaining 75 percent of industries are operated by the government and are billed for wastewater services as government customers. The GOGCWS is not able to distinguish public sector industry water flows from other types of customers in the government class. The GOE's General Organization for Industry (GOFI), however, monitors the activities of about 80 percent of all industries operated by the government. According to the GOFI, the industries they monitor discharged approximately 56 million cubic meters of wastewater into the collection system in 1992. To estimate the flows in fiscal year

1994/95, the annual rate of growth used to project water flows of large industrial factories (0.9 percent) is applied to the wastewater flows of public sector industries for three years.[5] **Table VI-4** presents estimates of private, public, and total wastewater flows discharged by Cairo's industries.

Table VI-4
Estimated Industrial Wastewater Flows
FY 1994/95

Sector	Flows (m^3 x 1,000)	Factor	Waste-Water Flow (m^3 x 1,000)
Large Industrial Factories	25,507 (1994/95 wastewater flows)	80%	20,406
Public	56,000 (1992 wastewater flows)	(1.009)[3]	57,526
Total			77,932

The second step in estimating potential revenues from industrial high strength surcharges is to determine the average effluent strength of Cairo's industrial customers. Neither GOFI nor other GOE sources provide adequate or reliable sample data to make a reasonable estimate of average industrial strength for the entire Greater Cairo area. Therefore, an alternative methodology for determining average industrial effluent strength is developed.

At present, the heaviest industrial areas in Cairo are located in the Embaba, South Kalioubia, and North and South Helwan Areas.[6] Sample strengths taken from the collectors and pump stations in these areas are the best approximation of average industrial wastewater strength available. Because most of Helwan's industries are not currently connected to the Helwan wastewater treatment plant, wastewater samples from this region are not used; only samples from the Embaba and Southern Kalioubia areas are used. Annual average BOD and TSS strengths for the pump stations and collectors in these industrial zones appear in **Table VI-5**.[7]

Table VI-5
Sample BOD and TSS Strengths in Cairo's Heavy Industrial Areas
1992

	Sample Location	BOD (mg/l)	TSS (mg/l)
1.	Awkaf Pump Station	435	602
2.	El Taweel Collector	324	327
3.	Old Shoubra Collector	356	396
4	New Shoubra Collector	443	452
	Average Strength	390	444

A simple average of these four samples yields an approximate average load of 390 mg/l for BOD and 444 mg/l for TSS.

Not all types of industries in the Greater Cairo area are included in these averages. Many industries have much higher BOD and TSS strengths than the averages above. Sample results from

5 Section III - *System Demand* presents system-wide demand characteristics. The compounded annual rate of growth for large industrial factory water flows from 1992/93 to 1998/99 is approximately 0.9 percent.

6 Source: Taylor Binnie & Partners, *METAP Cairo Industrial Effluent Control Study*, Figure 3.4. 1992.

7 Source: AMBRIC, *Wastewater Collection System Monitoring*, 1992. The determination of which facilities were located within the heavy industrial areas identified by the 1992 Taylor Binnie report was provided by CH2M Hill/OMI.

Taylor Binnie's 1992 report: *METAP Cairo Industrial Effluent Control Study*, reveal significant incidence of effluent strengths exceeding several thousand mg/l. For example, sample BOD and TSS strengths at a glue factory, brewery, and bus depot all are over 10,000 mg/l. The industries sampled by Taylor Binnie do not represent a reasonable cross section of the typical wastewater strengths of Cairo's industries. Due to the study's emphasis on identifying Cairo's most polluting industries, the study data are not used in this rate study to calculate the average system-wide industrial strength.[8]

Estimations of wastewater discharge volumes, threshold limits, and average strengths for BOD and TSS are used to project revenues from industrial surcharges. Total projected revenues are estimated using the same equation to determine surcharges for an individual customer. The difference between average industrial BOD and TSS strengths and estimated BOD and TSS threshold limits are multiplied by total estimated annual industrial wastewater flows. Total potential revenues from industrial high strength surcharges in fiscal year 1994/95 are projected at LE 5.2 million. Projected revenues from industrial surcharges are presented in **Figure VI-2** on the next page.

7. Implementation of Recommended High Strength Surcharges

High strength surcharges have proven to be effective in Western countries at encouraging industries to reduce pollutants discharged in wastewater. Industrial high strength surcharges also recover costs directly from users placing additional demand on the wastewater system.

If full cost recovery of treating high strength wastewater is the GOSD's objective, then the proposed surcharges establish a theoretical lower limit for a fair and equitable surcharge on industrial customers. It should be re-emphasized that the costs used to estimate the surcharge for this study do not include costs of implementing the program, nor significant costs of maintenance capital projects. The GOSD would be unable to implement the recommended surcharges before fiscal year 1997/98 because the high strength surcharge is dependent on a reliable program to estimate full costs, flows, strength, and plant removal efficiencies.

Whether the full surcharge or only a portion of the surcharge is ultimately imposed by the GOSD, implementation would involve a number of actions. Industrial customers must be identified, and their wastewater flows determined. Formal test protocols must be established for sampling customer wastewater flows. Sample test results should be reviewed with the customer. The surcharge then would be calculated based on actual BOD and TSS test results and measured wastewater flow.

To achieve greater equity in assessing the high strength surcharge, a more comprehensive engineering study must be performed to determine average and peak pollutant strengths throughout Cairo's heavy industrial zones. This should be done before implementing an industrial high strength surcharge. The results of a more comprehensive study will support the development of more accurate BOD and TSS threshold limits, system wide average industrial strengths, and average industrial wastewater discharge amounts.

[8] If an unweighted average of BOD and TSS strengths is calculated from the 45 different industrial customers sampled by Taylor Binnie in 1992, average values for BOD and TSS would be 2,098 and 2,706 milligrams per liter, respectively. Weighting the sampled BOD and TSS strengths from the Taylor Binnie study by each sample's flows results in even less reliable industrial averages of 7,431 mg/l for BOD and 3,492 mg/l for TSS.

Figure VI-2
Estimated Fiscal Year 1994/95 Revenues
From Industrial High Strength Surcharges

BOD: 77,932,000 cubic meters x 1,000 liters/m° x (390 mg/l - 281 mg/l) x

1kg/1,000,000 mg x LE 0.29/kg = **LE 2,463,431**

Plus,

TSS: 77,932,000 cubic meters x 1,000 liters/m° x (444 - 276 mg/l) x

1kg/1,000,000 mg x LE 0.21/kg = LE 2,749,441

Total LE 5,212,872

Where:

77,932,000	=	Projected annual cubic meters of wastewater discharged by industry
390 mg/l BOD	=	Industry average BOD strength
281 mg/l BOD	=	BOD threshold limit
444 mg/l TSS	=	Industry average TSS strength
276 mg/l TSS	=	TSS threshold limit
LE 0.29	=	Industrial high strength surcharge for BOD (the cost to remove one kilogram of BOD)
LE 0.21	=	Industrial high strength surcharge for TSS (the cost to remove one kilogram of TSS)

B. Sewer Lateral Connection Fees

Lateral connection fees are currently charged to a new customer to recover the costs of extending service from the sewer main in the street to an individual property. Revenues from connection fees are treated as offsets to GOSD revenue requirements. The GOSD currently charges new customers several fees for constructing sewer lateral connections to new customers.

1. Current GOSD Lateral Connection Fees

At present, the GOSD may charge builders, developers, and homeowners up to four different categories of fees for establishing sewer connections The number of fees and the amount charged depends on whether GOSD employees or private contractors perform the actual work of building the lateral connection.

All new customers, regardless of who constructs the sewer lateral connection, are charged a flat fee of LE 50. The LE 50 connection fee must be paid before building permits are issued.

A second charge assessed to new customers is the ten percent administrative fee for establishing new wastewater accounts. The amount of the administrative fee is based on the cost of constructing the lateral connection. The GOSD makes an estimation of this cost if the lateral connection is built by private contractors.

The third fee which is charged to new customers is a ten percent supervision fee. The supervision fee also is based on the cost of constructing the lateral connection. Supervision fees are charged to inspect the construction work of private contractors.

A fourth charge is assessed to customers who contract with the GOSD to build the lateral connection The customer is charged the GOSD's costs of installing the connection.

The fees that the GOSD charges for performing the construction of lateral connections depend on the following factors:

- Size of flat or type of business
- Diameter of the connection pipe installed
- Depth to which the lateral connection must be dug
- Need for new manholes
- Estimated discharge volume of the new customer.

Table VI-6 presents the specific fees that the GOSD now charges.

Table VI-6
Summary of GOSD Fees
for Constructing Lateral Connections

	Depth Meters	Price Per Meter Length (LE)	Price Per Manhole (LE)
Pipe diameter			
6" - 7"			
	0.60 - 1.75	100	400
	1.76 - 2.50	140	
	2.51 - 4.00	160	
9" - 10"			
	2.00 - 3.50	200	500
	3.51 - 5.00	230	
12" - 15"			
	2.50 - 4.00	250	600
	4.01 - 6.00	300	

Depth Meters	Price (LE)
0.00 - 2.00	1,000
2.01 - 3.00	1,500
3.01 - 4.00	2,000
4.01 - 6.00	2,500

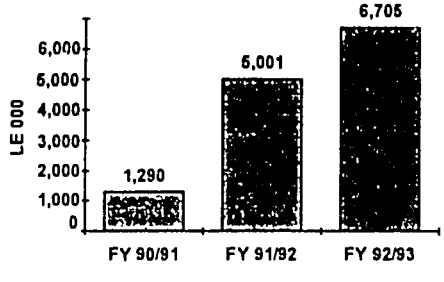
For a customer who has contracted with the GOSD for constructing a new lateral connection and requiring a 6" pipe, 25 meters long, and buried two meters deep, plus a manhole, the total fees charged by the GOSD would be LE 4,900. The calculation is shown below:

(25 x LE 140) + LE 1,000 + LE 400 = LE 4,900

2. Projected Revenues from Lateral Connection Fees

Current sewer lateral connection fees account for approximately 50 percent of total GOSD non-service revenues. **Figure VI-3** presents revenues generated from connection fees over the past three fiscal years.

Figure VI-3
Historical Revenues from Lateral Connection Fees
(LE 000s)



Source: GOSD Revenue Data, Fiscal Years 1990/91 to 1992/93.

Connection fee revenues are projected to increase at the same rate of growth that new customer accounts are estimated to increase from fiscal year 1992/93 through 1998/99. Projected revenues from connection fees are shown in **Table VI-7**.

3. Analysis of Current Lateral Connection Fees

Neither the LE 50 flat fee nor the ten percent administrative charge are determined based on cost of service. The ten percent administrative charge, for opening a new account, is based on the overall cost of constructing a lateral connection. The cost of opening a new account should be fairly constant and unrelated to the size of the customer. It may be more equitable for the administrative charge to be incorporated into the LE 50 flat fee.

Table VI-7
Projected Revenues From Lateral Connection Fees
(LE 000s)

Fiscal Year	Fee Revenues
1992/93	6,705
1993/94	6,920
1994/95	7,141
1995/96	7,370
1996/97	7,606
1997/98	7,849
1998/99	8,100

The 10 percent fee for supervision seems appropriate because larger and more complex lateral connections would require greater inspection than those of less cost. Documentation of on-site inspection should be provided to the new customer.

The GOSD charges new customers its cost for building lateral connections. The GOSD's costs are based on pipe size and length, depth to which the pipe is laid, and the direct cost of constructing manholes. The resulting customer charge for installation is well above current market rates. This may account for why the GOSD constructs less than five percent of all new lateral connections. The few contracts that the GOSD does win are usually for building connections to government offices. Unless the GOSD reduces its fees to market levels, revenues from lateral connections constructed by the GOSD will not increase significantly over the period of the rate study.

SECTION VII

RELATED FINDINGS AND RECOMMENDATIONS

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Section VII. Related Findings and Recommendations

There are several other sources of revenue which, while not significantly impacting the design of wastewater surcharges, affect the GOSD's goals of institutional and financial autonomy. The GOSD generates minor revenues from farming and selling sludge as fertilizer. The GOSD is considering initiating a program to sell reclaimed water. This section evaluates the viability of these three programs and their impact on the financial autonomy of the GOSD.

This section also presents alternatives to relying on the water utility for customer billings and collections. An internal billing and collection system would provide the GOSD with improved financial control, cash flow, and collection rates. An assessment of whether the GOSD should establish their own billing and collection system is made.

Another means for the GOSD to generate additional revenues is to increase the collection rate of its largest non-paying customers. Options to collect more from government offices, industries, and military units are presented in this section.

This section also assesses the need to meter industrial customers. An effective industrial metering program is required before industrial surcharges can be imposed and an industrial waste monitoring program implemented. The feasibility of metering industrial customers in the near term is discussed.

Finally, assessments of the GOSD's plans for establishing miscellaneous service charges are made. These plans are primarily to provide technical services to the private sector for a fee. All analyses in this section are based on limited data provided to us by the GOSD and CH2M Hill/OMI. As more of the requested information is developed, the GOSD may enhance the assessment, although the general conclusions in this section are expected to remain the same. This section is organized as follows:

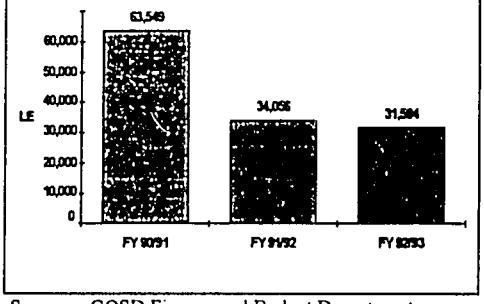
- *Feasibility of Farming Operations*
- *Viability of Sludge Disposal Operations*
- *Feasibility of Reclaimed Water Sales*
- *Alternative Non-Water Utility Billing and Collection Systems*
- *Options to Offset Lost Revenues Owed by Non-Paying Government Agencies*
- *Feasibility of Metering Industrial Customers*
- *Miscellaneous Other Charges*
- *Public Relations.*

A. Feasibility of Farming Operations

Formal Government of Egypt policy requires all government agencies to divest themselves of any business operations unrelated to their core business. Compliance with this policy requires the GOSD to discontinue its farming operations. Farming is not related to a sewer utility's mission or operations.

The GOSD also should discontinue farming operations because it loses money. **Figure VII-1** shows that revenues from GOSD agricultural operations have declined over the last three fiscal years from LE 63,549 to LE 31,594.

Figure VII-1
Revenues From the Sale of Crops
FY 1990/91 - 1992/93
(LE)



Source: GOSD Finance and Budget Department

The GOSD was not able to provide any information on the cost of its farming operations. Therefore, the costs of GOSD's farming operations are approximated using estimates of agricultural headcount and GOSD base salaries and bonuses.

According to a 1993 draft report on GOSD staffing, approximately 153 employees are involved in agriculture, irrigation, and sludge operations.[1] The findings of the staffing report are shown in **Table VII-1**.

Table VII-1
Number of GOSD Employees in Farming Operations - FY 1992/93

Region	Function	Number of Employees
West Bank	Agriculture	21
	Agriculture and Sludge	75
East Bank	Agriculture	42
South	Irrigation	15
	Total	**153**

If it is assumed that half of the employees in the agricultural and sludge and irrigation functions are dedicated solely to agricultural activities, then approximately 108 GOSD employees are involved with agriculture:

$21 + (75/2) + 42 + (15/2) = 108.$

The actual salary costs for these 108 employees depend on their employment grade. The GOSD has six employment grades and three management grades. GOSD salary and bonus payments for each grade are shown in **Table VII-2.** If it is assumed that all of the 108 agricultural employees are in the lowest grade, then total salaries and bonuses in fiscal year 1992/93 are estimated at LE 277,992 (108 x LE 2,574).

Table VII-2
GOSD Salaries and Bonuses by Position - FY 92/93

Grade	Annual Base Salary Plus Bonus (LE)
Top Management	10,948
High Management	8,776
General Manager	8,126
First	6,915
Second	5,905
Third	4,719
Fourth	3,634
Fifth	2,978
Sixth	2,574

[1] Source: CH2M Hill/OMI, *GOSD Draft II, Organizational Structure and Staffing Functions*, May, 1993 .

Assuming that all employees are in the lowest grade and that salaries are the only cost of farming, then farming loses money. In fact, for the last two years combined, farming revenues only recovered 12 percent of salary costs. There is no justification for rate payers to continue to support GOSD's unprofitable farming operations.

If it is the GOE's goal to provide employment for the people farming the lands, it should do so under the direction of the Ministry of Agriculture and Land Reclamation. The Ministry then should make the decision to keep the farming operation or eliminate it.

B. Viability of Sludge Disposal Operations

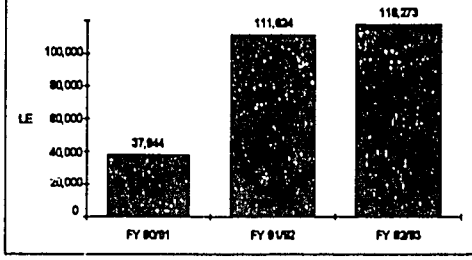
Unlike farming operations, sludge disposal operations are part of normal sewer utility operations. Wastewater treatment plants are designed to remove BOD, TSS, and other pollutants from wastewater flows. Sludge is a by-product of a plant's treatment and drying processes. Most costs related to sludge production are incurred during treatment and are, in effect, sunk costs. The cost of how sludge is disposed of, not produced, is the focus of this discussion.

There are two basic alternatives to sludge disposal. Sludge either is dried and sold as fertilizer or is pumped as waste into lagoons, evaporation ponds, percolating pits, or other suitable containment areas. Revenues generated from sludge sales help offset unit process treatment costs. Also, microbiological concerns (i.e. infectious disease, acute health effects from chemicals, and longer-term health impacts) and risks of incidental and unplanned contamination of groundwater are less likely to result from sludge drying operations than from evaporation and percolating ponds.[2]

Furthermore, the economic costs of producing sludge for reuse are comparable to pumping sludge to containment areas. Neither sludge drying bed nor sludge lagoon operations are labor intensive. The costs of both operations primarily depend on the length of the discharge pipe leaving the wastewater treatment plant. The GOSD sludge drying beds at the Abu Rawash, Berka, and Helwan wastewater treatment plants are adjacent to each wastewater treatment plant. Because the sludge drying beds are so close to the treatment plant, the cost of a sludge disposal pipe is relatively low.

The GOSD also incurs few costs once the sludge is pumped to the sludge drying beds. A local entrepreneur has contracted with the GOSD to stack and remove GOSD dried sludge to this entrepreneur and other individuals with his own machinery and laborers, paying the GOSD LE 1.25 per cubic meter. Revenues from the sale of sludge to this entrepreneur and other individuals during the last three fiscal years are shown in **Figure VII-2**.

Figure VII-2
Revenues From the Sale of Sludge
FY 1990/91 - 1992/93
(LE)



Source: GOSD Finance and Budget Department

The incremental economic costs that the GOSD incurs from drying sludge are comparable to those from pumping sludge to containment areas, the environmental impact of drying sludge is less than pumping sludge, and revenues can be generated at essentially no additional cost. Therefore, the GOSD should continue its dried sludge operations.

Although the GOSD has substantially increased it revenues over the last three fiscal years, the GOSD could increase revenues further by improving its current sludge disposal operations. The GOSD should focus on increasing sludge quantity and quality (i.e., reducing the content of heavy metals, presence of toxic substances, and water content). The more sludge the GOSD can efficiently produce and sell to marketable and legal specifications, the more revenues the GOSD can generate.

2 Source: CH2M Hill, *Reclamation Reuse for Groundwater Recharge*, Volume One Summary, City of San Jose, July, 1992.

According to the GOSD's head chemist, sludge specimens from the Abu Rawash and Berka treatment plants contain heavy metals and high percentages of microbes that cause diseases.[3] The presence of heavy metals could be controlled if Law 93 were enforced by the GOE.[4] Research and studies must be undertaken by the GOSD to address the microbiological concerns of dried sludge produced at Abu Rawash and Berka. The costs of further GOSD research would result regardless of whether the GOSD operated sludge drying beds or pumped sludge to containment areas. GOSD sludge and effluent are regularly monitored by the GOE's Ministry of Pubic Works and Irrigation and the Ministry of Health

According to the GOSD's head chemist, the current price for sludge of LE 1.25 per cubic meter could be increased to LE 4 per cubic meter if the characteristics of GOSD sludge were upgraded to market and legal specifications. Under the same circumstances, the quantity of sludge sold also could increase from approximately three cubic meters per acre to about five cubic meters per acre.

According to ISC team members, the GOSD is able to sell all of the sludge that it produces when the specifications of GOSD's sludge are acceptable to buyers. The managers of GOSD's sludge operations estimate that the demand for dried GOSD sludge will continue to be greater than the GOSD's sludge production capacity over the five year rate study. It is assumed that by fiscal year 1994/95 the GOSD will have reduced the toxins and heavy metals from its sludge at Abu Rawash and Berka treatment plants to marketable levels. Sludge sales are, therefore, projected to increase at the same rate that total sludge production is expected to increase during the five year period.[5] Estimated revenues from sludge production are shown in **Table VII-3**.

Table VII-3
Projected Revenues From Sludge Disposal Operations

Fiscal Year	Fee Revenues (LE 000s)
1992/93	118
1993/94	121
1994/95	124
1995/96	127
1996/97	130
1997/98	133
1998/99	136

3 GOSD Chemist Yeha Ibrahim Sherif: GOSD working paper, 1993.

4 As discussed in Section VI- *Recommended Other Service Charges*, Law 93 requires factories to pre-treat wastewater discharges and to prevent harmful residues from reaching the city's sewage network.

5 Sources: AMBRIC, *System Load Review*, Volume I, Table 4-2. Camp Dresser & McKee International, *Application of Enhanced Primary Treatment at the Abu Rawash Wastewater Treatment Facility*, Table 7. According to the two studies, the compounded annual growth rate for East and West Bank sludge production is 2.5 percent per annum.

C. Feasibility of Reclaimed Water Sales

Reclaimed water is the non-potable, higher quality effluent from a treatment plant. The production of reclaimed water typically requires several unit processes beyond primary and secondary treatment, of which all are costly to operate. Common processes used to produce reclaimed water include:

- ☐ Nutrient removal
- ☐ Filtration
- ☐ Demineralization
- ☐ Organic removal
- ☐ Disinfection.

The GOSD believes it can sell reclaimed water for irrigation and agricultural use from its secondary treatment plants after additional chlorination. This conclusion underestimates the complexities involved with funding, constructing, producing, and delivering reclaimed water to potential reclaimed water customers. According to the Cairo Wastewater Organization, the agency that currently would be responsible for designing and constructing GOSD reclaimed water facilities, the potential for GOSD reclaimed water sales is at least a decade away. For these reasons and those that will be discussed below, it is assumed that sales of reclaimed water are not viable during the five year rate study. The following issues illustrate the difficulties that the GOSD must overcome before reclaimed water sales are viable.

1. Physical Limitations

At present the GOSD has no reclaimed water production and delivery capabilities. As discussed in Section I - *Operating Environment*, the GOSD has only recently begun secondary wastewater treatment operations at two wastewater treatment plants. Secondary treatment is planned for two other GOSD plants but will not begin until sometime in 1995 and 1996. As mentioned above, the production of reclaimed water involves much more than adding chlorine to secondarily treated water. In addition to constructing the operational facilities for the unit processes to produce reclaimed water, the GOSD would also have to construct the following facilities to deliver reclaimed water:

- ☐ Transmission pipelines
- ☐ Distribution pipelines
- ☐ Transmission pumps
- ☐ Diversion pumps
- ☐ Storage tanks.

A minor constraint to establishing reclaimed water operations is that chlorine is difficult to obtain in Egypt. The vast majority of Egypt's chlorine supply is made available to the water utility to help provide potable water. If the supply of chlorine continues to be limited in the future, it will be difficult for the GOSD to obtain chlorine for the production of non-potable water.

2. Funding

A significant factor in designing reclaimed water operations is determining an optimally configured transmission system to deliver reclaimed water to customers. Longer transmission systems are more costly to construct and operate and require more time to plan and build. Funds also are required to purchase the right-of-way to build conveyance systems to customers in industrial areas. Only the Helwan and planned Shoubra el Kheima treatment plants are located near industrial areas. Estimates of when secondary treatment might begin at Shoubra el Kheima are unavailable from the CWO. The costs of serving potential reclaimed water customers from the remote locations of GOSD's other wastewater treatment plants makes reclaimed water operations at those sites not feasible at present except for agriculture.

The GOSD also has no available funds to undertake any of the intensive processes or projects required. GOSD funds are presently insufficient to operate and maintain the wastewater system. Funds required for even a small reclaimed water operation are substantial. For example, the estimated costs of a recent reclaimed water transmission system in the United States, which is only 13 miles in length and provides just 21 million gallons of reclaimed water per day (80,000 cubic meters) was approximately $60 million (LE 200 million).[6]

Initial funding for reclaimed water operations would need to come from the GOE or donor nations. Even if these sources approved funding, obtaining these funds could take several years. Project funding would require numerous studies and tests to determine feasibility, hydraulic needs, reclaimed water demand, health impacts and environmental risks, and results of groundwater simulations before any donations or grants are made available.

3. Reclaimed Water Demand

Reclaimed water for irrigation is typically demanded by large water users such as parks, sports clubs, and schools. Several industrial process facilities who use substantial amounts of water, also are potential users of reclaimed water. Reclaimed water also could be used by various Cairo businesses for paper and fiberglass processing, cooling tower feedwater, and operating air scrubbers. Reclaimed water is also suitable for agriculture use. However, the GOSD faces several obstacles for selling reclaimed water to each of these customers.

Water of comparable properties to reclaimed water is currently provided at a very low price from the water utility. The water utility sells raw water to industrial customers at eight piastres per cubic meter. Other industries illegally pump water from the Nile river or from Cairo's canals and drains for their purposes. Therefore, the GOSD may find it difficult to persuade potential customers to switch to reclaimed water. Unless GOE legislation is passed which bans and penalizes the use of unauthorized connections, or the GOSD can sell reclaimed water at a lower price than the water utility, sales of reclaimed water are likely to be insignificant within the five year rate study.

One alternative would be to lobby the GOE to draft legislation requiring industries bordering reclaimed water pipelines to connect to the system. The strategy of mandatory connection is currently being utilized in several areas of the United States. However, the GOE's timetable for drafting and approving such legislation is lengthy, especially when the interests of local governorates are impacted. Also, new legislation related to wastewater operations may get the same level of enforcement as present wastewater legislation, which is minimal to non-existent.

4. Long-Term Viability of Reclaimed Water Operations.

Even though reclaimed water sales during the five year period of the rate study are unlikely, the long-term potential for reclaimed water operations should not be dismissed. Reclaimed water is a valuable resource that will ease the loads placed on the Nile River. Therefore, the GOSD should establish an appropriate time frame today for examining the feasibility and implementation of reclaimed water within the next ten years. Several key issues that the GOSD should begin to address are summarized below:

- ☐ Determine the total costs and benefits from potential reclaimed water operations

6 Source: CH2M Hill, *Reclamation Reuse for Groundwater Recharge*, Volume One Summary, City of San Jose, July, 1992.

- ❒ Perform market assessment of reclaimed water demand
- ❒ Prepare an environmental impact review of the affects of reclaimed water
- ❒ Develop legal mechanisms and price incentives to promote the maximum use of reclaimed water
- ❒ Identify and pursue funding mechanisms and sources
- ❒ Develop agreements between various entities including CWO, local governorates, and relevant GOE ministries, for design, construction, administration, and operation of the system
- ❒ Obtain permits to sell reclaimed water from the Ministry of Public Works and Irrigation and the Ministry of Health.

D. Alternative Non-Water Utility Billing and Collection Systems

At present the GOSD has no internal billing and collection function. The GOSD currently depends on the water utility to issue water bills, process payments, process wastewater surcharges included on each water bill, and transfer full and correct wastewater revenues to the GOSD. The water utility bills all customers on a bi-monthly basis.

After processing payments, the water utility periodically (not necessarily each billing period) sends a check to the GOSD for the amount it collects from the surcharges on water consumption. The GOSD retains only 10 percent of the amount received from the water utility for salary and bonus payments. The GOSD is required to transfer the remaining 90 percent of surcharge revenues to the Ministry of Finance.

1. Analysis of Water Utility Billing and Collection Systems

The advantages to the GOSD of continuing to rely on the water utility for billing and collection are:

- Billing and collection services are received at little to no direct cost, assuming that the water utility does not withhold any payments
- An internal billing and collection department at the GOSD would add administrative overhead costs and could duplicate water utility processes.

Changes which should be made immediately if the water utility continues billing and collection include the following:

- Provide accurate billing data to the GOSD and identify billing errors. The GOSD has no control over the quality of bills sent to customers nor of the information about billings and collections from the water utility
- Provide customer billing information. Because the billed and collected amount from wastewater surcharges is transferred to the GOSD in one lump sum, the GOSD has no ability to manage its own cash flow operations. Detailed billing information would allow the GOSD to determine the average and range of wastewater demanded by each customer class, pinpoint the largest users of disposal services, identify collection rates, and determine the amount and timing of late payments by account and customer class
- Review billings and collections. At present, the GOSD has no mechanism to verify how much is billed now and how much revenue is actually collected from wastewater surcharges
- Establish mechanisms to encourage customers to pay their bills
- Establish fixed schedules for transferring revenues from surcharges to the GOSD on a regular basis. The GOSD currently has no control over the timing or the amount of cash received from the water utility. The irregular transfer of revenues after several months weakens the GOSD's working capital funds. Daily or weekly transfers of revenue would strengthen the GOSD's financial stability.

2. Recommendations

The changes required indicate how GOSD financial autonomy and institutional sustainability is constrained by its reliance on an external organization for revenue collection. The following two recommendations are made to improve the GOSD's chances of eventually becoming fully autonomous. The goal is to internalize billing and collection at the GOSD.

a. Staff GOSD Personnel in the Water Utility's Billing and Collection Department

The GOSD should begin negotiations with the water utility immediately to place GOSD accounting personnel in the water utility's billing and collection department. These GOSD personnel would track wastewater billings and collections and prepare monthly financial reports. Also, GOSD personnel located within the water utility could leverage the experience of water utility billing and collection staff to facilitate the establishment of similar operations at the GOSD. Although the GOSD should estimate the workload and appropriate staffing levels, it may be necessary for two accounting clerks and one clerical staff to be located at the water utility.

b. Internalize Billing and Collection

Within the next five years, the GOSD should establish its own billing and collection department. During this time, the GOSD should define specific billing and collection processes and procedures and determine the costs it would incur for providing these services. These processes and procedures include: (1) receiving updates from the building permit unit to determine new accounts, (2) setting up new accounts for billing, (3) obtaining meter readings from the water utility on a timely basis where applicable, (4) generating bills to customers, (5) receiving and responding to customer billing inquiries, (6) processing payments, (7) updating customer account information, (8) creating financial controls and an audit trail for billings and collections, (9) preparing appropriate financial reports, and (10) preparing ad-hoc reports.

A billing and collection unit also would track and develop reports on historical demand patterns, by account and by customer class. This would provide valuable baseline data for preparing forecasts of demand, which directly influence capital and financial planning and rate setting.

A GOSD billing and collection function would be responsive to GOSD needs, which the current GOGCWS system is not, and could provide immediate payback in terms of improved cash flow, collection rates, and overall financial control. Also, customer relations would be greatly improved. The GOSD could respond to customer inquiries directly and quickly, rather than explaining to the water utility what the inquiry is and relying on the water utility for a response.

E. Options to Offset Lost Revenues Owed by Non-Paying Government Agencies

As discussed in Section I- *Operating Environment*, the amounts collected from government customers is estimated to be only 27 percent of the total amount billed. This cost the GOSD an estimated LE 8.7 million in uncollected revenues in fiscal year 1992/93. This low rate is unacceptable, especially because these are non-paying government offices, public sector companies, and military operations. The GOSD has no method for determining which government customers do not pay their bills because the water utility does not maintain summary collection and billing records by individual customer or by customer classification.

The GOSD has several options for identifying the amounts owed by non-paying government customers. As an interim solution, it was earlier recommended that GOSD accounting personnel be assigned to the water utility's billing and collection department. This staff would work with water utility personnel to identify which government customers do not pay their bills. By analyzing water utility collections, the GOSD can monitor non-paying government customers to determine which accounts are past due by 30, 60, and 90 days.

The GOSD should attempt to collect from these entities directly or request direct payment from the Ministry of Finance (MOF). The ability to communicate to the GOE the actual identity and amount owed may help the GOSD reduce delinquent accounts. If the GOE does not make direct payment to the GOSD, the GOSD has the option to maintain a balance of the total amount of receivables owed from government agencies and offset this amount against any payables the GOSD owes to the GOE.

Other options require more direct participation and negotiation with the GOE. Because of this, these options appear less viable in the short-term than staffing personnel at the water utility.

One reason cited by government entities for non-payment is that the MOF does not approve sufficient budget amounts to enable them to pay utility expenses such as wastewater bills. One option, therefore, is to ensure that the MOF approve enough funds to be included in the budgets of government agencies for wastewater payments. The reduced amount of GOE direct subsidies to the GOSD could be used to fund the full wastewater bills of these government agencies.

Another option would be for the GOSD to control the wastewater budgets of government entities directly. Wastewater funds approved by the MOF for government entities could be held in escrow by the GOSD and used to pay bi-monthly wastewater bills.

Another reason cited by government agencies for late or non-payment is that the governorates in which they work refute utility rate increases. The right of governorates to contest rate increases allows government offices and public companies to delay payment for several billing periods. This situation would be eliminated by an autonomous GOSD that could enforce bill collections. Another option would be for the GOSD to require the GOE to remove the right of governorates to protest national tariff charges and force government entities to pay amounts owed.

F. Feasibility of Metering Industrial Customers

Widespread and well operating meters are beneficial to the design of equitable water and wastewater user fees. Without accurate flow measurements, any potential benefits of an industrial monitoring program and industrial high strength surcharges will not be attained.

In Cairo, water meters are neither widely installed nor operative. Estimates of water meter coverage for Cairo's domestic (residential) class is as low as 25 percent of total domestic connections. The water utility claims that approximately 75 to 80 percent of the installed meters are not working due to mechanical failure. Effectively, only one in five customers is metered.

Because of inoperative and uninstalled meters, the water utility must estimate water consumption for most water customers using one, or a combination of, the following measures:

- ☐ Average historical use
- ☐ Size of connection pipe
- ☐ Size and number of flats
- ☐ Amount billed in the previous period
- ☐ Estimates by the meter reader.

According to an analysis completed six years ago, water customers are overbilled, on average, up to 20 to 30 percent more than what they actually consume as a result of the water utility's methods of estimation.[7] By this measure, both the water utility and the GOSD clearly need a more effective system for measuring customer wastewater consumption.

According to the World Bank, up to 80 percent of water consumption can be attributed to no more than 20 percent of total connections.[8] Because industrial customers consume the largest quantity of water per account, it would be most appropriate to concentrate on metering these customers first.

Neither the water utility nor GOSD were able to provide information requested on:

- ☐ Total number of private and public sector industrial customers requiring new meters
- ☐ Total number of different meter sizes required by unmetered industrial customers
- ☐ Costs for each meter size
- ☐ Water or wastewater demand by industrial customers
- ☐ Tangible benefits of metering.

Without this information the feasibility of metering industrial customers could not be determined. Determining the feasibility of metering industrial customers also depends on improving and establishing the following baseline programs:

- ☐ Determine the number and size of meters required by all industrial customers in Cairo
- ☐ Develop agreements with the water utility for joint responsibility of implementing, administering, and operating an effective industrial metering program
- ☐ Determine funding requirements and identify and pursue funding sources for metering industrial customers
- ☐ Develop an effective training program on meter installation, repair, maintenance, and reading to support the metering of industrial customers

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7 Source: James Montgomery and Associates, *Pilot Metering Program*, 1987.

8 Source: The World Bank, *Arab Republic of Egypt, Water and Wastewater Sector Study*, page 49, April 27, 1992.

- Identify alternative suppliers of water meters.[9]

Metering large industrial customers will not be feasible until all of these baseline programs are established.

After these programs are established, the GOSD and the water utility should prioritize the sequence of meter installation. To support the industrial monitoring program and implementation of industrial surcharges, the industries in Cairo's heaviest industrial areas, Embaba, Kalioubia, and North and South Helwan, should be metered first. Helwan industries should not be metered until they have been connected to the wastewater system. The GOSD should also prioritize the metering of large volume customers within these four industrial areas, such as the glue factories, bus depots, breweries, and food processing companies that were highlighted in Taylor & Binnie Partners' 1992 report: *METAP Cairo Industrial Effluent Control Study*.

9 The GOE prohibits the water utility from importing water meters. At present, the water utility relies on a government-owned manufacturer to supply its water meters. The supplier does not provide well functioning meters in the quantities needed to meter unmetered customers. The GOE should consider lifting water meter import restrictions if the local supplier cannot expand production or deliver meters of the quality needed by the water utility and the GOSD.

G. Miscellaneous Other Charges

There are several other charges that the GOSD believes it can initiate in the short- and long-term to increase revenues. These revenues, however, will not have substantial impact on the five year financial plan. These potential charges can be classified as either operational or non-operational GOSD services.

1. Operational Revenues from Specific Services

Specific GOSD services provide a direct benefit to a particular customer or customer class. Therefore, the costs which result from specific services should be recovered from the direct beneficiary of the service rather than from general wastewater customers.

Though none of the specific services are offered by the GOSD, the GOSD is discussing the potential of initiating a fee-for-service for the following:

- ❒ Welding services
- ❒ Forgery work
- ❒ Training and consulting
- ❒ Lab services
- ❒ Sanitation services
- ❒ Pumping services
- ❒ Maintaining industrial pretreatment facilities.

The GOSD should also consider assessing penalties for non-payment.

In determining whether a specific service charge should be established, the following key issues should be addressed:

- ❒ Does the specific service occur with sufficient frequency to warrant a special charge being developed?
- ❒ Is a good work-order system in place to provide reasonable estimates of costs to establish the charge?
- ❒ Are revenues sufficient to justify the costs associated with providing these services?

Due to the preliminary nature of the GOSD's plans, the lack of cost accounting data, and the unproven track record of the GOSD in providing each of the proposed services, estimation of revenues would be unreliable. Furthermore, the potential revenues that might be derived from these sources are not significant enough to impact wastewater charges. Therefore, revenues are assumed to be zero from these services.

It should be noted that providing services to the private sector means establishing sideline businesses unrelated to the primary mission of the GOSD. Doing so would divert management's attention away from operating the utility. Also, staffing levels should not be so high as to afford the free time for personnel to provide these outside services during their normal shifts. The entire concept of fee-for-service is questionable at this time, given other significant issues which must be addressed to attain financial autonomy.

A brief discussion of other problems with establishing a fee-for-service program is provided below.

- ❒ **Welding Services**. Although the skills of GOSD welders are widely respected, it is unlikely that the GOSD can generate revenues from welding because the GOSD must match competitive prices offered by their own employees. GOSD welders currently offer their services after normal work hours at below market rates. Unless the GOSD restricts its employees from providing these services, or the GOSD adjusts its fees down to market prices, the GOSD will find it difficult to sell welding services to the private sector.
- ❒ **Forgery Work.** The GOSD lacks the lathe and smelting equipment required to establish the economies of scale

typical of mass produced parts. In the past, the GOSD was successful in forging discontinued pump casings and other spare parts. However, these products were designed for internal use by the GOSD. The GOSD would need to develop an expertise of private sector forgery needs before it could offer such services to Cairo's enterprises. The GOSD also needs to identify funding sources to invest in new lathes and related equipment. For these reasons, it is improbable that the GOSD will generate substantial revenues from forgery work during the five year rate study.

- **Training and Consulting.** A small number of qualified GOSD engineers, are believed to currently offer freelance consulting services to the private sector. Total billings and the scope of their consultations is believed to be small. The GOSD would like its engineers to assist in design and supervision of construction of other wastewater treatment plants in Egypt and charge for their services accordingly. The GOSD also wants to charge for providing training services in areas such as management, treatment, O&M, and sewer cleaning to other wastewater agencies elsewhere in Egypt, the Middle East, and Africa.

  Given the current unmet training needs of GOSD's own personnel, and the presence of foreign donors which currently provide funds for training services in these regions, it is unlikely that the GOSD will be able to provide these services and generate substantial revenues in the short-term. Although the GOSD may be able to provide these services in the long-term, the GOSD should not have excess capacity and additional employees focused solely on outside projects.

- **Lab Services.**[10] At present there are nine GOSD laboratory facilities. Three labs are located at treatment plants and are unable to serve the additional demands of the private sector due to size limitations and their distant location to Cairo's industries. Three other labs also are located at treatment plants but are currently under construction and are designed specifically to serve the needs of their respective treatment plants.

  The GOSD also operates two central laboratories; one at the Dayoura pump station and another in Heliopolis. The lab facilities at Dayoura are old and currently unsuitable for use by the private sector. The lab facilities at Heliopolis are under major refurbishment.

  The ninth GOSD lab is located at the Siphon Pump Station but was built as a temporary structure to train GOSD lab staff. The Siphon lab needs to be reconstructed if it is to offer lab services to the private sector. Due to the shortages of adequate equipment and space, it is unlikely that the GOSD will be able to increase revenues from lab services in the short term.

- **Sanitation Services.** The GOSD would like to provide pipe cleaning services and other sanitary services to Cairo's hotels, housing complexes, and large scale industries. The difficulty in projecting reliable revenues from sanitary services lies in assessing the potential demand for GOSD sanitary services from the private sector.

- **Pumping Services.** The GOSD would like to rent the use of its mobile pumps to pump ground water at construction

[10] Much of the analysis of GOSD lab facilities is taken form Taylor Binnie & Partners, *METAP Cairo Industrial Effluent Control Study*, Final Report, pages 58-64, July 1992.

sites when the pumps are not needed elsewhere at GOSD locations. Compared to the other potential revenue sources mentioned above, renting mobile pumps may be easier to implement in the short term. However, the GOSD must first determine how many pumps it has available to rent, as well as determine the private sector's need for mobile pumps.

- **Maintaining Industrial Pretreatment Facilities.** Large industries are required to install and operate pretreatment facilities by Law 93. In practice, Cairo's industries do not properly maintain pretreatment machinery and most pretreatment operations do not work. This would generally indicate that a large market for pretreatment facilities exists in the Greater Cairo area. However, industrial pretreatment facilities are largely inoperative because Law 93 is not enforced by penalties or fines. Unless the law is more strictly enforced, the demand for GOSD pretreatment services is unlikely.
- **Penalties for Non-Payment and New Account Fees.** These fees are not currently assessed to GOSD customers because the GOSD cannot identify non-paying customers or new accounts. Revenues could be generated from these sources if current billing and collection procedures are substantially modified as proposed in this report. In the short-term, the GOSD should focus on modifying billing and collection processes to collect amounts owed, then focus on implementing additional penalties.

2. Revenues From Non-Operating Sources

The GOSD also could generate revenues from selling assets, such as abandoned pump stations, vehicles, machinery, and spare parts. However, given the poor maintenance history of these assets, their only value may be in the scrap value of the material. A buyer will want an offset from the GOSD for the cost of transporting the scrap, so the net scrap value could be insignificant.

Sales of abandoned pump stations, machinery, vehicles, and inventory are constrained by the uncertainty of who owns the title to these assets. Ownership title to GOSD facilities is contested by the GOE, governorates, and the GOSD. According to GOSD ISC project team members, title of ownership is controlled by the governorates. The GOSD was not able to provide valuation information for any of the decommissioned pump stations, equipment or machinery eligible for sale. Because of this and ambiguous ownership potential revenues from the sales of these assets could not be determined.

H. Public Relations

The willingness of rate payers to accept higher wastewater charges will depend on their perception of the level and quality of wastewater services provided by the GOSD. Customers also need to be educated as to the health and environmental benefits of increased (and more costly) wastewater services. These objectives could be attained through an effective public awareness program which would help inform wastewater consumers of the need to charge a fair rate for maintaining and expanding wastewater services as the GOE and foreign donor subsidies are reduced.

Communicating the new charges will be a responsibility that GOSD must address as soon as feasible. An important point which must be stressed is that there are tremendous benefits gained from the rehabilitation, upgrade, and expansion of the existing wastewater collection and treatment system. Also, customers must be made aware that the charges they now pay cover only a fraction of the costs of the system, that government funds for the system will be reduced in the future, and that customers should be expected to pay a greater share of the costs of the system.

Communicating the new charges should be tailored to specific classes of customers. In the case of domestic customers, the proposed charges fall well within the economic means of all households. Lower income households are being provided a charge well below the true costs of providing the service. Higher income households should accept the higher charges, which are still very small in comparison with their income levels.

In the case of government customers, it should be clearly communicated that non-payment of wastewater bills will no longer be acceptable. Currently 70 percent of government customers do not pay their bills; the resulting shortfall in collections must be made up by those customers who do pay their bills (including domestic customers). The GOSD should work with the GOE and individual government customers to demonstrate the substantial benefits provided by the GOSD and the relatively low prices charged for the service.

The easiest way to inform wastewater customers would be through an insert to the bi-monthly water/wastewater bills. Written materials should be developed that explain the following:

- ☐ Need for wastewater services
- ☐ Gradual reduction in funding from the GOE
- ☐ Resulting increase in level of wastewater services and treatment to be provided by the GOSD during the transition to a financially autonomous utility
- ☐ Financial performance indicators showing the GOSD would be an efficient utility once autonomous
- ☐ New wastewater charges to be implemented during the next fiscal year
- ☐ Examples of domestic wastewater bills at different levels of usage
- ☐ Methods for reducing the customer's bi-monthly bill.

In addition to the water bill insert, a separate newsletter could be sent to all customers. The newsletter could provide more detail than the insert and contain the increased benefits of the rehabilitated and new system and future plans to improve service.

Other activities the GOSD could consider as part of a public awareness program include:

- ☐ Discussions on radio talk shows
- ☐ Public forums
- ☐ Billboards promoting the GOSD.

These activities might not be as successful in reaching wastewater customers as the water bill insert and newsletter.

SECTION VIII

FIVE YEAR FINANCIAL PLAN

ERNST & YOUNG

Section VIII. Five Year Financial Plan

Previous sections of this report have presented analyses regarding the GOSD's costs and revenues, estimated water and wastewater demand, recommended wastewater charges, and projected wastewater revenues to be generated from these charges during the five year rate period. The results of these analyses, along with the GOSD's Capital Improvement Plan (CIP), are the basis for GOSD's projected five year financial results.

Also, many assumptions are made in order to develop wastewater charges and projected five year financial results. This section presents the results of testing the sensitivity of wastewater charges and level of GOE funding to changes in several key assumptions: (1) autonomy dates, (2) electricity prices, (3) collection rates, and (4) GOSD's direct facility costs and maintenance capital costs.

Acceptance by Cairo residents and businesses of new, higher charges depends on the confidence customers have in the ability of the GOSD to run an efficient utility capable of providing good service at a reasonable cost. To become efficient, the GOSD must greatly improve or implement management, personnel, information, and financial processes which are necessary for the operation of a self supporting utility.

We found serious deficiencies in GOSD's ability to plan for, and implement, wastewater user charges and to operate as a financially autonomous utility. This section presents a number of specific recommendations to improve the GOSD's chances of becoming financially autonomous.

The remainder of this section is organized as follows:

- *Capital Improvement Plan*
- *Degree of Financial Autonomy Attained with Recommended Wastewater Charges*
- *Alternative Cost, Revenue, and Rate Scenarios*
- *Recommendations for Becoming a Financially Autonomous Utility.*

A. Capital Improvement Plan

Capital investments are necessary for the GOSD to provide quality wastewater services to existing customers and to provide wastewater facilities for the growth and economic development of Greater Cairo. Currently, two organizations are responsible for planning wastewater capital projects: the CWO is responsible for planning, design, and construction of major foreign funded wastewater facilities; and the GOSD is responsible for planning for all other wastewater projects and equipment purchases.

Neither organization prepares a comprehensive Facility Master Plan nor a Capital Improvement Plan (CIP). Typically, these documents would describe, in some detail, maintenance and new capital projects, and would include project locations, maps, and major capital outlay requirements for each year of the plan. These documents also would include demand projections, operating and regulatory issues, and other information required to substantiate the need for these projects.

Both the GOSD and CWO prepare five year capital outlay requirement schedules that describe each project, estimate capital outlay requirements for each project, project cumulative capital outlay requirements for a five year period and for the current fiscal year, and estimate the cumulative project funding by source for the five year period. No projections are made of annual capital outlay requirements for each year of the five year schedule. These schedules are prepared independently by the CWO and GOSD and are not combined into a single planning document. The most recent five year schedules are for fiscal years 1992/93 through 1996/97.

A comprehensive Capital Improvement Plan for the Greater Cairo wastewater system does not exist, though a CIP is a critical element of a wastewater utility's financial forecast. Because of the magnitude of expenditures involved with capital projects, any significant changes to the CIP (whether in amount or timing) can have a significant impact on the level and scheduling of rate increases.

A Capital Improvement Plan is required to compute wastewater charges. **Exhibit VIII-1**, on the next page, presents a CIP that is prepared from the capital outlay requirement schedules provided by the CWO and GOSD. The Capital Improvement Plan consists of three sections:

- Capital outlay requirements for new capital projects
- Capital sources for new capital projects
- Capital costs.

Capital outlay requirements are the cumulative amount of expenditures required to plan, design, and construct new capital projects in the Greater Cairo wastewater system. The amounts are shown in the year funds are first needed to finance construction. Capital sources are the projected funding sources for these new capital projects, including proceeds from grants and loans. Capital costs are the annualized costs recovered through wastewater charges, and include:

- Expenditures for maintenance capital projects
- Financing costs (principal and interest payments) for new capital projects
- Financing costs (principal and interest payments) on loans for existing capital projects
- Debt service reserve fund contributions for new and existing capital projects.

System–Wide Capital Improvement Plan

(LE 000s)

	Fiscal Year				
	1994/95	1995/96	1996/97	1997/98	1998/99
Capital Outlay Requirements					
Land	3,206	3,206	3,206	3,206	3,206
Construction	355,209	355,209	355,209	355,209	355,209
Equipment	88,422	88,422	88,422	88,422	88,422
Transportation	2,051	2,051	2,051	2,051	2,051
Other	2,624	2,624	2,624	2,624	2,624
Total Capital Outlay Requirements for New Capital Projects	451,512	451,512	451,512	451,512	451,512
Capital Sources					
Government Loans	93,102	93,102	93,102	93,102	93,102
Short–Term Loans	0	0	0	0	0
Foreign Government Grants	171,262	171,262	171,262	171,262	171,262
Government of Egypt Grants	187,148	187,148	187,148	187,148	187,148
System Development Charges	0	0	0	0	0
Interest Income	0	0	0	0	0
Sales of Assets	0	0	0	0	0
Other Revenues	0	0	0	0	0
Total Capital Sources for New Capital Projects	451,512	451,512	451,512	451,512	451,512
Capital Costs					
Maintenance Capital Projects	114,325	123,355	132,386	141,416	150,446
New Capital Projects	6,851	13,702	20,553	27,404	34,255
Existing Capital Projects	1,230	1,230	1,230	1,230	1,230
Debt Service Reserve Fund Contribution	8,081	6,851	6,851	6,851	6,851
Total Capital Costs	130,487	145,138	161,020	176,901	192,782

EXHIBIT VIII-1

1. Capital Outlay Requirements for New Capital Projects

New capital outlay requirements are for construction of new collection and treatment facilities. Construction outlays are approximately 79 percent of total projected new capital outlay requirements each year.

The largest construction projects are planned for the West Bank. Additional sewers are to be constructed in the Pyramids and Embaba areas, and branch tunnels are to be constructed in the Boulac area. Major East Bank projects include the new Gabel el Asfar wastewater treatment plant and branch tunnels in the central Cairo area.

Equipment purchases account for most of the remaining new capital projects. This includes equipment for the Gabal el Asfar and Abu Rawash wastewater treatment plants.

Requirements for new capital projects are assumed constant in each of the five years of this rate study period. Neither the CWO nor GOSD could provide year-by-year estimates of requirements for new capital projects. In reality, capital outlay requirements will vary from year to year, based on the planning, design, and construction of new wastewater projects projected to occur during each fiscal year.

2. Capital Sources for New Capital Projects

All planning, design, and construction of new capital projects must be funded. The CWO and GOSD identified the source of funds for each new capital project, though not the specific year these proceeds are needed. New capital projects are assumed financed from three major sources: government loans, foreign government grants, and GOE grants.

Only 20 percent of new capital projects are assumed financed through government loans to be repaid by the GOSD or GOE. The remaining 80 percent of new capital projects are assumed financed by grants from the GOE and foreign donors.

3. Capital Costs

Annual capital costs consist of: (1) expenditures for maintenance capital projects, (2) principal and interest payments on loans for new capital projects, (3) principal and interest payments on existing loans for existing capital projects, and (4) debt service reserve fund contributions. These capital costs are discussed below.

Maintenance Capital Projects

Maintenance capital project costs account for LE 114 of the LE 130 million fiscal year 1994/95 capital costs shown in the CIP. These projects are required to: (1) maintain the fixed assets of the GOSD in an operating condition, (2) ensure financial resources are available for necessary replacement of equipment, and (3) upgrade the facilities when equipment and buildings need to be replaced. Doing so more accurately reflects the true costs of maintenance, ensures plant and equipment reach their useful service life, and ensures that customers pay their fair share of maintaining the wastewater system.

The CWO does not recognize these critical costs in their capital schedule and the GOSD identifies just two maintenance capital projects in their current capital requirement schedule. The costs of these two maintenance capital projects is approximately LE 3.5 million per year. This amount of maintenance capital project expenditures is substantially less than what is required for a wastewater utility of GOSD's size.

A more appropriate estimate would be based on a detailed, bottom-up development of a preventative maintenance

program, which: (1) describes processes and equipment, (2) estimates useful life of each piece of equipment, (3) determines replacement schedules, and (4) estimates costs. Such a program is being developed by the ISC for the GOSD at this time.

An alternative for planning purposes is to base annual costs on the replacement value of existing plant and equipment. For this study, it is assumed that annual expenditures on maintenance capital projects are two percent of the current value of GOSD facilities.

The estimated value of existing facilities constructed as a result of the Greater Cairo Wastewater Project is assumed equal to LE 4.8 billion in fiscal year 1992/93, based on information provided by AMBRIC and compiled by CH2M Hill/OMI. This value is increased each year based on estimated annual CWO and GOSD expenditures on new capital projects.

New capital project outlays in fiscal years 1993/94 and 1994/95 are projected to be approximately LE 505 million and LE 452 million, respectively. These new capital project costs are added to the estimated value of existing facilities in fiscal year 1992/93 (4.8 billion) to estimate the asset value in fiscal year 1994/95 (LE 5.7 billion). This estimated asset value is multiplied by two percent to determine assumed fiscal year 1994/95 maintenance capital project expenditures (LE 114 million).

New Capital Projects

New capital project costs represent the annual debt service payments (principal and interest) on loans to fund new capital projects. These payments are on government loans assumed in the CIP. These loans are assumed to have an annual interest rate of four percent and a term of 20 years.

Existing Capital Projects

Existing capital project costs are principal and interest payments on existing GOSD loans that currently are paid by the GOE. These loans primarily are below market rate loans from foreign governments.

Debt Service Reserve Fund Contribution

Debt service reserve fund contributions are assumed equal to one year of principal and interest payments on loans for new and existing capital projects. This fund serves to secure the debt service payment to the lenders.

B. Degree of Financial Autonomy Attained with Recommended Wastewater Charges

Exhibit VIII-2, on the following page, presents projected five year financial results of the utility. These projected results incorporate assumptions in this report and assume wastewater charges presented in Section V-*Recommended Wastewater Charges* are imposed by the GOSD.

These financial results reflect the proportion of full costs to be recovered through wastewater charges each year. Operations costs are to be recovered first, followed by salaries, operating reserves, and finally maintenance capital project costs. By fiscal year 1998/99, the GOSD is projected to recover the costs required to operate and maintain the wastewater system.

The financial results also reflect increases in wastewater service charge revenues. These revenues increase from LE 68 million in fiscal year 1994/95 to almost LE 472 million in fiscal year 1998/99, an average increase of 62 percent per year.

The surplus or deficit projected for each fiscal year is not carried forward into the next year. It is assumed that the GOE will cover all deficits and will retain all surplus revenues during the five year rate period.

If the GOSD becomes financially autonomous, annual surpluses and deficits would be carried forward from year to year. This would assist the GOSD in smoothing wastewater charge increases in that surpluses in one year could be used to off-set future year deficits.

Prior to becoming financially autonomous, substantial funding is required from the GOE and donor nations for salaries, O&M, and capital projects. **Table VIII-1**, below, indicates the effective annual amount required from the GOE and donor nations each fiscal year.

Costs recovered by the GOSD are equal to the projected revenues generated from the recommended wastewater charges and all projected non-service charge revenues of the GOSD. Costs funded by the GOE and donor nations vary each year, depending on the proportion of annual salaries, operating costs, and capital costs recovered through wastewater charges. At a minimum, the GOE and donor nations fund all new capital costs, existing capital costs, and debt service reserve fund contributions.

Table VIII-1
Projected GOSD Costs and Funding
(LE 000s)

	Fiscal Year				
	1994/95	**1995/96**	**1996/97**	**1997/98**	**1998/99**
Costs Recovered by GOSD	79,897	123,453	193,060	313,721	491,241
Costs Funded by GOE and Donor Nations	220,528	227,983	257,263	171,229	42,336
Full Utility Costs (a)	300,425	351,436	450,323	484,950	533,577

(a) Section IV-*Revenue Requirements*, Exhibit IV-2, System-Wide Full Utility Costs by Line Item.

General Organization for Sanitary Drainage
Projected Five Year Financial Results
(LE 000s)

	Fiscal Year				
	1994/95	1995/96	1996/97	1997/98	1998/99
Expenditures (a)					
Salary Costs	0	0	0	71,686	76,703
Operations and Maintenance Costs					
Electricity	51,711	83,187	130,786	157,629	177,083
Fuels, Lubricants, and Chemicals	11,054	19,064	32,088	38,369	42,218
Spare Parts and Other Consumables	15,343	18,988	27,667	33,079	36,387
Other Operating Expenses	1,789	2,214	2,519	3,010	3,312
Total Operations and Maintenance Costs	79,897	123,453	193,060	232,087	259,000
Capital Costs					
Maintenance Capital Projects	0	0	0	5,657	150,446
New Capital Projects	0	0	0	0	0
Existing Capital Projects	0	0	0	0	0
Reserve Fund Contributions	0	0	0	4,276	5,092
Total Capital Costs	0	0	0	9,933	155,538
Total Expenditures	79,897	123,453	193,060	313,706	491,241
Revenues (b)					
Service Charges	68,035	111,420	180,583	295,129	472,370
Connection Fees	7,141	7,370	7,606	7,849	8,100
Administrative Fees	1,104	1,129	1,156	1,705	1,733
Industrial High Strength Surcharge	0	0	0	5,213	5,213
Other Revenues	3,895	3,922	3,951	3,983	4,018
Total Revenues	80,175	123,841	193,296	313,879	491,434
Net Surplus/Deficit	278	388	236	173	193

(a) Section IV–Revenue Requirements, Exhibit IV–3, System–Wide Adjusted Costs by Line Item.
(b) Service Charge Revenues: Section V–Recommended Wastewater Rates, Exhibit V–8, Wastewater Service Charge Revenues.
Non–Service Charge Revenues: Section IV–Revenue Requirements, Exhibit IV–4, System–Wide Non–Service Charge Revenues.

The proportion of full utility costs assumed recovered by the GOSD is projected to increase from 27 percent in fiscal year 1994/95 to 92 percent by fiscal year 1998/99. The level of true autonomy attained by the GOSD in fiscal year 1998/99 is still less than full utility costs.

To reach true autonomy, the GOSD would need to fund new capital projects. The GOSD could not realistically fund any new capital projects through the wastewater charges prior to fiscal year 1999/2000.

If the GOSD began funding a portion of new capital projects beginning in fiscal year 1999/2000, wastewater charges would have to increase an average of approximately 20 percent per year to reach true financial autonomy by fiscal year 2005/06.[1] These increases would be in addition to increases of approximately 40 to 50 percent per year for the five years of the rate study. This would be a tremendous burden on rate payers; it is doubtful customers would have the ability or willingness to pay the required wastewater charges in fiscal year 2005/06.

[1] Assuming capital outlay requirements remained constant at the projected fiscal year 1998/99 amounts.

C. Alternative Cost, Revenue, and Rate Scenarios

The baseline case developed in this report assumes all salaries, operating costs, and maintenance capital project costs are recovered through wastewater charges by fiscal year 1998/99. If changes are made to baseline assumptions of this study, then wastewater charges will change. This subsection examines the impact on wastewater charges from changes in a few key assumptions.

In assessing the sensitivity of wastewater charges under each scenario, the relationship between wastewater charges for each customer class is maintained (i.e., government and tourism and investment charges are similar, the charge per cubic meter for the higher domestic consumption block is approximately 50 percent above the lower domestic consumption block charge, etc.). Also, only the assumption being tested is modified and all other assumptions are held constant. This provides for an isolated evaluation of the sensitivity of wastewater charges to changes in each assumption.

1. Year of Financial Autonomy

Several alternatives have been suggested for when the GOSD first becomes financially autonomous. Prior versions of the Presidential Decree indicated financial autonomy should be attained by fiscal year 1997/98. Previous general estimates developed by AMBRIC indicate the GOSD could recover salaries, O&M costs, and repair and replacement costs by 1 July 1995. **Table VIII-2** provides a comparison of the annual compound rates of increase in domestic and government wastewater charges that are required for the GOSD to become financially autonomous by each fiscal year.

Annual compound increases in wastewater charges indicate the degree to which charges must increase each year. A large compound increase denotes a greater impact (i.e., rate shock) on customers. The required wastewater charges and the absolute percentage increases in wastewater charges are not indicative of the impact on customers of reaching autonomy at a sooner date and are misleading. Generally, the total costs to be recovered in a year are the same; the difference is how fast financial autonomy is reached. The sooner financial autonomy is reached, the more quickly wastewater charges must be increased.

Table VIII-2
Annual Compound Increases in Wastewater Charges Required to Reach Financial Autonomy
(From Fiscal Year 1992/93 to Assumed Autonomy Year)

	Financial Autonomy Year		
Customer Class	FY 98/99	FY 97/98	FY 95/96
1. Domestic			
0-60 cubic meters	42%	52%	96%
>60 cubic meters	46%	56%	106%
2. Government	48%	60%	110%

Financial Autonomy in Fiscal Year 1997/98

In order for the GOSD to be financially autonomous by fiscal year 1997/98, wastewater charges would have to increase over 50 percent per year for both domestic and government customers. This equals an eight fold increase in just five years for the lower domestic consumption block. The GOSD cannot reasonably expect wastewater customers to accept annual increases in wastewater charges of over 50 percent.

The required wastewater charge for the higher domestic block in fiscal year 1997/98 results in a bi-monthly wastewater bill of approximately LE 14.13 per household (in fiscal year 1992/93 Egyptian pounds). Approximately 50 percent of all Egyptian households have the ability to pay this wastewater bill.

Finally, the present value of cumulative GOE funding during the five year rate period (in fiscal year 1992/93 Egyptian pounds) is only eight percent lower if salaries, operating costs, and maintenance capital costs are recovered through wastewater charges by fiscal year 1997/98 rather than by fiscal year 1998/99. This is a minimal impact on the level of funding required by the GOE, considering the significant increases in charges required. Based on this analysis, attempting to recover salaries, operating costs, and maintenance capital project costs by fiscal year 1997/98 is not recommended.

Financial Autonomy in Fiscal Year 1995/96

Wastewater charges required for the GOSD to be financially autonomous by fiscal year 1995/96 would require a doubling of charges annually beginning in fiscal year 1993/94. Because charges are not going to double in fiscal year 1993/94, charges would need to more than double in fiscal years 1994/95 and 1995/96 for the GOSD to be financially autonomous by fiscal year 1995/96. The rate shock to wastewater customers would be intolerable, and financial autonomy by fiscal year 1995/96 is unrealistic.

The average household bi-monthly wastewater bill for the higher domestic consumption block in fiscal year 1995/96 would be LE 15.24 (in fiscal year 1992/93 Egyptian pounds). Neither lower income households nor 75 percent of middle income households could afford to pay this bill.

2. Sensitivity of Recommended Wastewater Charges to Changes in Electricity Prices

Two alternative scenarios for the price of electricity are examined. Under one scenario, the price of electricity is held constant at the current subsidized price of 18 piastres per kilowatt hour (kwhr). The second scenario assumes electricity prices are 20 percent lower than the baseline case. **Table VIII-3** compares fiscal year 1998/99 recommended wastewater charges with wastewater charges determined under each scenario.

Table VIII-3
Fiscal Year 1998/99 Wastewater Charges Assuming Different Electricity Prices
(Piastres per Cubic Meter)

	Scenario		
Customer Class	Baseline	One-18 PT/ kwhr	Two-20% Decrease
1. Domestic			
0-60 cu. meters	16.50	12.00	15.00
>60 cu. meters	24.70	18.85	22.75
2. Government	107.00	81.00	99.00

Subsidized Electricity Prices (Scenario 1)

The unsubsidized price of electricity is assumed to be 29 piastres per kwhr in fiscal year 1992/93.[2] This price is assumed to increase each year of the rate study at 10 percent. Data provided by the GOSD indicate that the GOSD was charged approximately 18 piastres per kwhr in fiscal year 1992/93, receiving a subsidy of 11 piastres per kwhr. If the GOSD paid only 18 piastres per kwhr for the five years of this rate study, wastewater charges would be approximately 25 percent lower than the

2 As discussed in Section II - *Methodology Used to Determine Wastewater Rates.*

recommended wastewater charges in fiscal year 1998/99.

However, an additional LE 252 million (in fiscal year 1992/93 Egyptian pounds) would need to be provided to the GOSD by either the GOE or Egyptian Electricity Authority during the five year rate period. Continued subsidies of electricity prices would result in lower wastewater charges, though at a cost to the GOE.

Changes in Electricity Prices (Scenario 2)

The sensitivity of wastewater charges to changes in electricity prices also is measured. Specifically, the effect on wastewater charges is determined from reducing the projected electricity prices by 20 percent each year.

Projected wastewater charges would be approximately eight percent lower if electricity prices are 20 percent lower than the baseline case. This indicates that wastewater charges are highly sensitive to changes in electricity prices, increasing or decreasing almost 50 percent of the percentage change in electricity prices.

3. Sensitivity of Recommended Wastewater Charges to Changes in Costs

Two final sensitivity analyses examine the impacts of changes in direct facility costs and maintenance capital project costs on the recommended fiscal year 1998/99 wastewater charges. These two cost items account for most of the estimated operations and maintenance costs of the utility. Estimates for both have been made during the last 12 months by engineering firms working on Cairo Sewerage II. Each new revised estimate of these costs is based on better data and different assumptions. Each update in costs has been substantially different than prior estimates. As a result, the costs expected to be recovered through wastewater charges has changed significantly.

Two alternatives are examined to determine the net impact on required wastewater charges. First, direct facility costs are increased by 10 percent over the baseline estimates. Second, maintenance capital costs are estimated as 1.5 percent of the current value of GOSD facilities (two percent is assumed for the baseline case). **Table VIII-4** compares the fiscal year 1998/99 recommended wastewater charges with wastewater charges that would be required under each alternative cost estimate.

Table VIII-4
Fiscal Year 1998/99 Wastewater Charges Assuming Different Costs
(Piastres per Cubic Meter)

	Scenario		
Customer Class	Baseline	One-Direct Facility Costs	Two-Maint. Capital Costs
1. Domestic			
0-60 cu. meters	16.50	17.50	15.00
>60 cu. meters	24.70	26.00	22.75
2. Government	107.00	113.00	98.00

Direct Facility Costs (Scenario 1)

Direct facility costs include all wastewater treatment plant and major pump station salaries and operating costs. These costs are estimated by AMBRIC in the update to their October, 1992 report: *Wastewater Service Charge Study for the Greater Cairo Wastewater Project*. Also, estimates of staffing costs are developed by CH2M Hill/OMI based on data provided by the GOSD.[3]

[3] As discussed in Section II-*Methodology Used to Determine Wastewater Rates*.

Increasing direct facility costs by ten percent would result in an increase of five to six percent in recommended fiscal year 1998/99 wastewater charges. Direct facility costs have a significant impact on estimated wastewater charges. To the extent these costs are higher than projected, wastewater charges would increase over half of the percentage increase in direct facility costs.

Maintenance Capital Project Costs (Scenario 2)

Projected maintenance capital projects are assumed equal to two percent of the existing value of capital for the baseline case in this report. Other estimates of maintenance capital project expenditures, provided by engineering firms working on Cairo Sewerage II, have ranged from 1.0 percent to 2.5 percent of the replacement value of existing capital.

An alternative is to determine wastewater charges assuming maintenance capital projects are equal to 1.5 percent of asset value. Lowering the percentage by one-half of a percentage point results in an eight to nine percent decrease in wastewater charges. This is significant given the potential margin for error in estimating the maintenance capital project costs. A top priority of the GOSD should be to develop a comprehensive and reliable five year plan of maintenance capital project needs, and estimate the costs to implement this plan.

D. Recommendations for Becoming a Financially Autonomous Utility

Over the past ten years, an estimated LE 4.8 billion has been authorized to improve the collection and treatment of wastewater in Greater Cairo. However, very few substantive changes have been made in the management and operation of the sewer utility. All major responsibilities of one of the largest sewer utilities in the world are still micro-managed by both local and central government authorities.

Acceptance by Cairo residents and businesses of new, higher wastewater charges depends on the confidence customers have in the ability of the GOSD to run an efficient utility capable of providing good service at a reasonable cost. To become efficient, the GOSD must greatly improve or implement management, personnel, information, and financial processes which are necessary for the operation of a self supporting utility.

Becoming financially autonomous requires the utility to also become institutionally autonomous. The ISC contractor is providing technical assistance to the GOSD to implement improvements in a number of areas to strengthen the organization and technical capabilities of the utility.

Under the current organization and regulations, there is insufficient capability to plan for and implement wastewater user charges, and to control the revenues raised through these user charges. Most significant was the lack of an effective long-range capital and financing plan. Without this plan, it is difficult to determine required wastewater charges and to justify these charges on sound cost accounting and financial reporting principles.

This subsection provides a summary of specific recommendations to improve the GOSD's chances of becoming financially autonomous. **Exhibit VIII-3**, on the next page, lists these recommendations. The contract and scope of work for preparing this rate study did not include developing these recommendations.

We identified several significant barriers to the GOSD becoming financially autonomous that are not being directly addressed or implemented by the GOSD. Without addressing these issues, implementation of the recommended wastewater charges in this report would not necessarily result in financial autonomy for the GOSD by fiscal year 1998/99. The recommendations which follow are to ensure that the GOSD is aware of the significant challenges ahead in becoming truly autonomous.

1. Capital and Financial Planning

A major challenge to the GOSD is to develop an effective long-range capital and financing plan. This long-range plan would identify the types of facilities that are required over a long-range planning horizon for:

- Expansion of wastewater service
- Improvement of wastewater treatment quality
- Replacement of deteriorated wastewater infrastructure.

Financial requirements related to the capital plan would be identified each year and appropriate sources to finance these capital items developed. These costs would be annualized in order to evaluate the economic impacts of the capital plan on wastewater customers.

The capital and financial planning process would consist of several steps that ensure all relevant factors are considered and that the capital plan is consistent with the planning objectives of the GOSD and its customers. **Figure VIII-1**, on the top of page VIII-17, presents a recommended capital and financial planning process for the GOSD.

Summary of Recommendations

Capital and Financial Planning

- ☐ Prepare Forecasts of Customer Demand and Economic Conditions Affecting Capital and Financial Planning
- ☐ Prepare a Facility Master Plan
- ☐ Prepare a Capital Improvement Plan (CIP)

Accounting and Budgeting

- ☐ Improve Accounting Processes
- ☐ Develop Financial Reporting System
- ☐ Develop an Improved Budgeting Process

Organization and Personnel

- ☐ Approve Proposed Presidential Decree
- ☐ Consolidate Capital Planning Functions now Performed by Other Agencies
- ☐ Establish the Utility as an Enterprise Fund
- ☐ Establish a Financial and Economic Analysis Unit
- ☐ Recruit Personnel for Economic and Rate Analysis Function
- ☐ Establish Performance Goals
- ☐ Improve Collection Rates

Rate Structure

- ☐ Add Third Domestic Consumption Block
- ☐ Implement Full Cost-of-Service Wastewater Charges

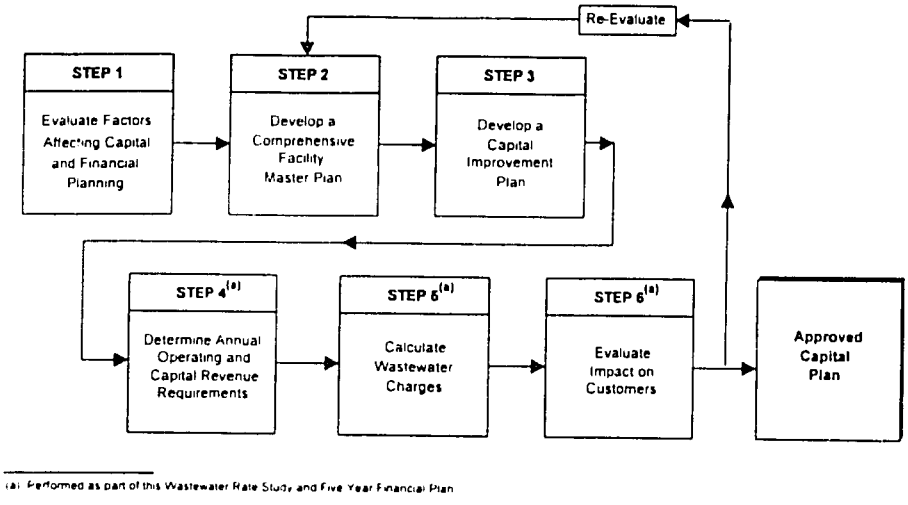
Demand Management

- ☐ Improve Metering and Billing Practices
- ☐ Measure Wastewater Flows and Strengths
- ☐ Establish Industrial Monitoring Program
- ☐ Monitor Average Wastewater Flows and Strengths at GOSD Treatment Plants

Information Management

- ☐ Identify Information Needs
- ☐ Integrate GOSD Business Processes with Automation

Figure VIII-1
Capital and Financial Planning Process



(a) Performed as part of this Wastewater Rate Study and Five Year Financial Plan

The last three steps were performed as part of this rate study and five year financial plan. The first three steps are not sufficiently performed by the GOSD.

As an autonomous utility, the GOSD would not be able to obtain capital financing from private sector sources without a more comprehensive capital and financial planning process. Without such planning, it also would be difficult to determine the required wastewater charges and to justify wastewater charges to customers.

Three recommendations that would assist the GOSD in developing a more complete capital and financial planning process are provided in this subsection. These recommendations relate to the first three steps of the recommended capital and planning process in Figure VIII-1.

Prepare Forecasts of Customer Demand and Economic Conditions Affecting Capital and Financial Planning

On a periodic basis, perhaps every two years, the GOSD should identify and consider relevant factors that affect capital and financial planning. These factors include: (1) customer demand for wastewater services, including the economic conditions in Cairo that impact future customer demand, (2) customer demand for improved wastewater services (e.g., higher level of wastewater treatment), (3) the condition of GOSD plant and equipment, and (4) the level of assistance to be provided by the GOE and foreign donors. Each of these factors potentially impacts the types and sizes of wastewater facilities to be constructed, the manner in which facilities are financed, and the way in which costs are recovered from utility customers.

The GOSD also should identify facilities to be included in the capital plan, steps the GOSD should take to protect its capital investment and maintain full service, and specific needs to replace deteriorating facilities. Included would be projections of a reduced role for the GOE and donor nations in funding operating and capital costs.

Prepare a Facility Master Plan

The GOSD should prepare a comprehensive Facility Master Plan to identify capital facilities for rehabilitation, replacement, upgrade, and expansion of the sewer system. Because many facilities are designed to meet long-term demand, the planning horizon should be longer than five years, spanning 20 to 30 years. Long-range planning allows some economies of scale from larger wastewater facilities designed to meet the higher wastewater demand over a longer time frame, rather than constructing facilities just to meet current and short-term wastewater demand.

The plan should be a comprehensive document and describe all major operational and regulatory issues affecting the plan. Included in the plan would be an evaluation of alternative technological solutions: the most appropriate and cost-effective solution that meets the needs of the customers in the community should be chosen.

The GOSD also should relate the plan to wastewater demand estimates and consider financial and operational impacts of adopting the plan. The Facility Master Plan is a primary document needed to secure external financing for the facilities.

Prepare a Capital Improvement Plan (CIP)

The GOSD should prepare a five year Capital Improvement Plan for the first increment of maintenance and new capital projects in the Facility Master Plan. This CIP should be for five years and include the following:

- *Maintenance capital projects* required to replace equipment when necessary, and to upgrade facilities to improve efficiencies. These projects are critical to the integrity of the wastewater system, though not now formally recognized by the CWO or GOSD. A first priority of the GOSD should be to recognize these projects as required operations and maintenance investments and prepare reliable estimates of costs for these projects.
- *New capital projects* identified to expand the capacity of the system and extend coverage to new customers
- *Minor capital outlays* not identified in the Facility Master Plan. These would include costs of sewer extensions and minor capital outlays.

In addition to showing when capital is needed for replacement or new facilities, the CIP should demonstrate the type and amount of financing to be used to fund the plan. The combination of short- and long-term borrowings, government grants, plus "pay as you go" funding should be identified.

The impact of the CIP on wastewater charges should be evaluated before adopting the CIP. The GOSD must be able to recover the costs through wastewater charges or it cannot afford the CIP. If funding in any one year is projected to be less than required capital outlays for the year, facilities would be postponed until financing can be arranged.

2. Accounting and Budgeting

Identifying costs that must be recovered in order to maintain the financial self-sufficiency of the GOSD is

an important step in establishing wastewater charges. The GOSD's current inability to determine true historical operations and maintenance costs at the level sufficient to determine wastewater charges is a significant problem that must be addressed before financial autonomy can be attained.

The current GOSD budgeting process makes it extremely difficult to manage the financial performance of the utility. Estimates of expenditures for the next fiscal year are provided to the GOSD several months prior to the start of the fiscal year. These estimates are not based on historical costs or more recent information, but generally are developed by repeating the prior year's budget. Without historical costs or the most recent data, the resulting GOSD budget is essentially useless as a planning document.

The budget represents estimated expenditures for the GOSD in total, and does not relate to specific GOSD processes, organizational units, or facilities. Without cost data for specific processes, organizational units, or facilities, the GOSD cannot effectively monitor the performance of the utility.

The wide variation in estimated treatment plant operating costs per cubic meter of wastewater flow (shown in **Table VIII-6**) illustrates this point. If the GOSD tracked these costs by facility, it could monitor and evaluate the relative performance of each wastewater treatment plant and implement changes to improve these facilities.

Several recommendations as to how the GOSD could improve accounting and budgeting processes are discussed below. These issues must be addressed to provide a support system for the GOSD to become financially autonomous.

Table VIII-6
Estimated Fiscal Year 1994/95
Wastewater Treatment Plant Costs per Cubic Meter of Wastewater Flow

	Direct Facility Costs (LE 000s)	Annual Flow (Cubic Meters 000s)	Cost (LE) per Cubic Meter
Primary			
1. Abu Rawash	14,067	85,775	0.16
2. Berka	14,930	118,625	0.13
3. Shoubra el Kheima	9,977	101,470	0.10
Secondary			
1. Zenein	15,360	120,450	0.13
2. Helwan	14,133	60,225	0.23

Improve Accounting Processes

In order for the GOSD to manage the utility autonomously, it must develop a common system for classifying costs consistent from year to year. Specifically, costs should be classified in a manner to:

- Support cost-of-service and rate setting calculations
- Provide proper monitoring and reporting of O&M and capital costs
- Allow for comparing costs among the six wastewater treatment plants and among the 17 major pump stations
- Provide appropriate information for management to operate the system effectively.

In addition to simply identifying a chart of accounts, accounting processes should be established to ensure that all financial transactions get recorded properly, and that useful information is made available to management to operate the utility effectively.

Develop Financial Reporting System

Currently, there is a need to improve reporting to GOSD management of the financial performance of the utility. Improvements are required in order to allow GOSD management to improve planning and budgeting, deploy personnel or financial resources, measure the performance of GOSD managers, determine the need for replacement or new facilities, establish wastewater charges, and communicate performance to wastewater customers.

The GOSD should establish a committee of managers from a range of functional areas (e.g., engineering, operations, maintenance, and accounting) to define: (1) a process for financial reporting, (2) the format for reporting financial performance, and (3) how to act upon the information. The overriding goal of the financial reporting system should be to improve the quality, speed, and accuracy of the information supplied in the most efficient manner possible.

The financial reporting system should be derived from the use of standard data in order to simplify the process. The number of financial and performance measures also should be limited to those essential to running the utility. Examples include:

- ❒ Annual revenues and expenditures
- ❒ Capital investment per cubic meter of wastewater collected
- ❒ Capital investment per cubic meter of wastewater treated
- ❒ Bill collection rates by class of customer
- ❒ Treatment plant efficiencies (percent reduction in pollutants)
- ❒ Capital costs per 1,000 connections
- ❒ Connections per employee.

Improvements should be made in the following areas in order for the financial reporting system to work:

- ❒ Data collection, integrity, and reporting formats
- ❒ Ability to perform ad hoc analysis, such as those usually required to establish wastewater charges
- ❒ Communication of results to plant and station managers.

Finally, the financial reporting system should not just focus on delivering the financial information, but also how to act upon it. The committee of managers formed to develop a financial reporting system should determine what actions should be taken in response to specific financial results.

Develop an Improved Budgeting Process

The budgeting and financial planning process can be described as bureaucratic, top down, and not fully based on future needs. Existing procedures present substantial challenges to the GOSD's goal of financial autonomy.

It is recommended that the GOSD begin to develop a comprehensive budgeting process and plan to implement new procedures within three years. Basic elements of the budgeting process should include the following:

- ❒ Responsibilities and plans for each organizational unit for each of the next two fiscal years
- ❒ Estimates of workload in each of the next two fiscal years
- ❒ Annual historical costs, by line item
- ❒ Staffing level, by pay grade and by personnel classification
- ❒ Cost-based estimates of non-staffing costs (e.g., electricity)
- ❒ Funding sources
- ❒ Consolidation and reconciliation of individual organizational budgets into a GOSD budget document

- ☐ Reporting of variances from budget
- ☐ Budget change process for modifications to budgets during the fiscal year.

3. Organization and Personnel

The GOSD is micro-managed by several local and central government agencies. The result is an organization slow to respond to the significant demands it faces.

For the GOSD to become autonomous, significant changes in the organization and personnel practices of the GOSD must occur. Without these changes, the GOSD cannot be truly autonomous.

Approve Proposed Presidential Decree

The GOSD must be given the authority and freedom to implement wastewater charge adjustments, unencumbered by existing tariff regulations and external pressures from multiple levels of Egyptian government. Approval of the Presidential Decree proposed by the GOSD would help provide for this autonomy.

The GOSD should eventually be given unrestricted access to capital markets without government interference or guarantees. However, access to these markets will not occur until the GOSD demonstrates that it can operate efficiently and is financially sustainable.

Consolidate Capital Planning Functions now Performed by Other Agencies

Planning the design and construction of new wastewater facilities should be a goal of the GOSD. The CWO, a "temporary" agency established 10 years ago, currently is responsible for planning, designing, and constructing new wastewater facilities. The GOSD is responsible for operating and maintaining the facilities. The responsibilities of design, construction, and operation of the system should all be integrated within the GOSD. This will require significant changes in organization, personnel practices, and compensation.

Establish the Utility as an Enterprise Fund

The proposed Presidential Decree should ensure that the accounting for wastewater operations be established as an Enterprise Fund. As an Enterprise Fund, the utility should be viewed as a business. All operating and capital costs should be recovered or financed primarily through wastewater user charges.

Also, the GOSD should be allowed to retain all revenues collected from wastewater customers; it now is allowed to retain only 10 percent of what is collected. Transferring 90 percent of revenues to the Ministry of Finance defeats any attempt to become financially autonomous. A provision to ensure 100 percent retention of wastewater revenues should be included in a revised draft of the Presidential Decree.

Operating as an Enterprise Fund also should result in more accountability to rate payers; all costs and revenues of the GOSD would be separately reported from those of the GOE. Charges should be established based on principles of cost identification, accounting, and financial reporting.

Establish a Financial and Economic Analysis Unit

A separate unit should be established, reporting to the chairman, with the responsibility to set wastewater user charges. Among its responsibilities, this unit would:

- ☐ Develop background data on Greater Cairo demographics
- ☐ Prepare demand and economic forecasts

- ☐ Prepare the CIP
- ☐ Coordinate capital finance needs
- ☐ Determine the utility's costs-of-service
- ☐ Identify pricing objectives
- ☐ Recommended new wastewater charges
- ☐ Make recommendations for improving the analysis of new project feasibility.

This group also would provide assistance on financing plans (e.g., interest rates and costs of issuance) and acceptable short and long-term debt instruments. Finally, this group would provide advice on other forms of financing utility costs, such as development fees and privatization of selected operations.

Staffing levels for the section should be determined by the GOSD. However, given the size of the utility and the responsibilities being assigned to this group, three professional and one clerical positions may be required. The group should be headed by a senior financial professional, with education and experience in finance, economics, or accounting.

Recruit Personnel for Economic and Rate Analysis Function

An autonomous GOSD will need to attract and retain employees trained in financial management, cost accounting, economic analysis, and rate setting. This may require increasing salaries and providing incentives and opportunities for advancement to attract and retain qualified personnel in the utility.

Establish Performance Goals

If the GOSD expects consumers to pay higher wastewater charges, and if the GOSD is to secure private sector financing for new capital projects in the future, the GOSD must demonstrate that it has the management capabilities to operate the system efficiently, that investments in the system would be sufficiently protected, and that the GOSD has the financial capacity to repay its loans. The utility must be able to operate under full cost recovery principles, attain a sustained level of financial performance through proper wastewater charges, and meet reasonably expected financial performance criteria.

Utility-wide performance goals should be established and monitored, as should performance goals for individual operating units. These goals should include both financial and non-financial targets. The GOSD employees should understand how their targets are to be achieved, and be given the authority to take direct action without requiring approval from the Chairman's office.

Improve Collection Rates

An aging (accounts receivable) report should be prepared monthly to monitor and act upon non-payment of wastewater bills. In the case of government customers, the amount owed to the GOSD should be formally requested from the GOE as a direct payment to the GOSD. In the case of non-government customers, attempts should be made to collect the payments by letters or phone calls. Any chronically delinquent accounts (e.g., greater than six months) should be seriously counseled, or water service should be cut off.

4. Rate Structure

The recommended wastewater charges for domestic customers follow the two block rate structure currently used by the water utility. The recommended wastewater charges provide some incentive for customers to generate less wastewater (by consuming less water) by increasing the per cubic meter charge if more water is used. Also, lower and middle income

customers are subsidized by other customer classes, providing a lifeline charge to a broad range of customers.

However, the two block rate structure makes it difficult to subsidize just low income customers, or to charge middle and upper income customers their equitable share for wastewater services. Water usage allowed in the lower consumption block is too high to distinguish between low and middle income customers. Below are two recommendations related to the wastewater rate structure.

Add Third Domestic Consumption Block

The first consumption block for domestic customers is established at 60 cubic meters or less per billing period. This is too high to establish a fair lifeline charge for low income Cairo residents. Given average water flows of the lowest income households, the first block should be set at no greater than 30 cubic meters per billing period. This would reflect essential water and wastewater needs for a poor household. The second and third blocks would be reestablished for average flows of middle and high income households.

Three consumption blocks would allow the GOSD to more fairly distribute the costs of the system to those who have the ability to pay. Three blocks also would allow phasing in of full cost recovery (by increasing the charges to the upper two blocks more than the lower block) without an undue impact on lower income households.

Implement Full Cost-of-Service Wastewater Charges

The recommended wastewater charges still provide for substantial cross-subsidization among wastewater customers. The GOSD should transition towards a true cost-of-service rate structure over a ten year period so that customers pay their fair share for wastewater services.[4] This would provide for fair and equitable wastewater charges that are justified on cost accounting principals.

5. Demand Management

The GOSD currently does not monitor customer wastewater flows or the strength of discharges. This information is necessary to determine equitable wastewater charges and industrial high strength surcharges, and to support a capital and financial planning process. Several recommendations related to wastewater demand management are presented below.

Improve Metering and Billing Practices

If the water utility remains responsible for determining water and wastewater bills, then significant improvements must be made in metering customers and billing for wastewater services. Customers should not be expected to accept the higher wastewater charges recommended in this report if their bills are determined arbitrarily and without any relation to actual demand placed on the wastewater system.

The water utility should end the practice of guessing a customer's water use, and not allow meter readers to arbitrarily set water use. If the water utility is planning to install new meters, then sufficient funds and personnel must be made available to maintain the meters in a working condition. Fines should be assessed any customer for tampering with or breaking a water meter. The cost to replace a damaged meter should be charged to the customer.

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4 The one exception would be for lifeline charges, which should be subsidized so that low income customers can afford basic wastewater services.

If new water meters are not planned, engineering studies should be conducted to determine average monthly or bi-monthly water flows, by size of lateral pipe and by type of customer. These estimates would become the basis for water demand for all customers of a specified type.

Measure Wastewater Flows and Strengths

Water flows are used in this report as an estimate of wastewater flows. This is fair so long as the proportion of water usage which is discharged as wastewater is the same for each customer class. However, if the proportion of water usage that is discharged is different, there will be a hidden and unfair discrimination in charges between customer classes.

The GOSD should perform engineering studies to measure wastewater flows and strengths by customer class. These studies would confirm or refute the implicit assumption in this report that wastewater generation is a fixed proportion of waste use for all customers. If there are differences, then the wastewater charge should be adjusted to reflect the findings of the engineering surveys.

Establish Industrial Monitoring Program

An industrial high strength surcharge is assumed to be instituted by the GOSD by fiscal year 1997/98. This charge will be assessed those customers that discharge wastewater into the collection system at pollutant strengths above the average strength of wastewater. The charge is based on the flow and strength of the customer's wastewater. Revenues are estimated to be approximately LE seven million annually.

It is recommended that the GOSD establish an industrial waste sampling and enforcement program to control industrial discharges and to monitor customers who are assessed the surcharge. This program would establish formal test protocols for sampling a customer's wastewater, identify industrial customers, measure their flow and strength of wastewater discharge, review test results with the customer, and monitor these flows and strength on an ongoing basis. The purpose is to identify customers that should be assessed the charge, provide on-going engineering data to determine the amount of the charge, and encourage industrial customers to decrease their discharge of high-strength wastewater.

This program also should include implementation and administration of a wastewater pretreatment program. The long-term goal of this program should be to eliminate discharges which violate existing Egyptian legal standards. More immediate term goals would be to inform major polluters of the law, encourage and monitor efforts by industry to reduce the pollutants discharged, and provide technical assistance to industry on alternatives to reduce or pretreat their wastewater.

The industrial high strength surcharge should be reevaluated, based upon updated costs of treatment. Other recommendations provided in this section should provide more accurate estimates of the full costs of treatment, which is the basis for the surcharge. Also, other recommendations in this section providing for comprehensive engineering surveys should provide better estimates of flows, strengths, and efficiency levels of treatment plants, improving the basis for setting the high strength surcharge.

Monitor Average Wastewater Flows and Strengths at GOSD Treatment Plants

The GOSD should conduct comprehensive engineering surveys to develop accurate and reliable estimates of flow, strength, and removal efficiencies at each treatment plant. This information is critical to managing the performance of

each plant, assuring that the treatment plants, which users are paying for, are being operated efficiently, and establishing the industrial high strength surcharge.

6. Information Management

Identification of information needs is essential to the rate setting process and should occur before automation in order to adequately determine system requirements. Several recommendations below relate to information needs of the GOSD.

Identify Information Needs

Information available from the GOSD to establish wastewater charges is essentially non-existent. Nearly all of the information for this rate study had to be generated from a variety of secondary sources, interviews, and simplifying assumptions.

The GOSD should determine the information it needs to: (1) monitor the utility's financial performance, and (2) determine wastewater charges in the future. This information should include the following:

- ❒ Capital costs and timing:
  - Maintenance capital projects. Estimating these costs should be a top priority of the GOSD.
  - New capital projects
- ❒ Financing sources, including level of funding from the GOE and donor nations
- ❒ Current value of wastewater equipment and buildings
- ❒ Staffing levels, labor hours, and labor rates
- ❒ Electricity consumption at major facilities
- ❒ Electricity prices
- ❒ Fuel consumption and costs
- ❒ Average daily flows for each treatment plant and major pump station
- ❒ Treatment plant performance and efficiency of removing pollutants
- ❒ Bill frequency analysis for each class of customer to determine both the average and range of water and wastewater demand for each customer class
- ❒ Billings and collections, by customer class (collection rates)
- ❒ Revenues from wastewater user charges, by customer class
- ❒ Revenues from secondary services (connection fees, administrative fees, etc.)
- ❒ Financial performance of the utility (e.g., income statement, sources and uses of funds, collection rates, accounts receivable, costs per unit of flow, employees per unit of flow)

Integrate GOSD Business Processes with Automation

The computer system being considered for GOSD will initially provide for automation of the GOSD data processing along existing functional lines. Later, as the GOSD reorganization progresses, the system should be utilized increasingly more as a management information system. A determination then should be made of what information is needed to monitor major utility processes and to establish costs to be recovered through wastewater user charges. Major utility processes include collection and treatment of wastewater and planning for future expansion.

ISC

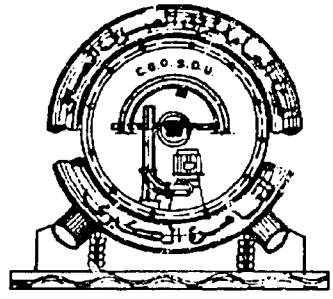
USAID

Cairo Sewerage II Project
Institutional Support Contract
USAID Grant No. 263-0173.01

General Organization for Sanitary Drainage
Institutional Support Contract (ISC)

Wastewater Rate Study and Five Year Financial Plan

Volume II - Appendices



March 26, 1994

Prepared by ERNST & YOUNG for
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in association with
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189

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September 30, 1993

Mr. Otto Vydra
Senior Vice President
Technical Director
CH2M Hill International Ltd.
Cairo Sewerage II Project
32 Ramsis Street
Cairo, Egypt

Dear Mr. Vydra:

Ernst & Young is pleased to present **Volume II - Appendices** of the *Wastewater Rate Study and Five Year Financial Plan* for the General Organization for Sanitary Drainage for Greater Cairo (GOSD). The full report documents the results, methodology, and assumptions used in calculating wastewater service charges and a five year financial plan.

Volume II presents all of the schedules which support the recommended wastewater service charges and five year financial plan. These appendices include the projected operating and capital costs for each of the major wastewater facilities, in sufficient detail to reflect the size and complexity of each facility.

We are delivering with this report a floppy disk which contains the Lotus 1-2-3 files on which all of the enclosed schedules were prepared. If you should have any questions regarding this report, please contact Michael Geiss or Edward Kaempf in Sacramento, California, at (916) 449-3400.

Very truly yours,

Ernst + Young

TABLE OF CONTENTS

APPENDICES

APPENDIX A

ACRONYMS

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Appendix A
Acronyms

AGOSD	Alexandria General Organization for Sanitary Drainage
AMBRIC	American British Consultants
AWGA	Alexandria Water General Authority
BAB	Chapter (budgetary expenditure)
BOD	Biochemical Oxygen Demand
CAPMAS	Central Agency for Public Mobilization and Statistics
CH2M HILL	CH2M HILL International Services, Inc
CIP	Capital Improvement Program
FY	Fiscal Year (July 1 through June 30)
CAOA	Central Agency for Organization and Administration
CEDC	Cairo Electric Distributing Company
CMD	Cubic Meters per Day
CWO	Cairo Wastewater Organization
g	Grams
GOE	Government of Egypt
GOFI	General Organization for Industry
GOGCWS	General Organization for Greater Cairo Water Supply
GOSD	General Organization for Sanitary Drainage for Greater Cairo
HCPEA	High Committee for Policy and Economic Affairs
ISC	Institutional Support Contract
kg	Kilograms
kwhr	Kilowatt Hours
l	Liters
LE or L.E.	Egyptian Pounds
m^3	Cubic Meters
mg	Milligrams
MHPU	Ministry of Housing, New Communities, and Public Utilities
MLA	Ministry of Local Administration
MLF	Ministry of Local Government

Appendix A
Acronyms
(Continued)

MOF	Ministry of Finance
MOP	Ministry of Planning
NIB	National Investment Bank
NOPWASD	National Organization for Potable Water and Sanitary Drainage
O&M	Operations and Maintenance
OMI	Operations Management International, Inc.
PT	Egyptian Piasters
TSS	Total Suspended Solids
USAID	US Agency for International Development
WWTP	Wastewater Treatment Plant

APPENDIX B

DEMAND CHARACTERISTICS

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Appendix B
Demand Characteristics

This appendix presents estimates and projections of:

- Total number of water accounts
- Annual water consumption
- Average annual water consumption per account.

Projections of water demand by customer class are used to allocate costs of the GOSD to each customer class. Also, these projections determine projections of water revenues needed to calculate the recommended wastewater surcharges.

System–Wide Water Demand Characteristics

Item	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Number of Water Accounts							
1. Domestic	437,172	451,055	465,382	480,168	495,427	511,174	527,425
2. Government	9,531	9,544	9,557	9,571	9,585	9,599	9,613
3. Small Factories and Shops	28,430	28,765	29,104	29,447	29,794	30,145	30,501
4. Large Industrial Factories	285	287	289	292	295	298	301
5. Tourism and Investment	563	574	585	596	607	620	633
6. Worship and Charities	3,296	3,338	3,381	3,425	3,470	3,515	3,560
7. Sports Clubs and Embassies	454	454	454	454	454	454	454
Total Number of Water Accounts	479,731	494,017	508,752	523,953	539,632	555,805	572,487
Annual Water Flows (Cubic Meters 000s)							
1. Domestic	854,433	881,567	909,569	938,467	968,290	999,068	1,030,831
2. Government	249,269	249,621	249,974	250,327	250,681	251,036	251,392
3. Small Factories and Shops	68,389	69,193	70,008	70,833	71,668	72,513	73,369
4. Large Industrial Factories	25,072	25,288	25,507	25,729	25,953	26,180	26,410
5. Tourism and Investment	13,034	13,294	13,560	13,831	14,108	14,390	14,677
6. Worship and Charities	10,368	10,502	10,638	10,776	10,916	11,058	11,202
7. Sports Clubs and Embassies	7,118	7,118	7,118	7,118	7,118	7,118	7,118
Total Water Flows	1,227,683	1,256,583	1,286,374	1,317,081	1,348,734	1,381,363	1,414,999
Average Annual Water Flows per Account (Cubic Meters)							
1. Domestic	1,954.45	1,954.46	1,954.46	1,954.46	1,954.46	1,954.46	1,954.46
2. Government	26,153.50	26,154.76	26,156.12	26,154.74	26,153.47	26,152.31	26,151.25
3. Small Factories and Shops	2,405.52	2,405.46	2,405.44	2,405.44	2,405.45	2,405.47	2,405.46
4. Large Industrial Factories	87,971.93	88,111.50	88,259.52	88,113.01	87,976.27	87,852.35	87,740.86
5. Tourism and Investment	23,150.98	23,160.28	23,179.49	23,206.38	23,242.17	23,209.68	23,186.41
6. Worship and Charities	3,145.63	3,146.20	3,146.41	3,146.28	3,145.82	3,145.95	3,146.63
7. Sports Clubs and Embassies	15,678.41	15,678.41	15,678.41	15,678.41	15,678.41	15,678.41	15,678.41

West Bank Water Demand Characteristics

Item	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Number of Water Accounts							
1. Domestic	128,000	132,608	137,382	142,328	147,452	152,760	158,259
2. Government	2,800	2,800	2,800	2,800	2,800	2,800	2,800
3. Small Factories and Shops	8,350	8,484	8,620	8,758	8,898	9,040	9,185
4. Large Industrial Factories	80	80	80	80	80	80	80
5. Tourism and Investment	165	168	171	174	177	181	185
6. Worship and Charities	970	989	1,009	1,029	1,050	1,071	1,092
7. Sports Clubs and Embassies	140	140	140	140	140	140	140
Total Number of Water Accounts	140,505	145,269	150,202	155,309	160,597	166,072	171,741
Annual Water Flows (Cubic Meters 000s)							
1. Domestic	250,170	259,176	268,506	278,172	288,186	298,561	309,309
2. Government	73,230	73,230	73,230	73,230	73,230	73,230	73,230
3. Small Factories and Shops	20,086	20,407	20,734	21,066	21,403	21,745	22,093
4. Large Industrial Factories	7,038	7,038	7,038	7,038	7,038	7,038	7,038
5. Tourism and Investment	3,820	3,896	3,974	4,053	4,134	4,217	4,301
6. Worship and Charities	3,051	3,112	3,174	3,237	3,302	3,368	3,435
7. Sports Clubs and Embassies	2,195	2,195	2,195	2,195	2,195	2,195	2,195
Total Water Flows	359,590	369,054	378,851	388,991	399,488	410,354	421,601
Average Annual Water Flows per Account (Cubic Meters)							
1. Domestic	1,954.45	1,954.45	1,954.45	1,954.44	1,954.44	1,954.44	1,954.45
2. Government	26,153.50	26,153.57	26,153.57	26,153.57	26,153.57	26,153.57	26,153.57
3. Small Factories and Shops	2,405.52	2,405.35	2,405.34	2,405.34	2,405.37	2,405.42	2,405.33
4. Large Industrial Factories	87,971.93	87,975.00	87,975.00	87,975.00	87,975.00	87,975.00	87,975.00
5. Tourism and Investment	23,150.98	23,190.48	23,239.77	23,293.10	23,355.93	23,298.34	23,248.65
6. Worship and Charities	3,145.63	3,146.61	3,145.69	3,145.77	3,144.76	3,144.72	3,145.60
7. Sports Clubs and Embassies	15,678.41	15,678.57	15,678.57	15,678.57	15,678.57	15,678.57	15,678.57

East Bank Water Demand Characteristics

Item	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Number of Water Accounts							
1. Domestic	309,172	318,447	328,000	337,840	347,975	358,414	369,166
2. Government	6,731	6,744	6,757	6,771	6,785	6,799	6,813
3. Small Factories and Shops	20,080	20,281	20,484	20,689	20,896	21,105	21,316
4. Large Industrial Factories	205	207	209	212	215	218	221
5. Tourism and Investment	398	406	414	422	430	439	448
6. Worship and Charities	2,326	2,349	2,372	2,396	2,420	2,444	2,468
7. Sports Clubs and Embassies	314	314	314	314	314	314	314
Total Number of Water Accounts	339,226	348,748	358,550	368,644	379,035	389,733	400,746
Annual Water Flows (Cubic Meters 000s)							
1. Domestic	604,263	622,391	641,063	660,295	680,104	700,507	721,522
2. Government	176,039	176,391	176,744	177,097	177,451	177,806	178,162
3. Small Factories and Shops	48,303	48,786	49,274	49,767	50,265	50,768	51,276
4. Large Industrial Factories	18,034	18,250	18,469	18,691	18,915	19,142	19,372
5. Tourism and Investment	9,214	9,398	9,586	9,778	9,974	10,173	10,376
6. Worship and Charities	7,317	7,390	7,464	7,539	7,614	7,690	7,767
7. Sports Clubs and Embassies	4,923	4,923	4,923	4,923	4,923	4,923	4,923
Total Water Flows	868,093	887,529	907,523	928,090	949,246	971,009	993,398
Average Annual Water Flows per Account (Cubic Meters)							
1. Domestic	1,954.46	1,954.46	1,954.46	1,954.46	1,954.46	1,954.46	1,954.46
2. Government	26,153.47	26,155.25	26,157.17	26,155.22	26,153.43	26,151.79	26,150.30
3. Small Factories and Shops	2,405.53	2,405.50	2,405.49	2,405.48	2,405.48	2,405.50	2,405.52
4. Large Industrial Factories	87,970.73	88,164.25	88,368.42	88,165.09	87,976.74	87,807.34	87,656.11
5. Tourism and Investment	23,150.75	23,147.78	23,154.59	23,170.62	23,195.35	23,173.12	23,160.71
6. Worship and Charities	3,145.74	3,146.02	3,146.71	3,146.49	3,146.28	3,146.48	3,147.08
7. Sports Clubs and Embassies	15,678.34	15,678.34	15,678.34	15,678.34	15,678.34	15,678.34	15,678.34

APPENDIX C

ANNUAL STAFFING LEVELS AND MAINTENANCE COSTS

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Appendix C
Annual Staffing Levels and Salary Costs

This appendix presents historical and projections of future annual staffing levels and salary costs for GOSD treatment plants and pumping stations. These facilities are listed below.

Wastewater Treatment Plants	Pumping Stations	
West Bank		
Abu Rawash	Abu Rawash	GOSD No. 4
Zenein	Boulac	GOSD No. 5
	Cheops	Junction
	El Ahram	Pyramids
	Embaba	South Muheit
	Giza	Zenein
East Bank		
Berka	Ameria	Khalag
Gabal el Asfar	Ein Shams	Koussous
Shoubra el Kheima		
South		
Helwan	Helwan	

Annual Staffing Levels and Salary Costs

Abu Rawash Wastewater Treatment Plant, West Bank

Salary Positions and Costs	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Number of Full Time Equivalent Staff by Grade							
First	4	4	4	4	4	4	4
Second	25	25	25	25	25	25	25
Third	67	67	67	67	67	67	67
Fourth	87	87	87	87	87	87	87
Fifth	95	95	95	95	95	95	95
Sixth	89	89	89	89	89	89	89
Total Staff	367	367	367	367	367	367	367
Annual Salary Costs by Grade (L.E.)							
First	27,660	34,300	36,700	39,268	42,016	44,956	48,104
Second	147,625	183,050	195,875	209,575	224,250	239,950	256,750
Third	316,173	392,084	419,554	448,900	480,323	513,957	549,936
Fourth	316,158	392,022	419,427	448,746	480,153	513,735	549,666
Fifth	282,910	350,835	375,440	401,755	429,875	459,990	492,195
Sixth	229,086	284,088	303,935	325,206	347,990	372,376	398,453
Total Salary Costs	1,319,612	1,636,379	1,750,931	1,873,450	2,004,607	2,144,964	2,295,104

202

Annual Staffing Levels and Salary Costs

Zenein Wastewater Treatment Plant, West Bank

Salary Positions and Costs	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Number of Full Time Equivalent Staff by Grade							
First	3	3	3	3	3	3	3
Second	19	19	19	19	19	19	19
Third	52	52	52	52	52	52	52
Fourth	68	68	68	68	68	68	68
Fifth	74	74	74	74	74	74	74
Sixth	69	69	69	69	69	69	69
Total Staff	285	285	285	285	285	285	285
Annual Salary Costs by Grade (L.E.)							
First	20,745	25,725	27,525	29,451	31,512	33,717	36,078
Second	112,195	139,118	148,865	159,277	170,430	182,362	195,130
Third	245,388	304,304	325,624	348,400	372,788	398,892	426,816
Fourth	247,112	306,408	327,828	350,744	375,292	401,540	429,624
Fifth	220,372	273,282	292,448	312,946	334,850	358,308	383,394
Sixth	177,606	220,248	235,635	252,126	269,790	288,696	308,913
Total Salary Costs	1,023,418	1,269,085	1,357,925	1,452,944	1,554,662	1,663,515	1,779,955

Annual Staffing Levels and Salary Costs

Abu Rawash Pump Station, West Bank

Salary Positions and Costs	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Number of Full Time Equivalent Staff by Grade							
First	0	0	0	0	0	0	0
Second	2	2	2	2	2	2	2
Third	5	5	5	5	5	5	5
Fourth	7	7	7	7	7	7	7
Fifth	7	7	7	7	7	7	7
Sixth	7	7	7	7	7	7	7
Total Staff	28	28	28	28	28	28	28
Annual Salary Costs by Grade (L.E.)							
First	0	0	0	0	0	0	0
Second	11,810	14,644	15,670	16,766	17,940	19,196	20,540
Third	23,595	29,260	31,310	33,500	35,845	38,355	41,040
Fourth	25,438	31,542	33,747	36,106	38,633	41,335	44,226
Fifth	20,846	25,851	27,664	29,603	31,675	33,894	36,267
Sixth	18,018	22,344	23,905	25,578	27,370	29,288	31,339
Total Salary Costs	99,707	123,641	132,296	141,553	151,463	162,068	173,412

Annual Staffing Levels and Salary Costs

Boulac Pump Station, West Bank

Salary Positions and Costs	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Number of Full Time Equivalent Staff by Grade							
First	0	0	0	0	0	0	0
Second	2	2	2	2	2	2	2
Third	5	5	5	5	5	5	5
Fourth	7	7	7	7	7	7	7
Fifth	7	7	7	7	7	7	7
Sixth	7	7	7	7	7	7	7
Total Staff	28	28	28	28	28	28	28
Annual Salary Costs by Grade (L.E.)							
First	0	0	0	0	0	0	0
Second	11,810	14,644	15,670	16,766	17,940	19,196	20,540
Third	23,595	29,260	31,310	33,500	35,845	38,355	41,040
Fourth	25,438	31,542	33,747	36,106	38,633	41,335	44,226
Fifth	20,846	25,851	27,664	29,603	31,675	33,894	36,267
Sixth	18,018	22,344	23,905	25,578	27,370	29,288	31,339
Total Salary Costs	99,707	123,641	132,296	141,553	151,463	162,068	173,412

Annual Staffing Levels and Salary Costs

Cheops Pump Station, West Bank

Salary Positions and Costs	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Number of Full Time Equivalent Staff by Grade							
First	0	0	0	0	0	0	0
Second	0	3	3	3	3	3	3
Third	0	7	7	7	7	7	7
Fourth	0	10	10	10	10	10	10
Fifth	0	10	10	10	10	10	10
Sixth	0	10	10	10	10	10	10
Total Staff	0	40	40	40	40	40	40
Annual Salary Costs by Grade (L.E.)							
First	0	0	0	0	0	0	0
Second	0	21,966	23,505	25,149	26,910	28,794	30,810
Third	0	40,964	43,834	46,900	50,183	53,697	57,456
Fourth	0	45,060	48,210	51,580	55,190	59,050	63,180
Fifth	0	36,930	39,520	42,290	45,250	48,420	51,810
Sixth	0	31,920	34,150	36,540	39,100	41,840	44,770
Total Salary Costs	0	176,840	189,219	202,459	216,633	231,301	248,026

Annual Staffing Levels and Salary Costs

El Ahram Pump Station, West Bank

Salary Positions and Costs	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Number of Full Time Equivalent Staff by Grade							
First	0	0	0	0	0	0	0
Second	1	1	1	1	1	1	1
Third	3	3	3	3	3	3	3
Fourth	4	4	4	4	4	4	4
Fifth	4	4	4	4	4	4	4
Sixth	4	4	4	4	4	4	4
Total Staff	16	16	16	16	16	16	16
Annual Salary Costs by Grade (L.E.)							
First	0	0	0	0	0	0	0
Second	5,905	7,322	7,635	8,383	8,970	9,598	10,270
Third	14,157	17,556	18,786	20,100	21,507	23,013	24,624
Fourth	14,536	18,024	19,284	20,632	22,076	23,620	25,272
Fifth	11,912	14,772	15,808	16,916	18,100	19,368	20,724
Sixth	10,296	12,768	13,660	14,616	15,640	16,736	17,908
Total Salary Costs	56,806	70,442	75,373	80,647	86,293	92,335	98,798

Annual Staffing Levels and Salary Costs

Embaba Pump Station, West Bank

Salary Positions and Costs	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Number of Full Time Equivalent Staff by Grade							
First	0	0	0	0	0	0	0
Second	3	3	3	3	3	3	3
Third	7	7	7	7	7	7	7
Fourth	10	10	10	10	10	10	10
Fifth	10	10	10	10	10	10	10
Sixth	10	10	10	10	10	10	10
Total Staff	40	40	40	40	40	40	40
Annual Salary Costs by Grade (L.E.)							
First	0	0	0	0	0	0	0
Second	17,715	21,966	23,505	25,149	26,910	28,794	30,810
Third	33,033	40,964	43,834	46,900	50,183	53,697	57,456
Fourth	36,340	45,060	48,210	51,580	55,190	59,050	63,180
Fifth	29,780	36,930	39,520	42,290	45,250	48,420	51,810
Sixth	25,740	31,920	34,150	36,540	39,100	41,840	44,770
Total Salary Costs	142,608	176,840	189,219	202,459	216,633	231,801	248,026

Annual Staffing Levels and Salary Costs

Giza Pump Station, West Bank

Salary Positions and Costs	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Number of Full Time Equivalent Staff by Grade							
First	4	4	4	4	4	4	4
Second	16	16	16	16	16	16	16
Third	23	23	23	23	23	23	23
Fourth	18	18	18	18	18	18	18
Fifth	18	18	18	18	18	18	18
Sixth	14	14	14	14	14	14	14
Total Staff	93	93	93	93	93	93	93
Annual Salary Costs by Grade (L.E.)							
First	27,660	34,300	36,700	39,268	42,016	44,956	48,104
Second	94,480	117,152	125,360	134,128	143,520	153,568	164,320
Third	108,537	134,596	144,026	154,100	164,887	176,433	188,784
Fourth	65,412	81,108	86,778	92,844	99,342	106,290	113,724
Fifth	53,604	66,474	71,136	76,122	81,450	87,156	93,258
Sixth	36,036	44,688	47,810	51,156	54,740	58,576	62,678
Total Salary Costs	385,729	478,318	511,810	547,618	585,955	626,979	670,868

Annual Staffing Levels and Salary Costs

GOSD No. 4 Pump Station, West Bank

Salary Positions and Costs	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Number of Full Time Equivalent Staff by Grade							
First	0	0	0	0	0	0	0
Second	3	3	3	3	3	3	3
Third	7	7	7	7	7	7	7
Fourth	10	10	10	10	10	10	10
Fifth	10	10	10	10	10	10	10
Sixth	10	10	10	10	10	10	10
Total Staff	40	40	40	40	40	40	40
Annual Salary Costs by Grade (L.E.)							
First	0	0	0	0	0	0	0
Second	17,715	21,966	23,505	25,149	26,910	28,794	30,810
Third	33,033	40,964	43,834	46,900	50,183	53,697	57,456
Fourth	36,340	45,060	48,210	51,580	55,190	59,050	63,180
Fifth	29,780	36,930	39,520	42,290	45,250	48,420	51,810
Sixth	25,740	31,920	34,150	36,540	39,100	41,840	44,770
Total Salary Costs	142,608	176,840	189,219	202,459	216,633	231,801	248,026

Annual Staffing Levels and Salary Costs

GOSD No. 5 Pump Station, West Bank

Salary Positions and Costs	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Number of Full Time Equivalent Staff by Grade							
First	0	0	0	0	0	0	0
Second	3	3	3	3	3	3	3
Third	7	7	7	7	7	7	7
Fourth	10	10	10	10	10	10	10
Fifth	10	10	10	10	10	10	10
Sixth	10	10	10	10	10	10	10
Total Staff	40	40	40	40	40	40	40
Annual Salary Costs by Grade (L.E.)							
First	0	0	0	0	0	0	0
Second	17,715	21,966	23,505	25,149	26,910	28,794	30,810
Third	33,033	40,964	43,834	46,900	50,183	53,697	57,456
Fourth	36,340	45,060	48,210	51,580	55,190	59,050	63,180
Fifth	29,780	36,930	39,520	42,290	45,250	48,420	51,810
Sixth	25,740	31,920	34,150	36,540	39,100	41,840	44,770
Total Salary Costs	142,608	176,840	189,219	202,459	216,633	231,801	248,026

Annual Staffing Levels and Salary Costs

Junction Pump Station, West Bank

Salary Positions and Costs	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Number of Full Time Equivalent Staff by Grade							
First	0	0	0	0	0	0	0
Second	2	2	2	2	2	2	2
Third	7	7	7	7	7	7	7
Fourth	9	9	9	9	9	9	9
Fifth	9	9	9	9	9	9	9
Sixth	9	9	9	9	9	9	9
Total Staff	36	36	36	36	36	36	36
Annual Salary Costs by Grade (L.E.)							
First	0	0	0	0	0	0	0
Second	11,810	14,644	15,670	16,766	17,940	19,196	20,540
Third	33,033	40,964	43,834	46,900	50,183	53,697	57,456
Fourth	32,706	40,554	43,389	46,422	49,671	53,145	56,862
Fifth	26,802	33,237	35,568	38,061	40,725	43,578	46,629
Sixth	23,166	28,728	30,735	32,886	35,190	37,656	40,293
Total Salary Costs	127,517	158,127	169,196	181,035	193,709	207,272	221,780

Annual Staffing Levels and Salary Costs

Pyramids Pump Station, West Bank

Salary Positions and Costs	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Number of Full Time Equivalent Staff by Grade							
First	0	0	0	0	0	0	0
Second	3	3	3	3	3	3	3
Third	7	7	7	7	7	7	7
Fourth	10	10	10	10	10	10	10
Fifth	10	10	10	10	10	10	10
Sixth	10	10	10	10	10	10	10
Total Staff	40	40	40	40	40	40	40
Annual Salary Costs by Grade (L.E.)							
First	0	0	0	0	0	0	0
Second	17,715	21,966	23,505	25,149	26,910	28,794	30,810
Third	33,033	40,964	43,834	46,900	50,183	53,697	57,456
Fourth	36,340	45,060	48,210	51,580	55,190	59,050	63,180
Fifth	29,780	36,930	39,520	42,290	45,250	48,420	51,810
Sixth	25,740	31,920	34,150	36,540	39,100	41,840	44,770
Total Salary Costs	142,608	176,840	189,219	202,459	216,633	231,801	248,026

Annual Staffing Levels and Salary Costs

South Muheit Pump Station, West Bank

Salary Positions and Costs	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Number of Full Time Equivalent Staff by Grade							
First	0	0	0	0	0	0	0
Second	2	2	2	2	2	2	2
Third	7	7	7	7	7	7	7
Fourth	9	9	9	9	9	9	9
Fifth	9	9	9	9	9	9	9
Sixth	9	9	9	9	9	9	9
Total Staff	36	36	36	36	36	36	36
Annual Salary Costs by Grade (L.E.)							
First	0	0	0	0	0	0	0
Second	11,810	14,644	15,670	16,766	17,940	19,196	20,540
Third	33,033	40,964	43,834	46,900	50,183	53,697	57,456
Fourth	32,706	40,554	43,389	46,422	49,671	53,145	56,862
Fifth	26,802	33,237	35,568	38,061	40,725	43,578	46,629
Sixth	23,166	28,728	30,735	32,886	35,190	37,656	40,293
Total Salary Costs	127,517	158,127	169,196	181,035	193,709	207,272	221,780

Annual Staffing Levels and Salary Costs

Zenein Pump Station, West Bank

Salary Positions and Costs	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Number of Full Time Equivalent Staff by Grade							
First	0	0	0	0	0	0	0
Second	3	3	3	3	3	3	3
Third	7	7	7	7	7	7	7
Fourth	10	10	10	10	10	10	10
Fifth	10	10	10	10	10	10	10
Sixth	10	10	10	10	10	10	10
Total Staff	40	40	40	40	40	40	40
Annual Salary Costs by Grade (L.E.)							
First	0	0	0	0	0	0	0
Second	17,715	21,966	23,505	25,149	26,910	28,794	30,810
Third	33,033	40,964	43,834	46,900	50,183	53,697	57,456
Fourth	36,340	45,060	48,210	51,580	55,190	59,050	63,180
Fifth	29,780	36,930	39,520	42,290	45,250	48,420	51,810
Sixth	25,740	31,920	34,150	36,540	39,100	41,840	44,770
Total Salary Costs	142,608	176,840	189,219	202,459	216,633	231,801	248,026

Annual Staffing Levels and Salary Costs

Berka Wastewater Treatment Plant, East Bank

Salary Positions and Costs	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Number of Full Time Equivalent Staff by Grade							
First	4	4	4	6	6	6	6
Second	25	25	25	38	38	38	38
Third	67	67	67	101	101	101	101
Fourth	87	87	87	131	131	131	131
Fifth	94	94	94	141	141	141	141
Sixth	88	88	88	132	132	132	132
Total Staff	365	365	365	549	549	549	549
Annual Salary Costs by Grade (L.E.)							
First	27,660	34,300	36,700	58,902	63,024	67,434	72,156
Second	147,625	183,050	195,875	318,554	340,860	364,724	390,260
Third	316,173	392,084	419,554	676,700	724,069	774,771	829,008
Fourth	316,158	392,022	419,427	675,698	722,989	773,555	827,658
Fifth	279,932	347,142	371,488	596,289	638,025	682,722	730,521
Sixth	226,512	280,896	300,520	482,328	516,120	552,288	590,964
Total Salary Costs	1,314,060	1,629,494	1,743,564	2,808,471	3,005,087	3,215,494	3,440,567

Annual Staffing Levels and Salary Costs

Gabal el Asfar Wastewater Treatment Plant, East Bank

Salary Positions and Costs	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Number of Full Time Equivalent Staff by Grade							
First	3	3	3	3	5	5	5
Second	21	21	21	21	38	38	38
Third	57	57	57	57	103	103	103
Fourth	74	74	74	74	133	133	133
Fifth	80	80	80	80	144	144	144
Sixth	76	76	76	76	137	137	137
Total Staff	311	311	311	311	560	560	560
Annual Salary Costs by Grade (L.E.)							
First	20,745	25,725	27,525	29,451	52,520	56,195	60,130
Second	124,005	153,762	164,535	176,043	340,860	364,724	390,260
Third	268,983	333,564	356,934	381,900	738,407	790,113	845,424
Fourth	268,916	333,444	356,754	381,692	734,027	785,365	840,294
Fifth	238,240	295,440	316,160	338,320	651,600	697,248	746,064
Sixth	195,624	242,592	259,540	277,704	535,670	573,208	613,349
Total Salary Costs	1,116,513	1,384,527	1,481,448	1,585,110	3,053,084	3,266,853	3,495,521

Annual Staffing Levels and Salary Costs

Shoubra el Kheima Wastewater Treatment Plant, East Bank

Salary Positions and Costs	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Number of Full Time Equivalent Staff by Grade							
First	3	3	3	3	3	3	3
Second	19	19	19	19	19	19	19
Third	52	52	52	52	52	52	52
Fourth	68	68	68	68	68	68	68
Fifth	74	74	74	74	74	74	74
Sixth	69	69	69	69	69	69	69
Total Staff	285	285	285	285	285	285	285
Annual Salary Costs by Grade (L.E.)							
First	20,745	25,725	27,525	29,451	31,512	33,717	36,078
Second	112,195	139,118	148,865	159,277	170,430	182,362	195,130
Third	245,388	304,304	325,624	348,400	372,788	398,892	426,816
Fourth	247,112	306,408	327,828	350,744	375,292	401,540	429,624
Fifth	220,372	273,282	292,448	312,946	334,850	358,308	383,394
Sixth	177,606	220,248	235,635	252,126	269,790	288,696	308,913
Total Salary Costs	1,023,418	1,269,085	1,357,925	1,452,944	1,554,662	1,663,515	1,779,955

Annual Staffing Levels and Salary Costs

Ameria Pump Station, East Bank

Salary Positions and Costs	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Number of Full Time Equivalent Staff by Grade							
First	2	2	2	2	2	2	2
Second	15	15	15	15	15	15	15
Third	40	40	40	40	40	40	40
Fourth	53	53	53	53	53	53	53
Fifth	57	57	57	57	57	57	57
Sixth	54	54	54	54	54	54	54
Total Staff	221	221	221	221	221	221	221
Annual Salary Costs by Grade (L.E.)							
First	13,830	17,150	18,350	19,634	21,008	22,478	24,052
Second	88,575	109,830	117,525	125,745	134,550	143,970	154,050
Third	188,760	234,080	250,480	268,000	286,760	306,840	328,320
Fourth	192,602	238,818	255,513	273,374	292,507	312,965	334,854
Fifth	169,746	210,501	225,264	241,053	257,925	275,994	295,317
Sixth	138,996	172,368	184,410	197,316	211,140	225,936	241,758
Total Salary Costs	792,509	982,747	1,051,542	1,125,122	1,203,290	1,288,183	1,378,351

Annual Staffing Levels and Salary Costs

Ein Shams Pump Station, East Bank

Salary Positions and Costs	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Number of Full Time Equivalent Staff by Grade							
First	2	2	2	2	2	2	2
Second	12	12	12	12	12	12	12
Third	31	31	31	31	31	31	31
Fourth	40	40	40	40	40	40	40
Fifth	43	43	43	43	43	43	43
Sixth	41	41	41	41	41	41	41
Total Staff	169	169	169	169	169	169	169
Annual Salary Costs by Grade (L.E.)							
First	13,830	17,150	18,350	19,634	21,008	22,478	24,052
Second	70,860	87,864	94,020	100,596	107,640	115,176	123,240
Third	146,289	181,412	194,122	207,700	222,239	237,801	254,448
Fourth	145,360	180,240	192,840	206,320	220,760	236,200	252,720
Fifth	128,054	158,799	169,936	181,847	194,575	208,206	222,783
Sixth	105,534	130,872	140,015	149,814	160,310	171,544	183,557
Total Salary Costs	609,927	756,337	809,283	865,911	926,532	991,405	1,060,800

Annual Staffing Levels and Salary Costs

Khalag Pump Station, East Bank

Salary Positions and Costs	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Number of Full Time Equivalent Staff by Grade							
First	0	0	0	0	1	1	1
Second	0	0	0	0	6	6	6
Third	0	0	0	0	18	18	18
Fourth	0	0	0	0	23	23	23
Fifth	0	0	0	0	25	25	25
Sixth	0	0	0	0	23	23	23
Total Staff	0	0	0	0	96	96	96
Annual Salary Costs by Grade (L.E.)							
First	0	0	0	0	10,504	11,239	12,026
Second	0	0	0	0	53,820	57,588	61,620
Third	0	0	0	0	129,042	138,078	147,744
Fourth	0	0	0	0	126,937	135,815	145,314
Fifth	0	0	0	0	113,125	121,050	129,525
Sixth	0	0	0	0	89,930	96,232	102,971
Total Salary Costs	0	0	0	0	523,358	560,002	599,200

Annual Staffing Levels and Salary Costs

Koussous Pump Station, East Bank

Salary Positions and Costs	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Number of Full Time Equivalent Staff by Grade							
First	1	1	1	1	1	1	1
Second	7	7	7	7	7	7	7
Third	19	19	19	19	19	19	19
Fourth	25	25	25	25	25	25	25
Fifth	27	27	27	27	27	27	27
Sixth	25	25	25	25	25	25	25
Total Staff	104	104	104	104	104	104	104
Annual Salary Costs by Grade (L.E.)							
First	6,915	8,575	9,175	9,817	10,504	11,239	12,026
Second	41,335	51,254	54,845	58,681	62,790	67,186	71,890
Third	89,661	111,188	118,978	127,300	136,211	145,749	155,952
Fourth	90,850	112,650	120,525	128,950	137,975	147,625	157,950
Fifth	80,406	99,711	106,704	114,183	122,175	130,734	139,887
Sixth	64,350	79,800	85,375	91,350	97,750	104,600	111,925
Total Salary Costs	373,517	463,178	495,602	530,281	567,405	607,133	649,630

Annual Staffing Levels and Salary Costs

Helwan Wastewater Treatment Plant, South Region

Salary Positions and Costs	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Number of Full Time Equivalent Staff by Grade							
First	1	1	1	1	1	1	1
Second	7	7	7	7	7	7	7
Third	18	18	18	18	18	18	18
Fourth	24	24	24	24	24	24	24
Fifth	26	26	26	26	26	26	26
Sixth	24	24	24	24	24	24	24
Total Staff	100	100	100	100	100	100	100
Annual Salary Costs by Grade (L.E.)							
First	6,915	8,575	9,175	9,817	10,504	11,239	12,026
Second	41,335	51,254	54,845	58,681	62,790	67,186	71,890
Third	84,942	105,336	112,716	120,600	129,042	138,078	147,744
Fourth	87,216	108,144	115,704	123,792	132,456	141,720	151,632
Fifth	77,428	96,018	102,752	109,954	117,650	125,892	134,706
Sixth	61,776	76,608	81,960	87,696	93,840	100,416	107,448
Total Salary Costs	359,612	445,935	477,152	510,540	546,282	584,531	625,446

Annual Staffing Levels and Salary Costs

Helwan Pump Station, South Region

Salary Positions and Costs	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Number of Full Time Equivalent Staff by Grade							
First	2	2	2	2	2	2	2
Second	13	13	13	13	13	13	13
Third	35	35	35	35	35	35	35
Fourth	46	46	46	46	46	46	46
Fifth	49	49	49	49	49	49	49
Sixth	46	46	46	46	46	46	46
Total Staff	191	191	191	191	191	191	191
Annual Salary Costs by Grade (L.E.)							
First	13,830	17,150	18,350	19,634	21,008	22,478	24,052
Second	76,765	95,186	101,855	108,979	116,610	124,774	133,510
Third	165,165	204,820	219,170	234,500	250,915	268,485	287,280
Fourth	167,164	207,276	221,766	237,268	253,874	271,630	290,628
Fifth	145,922	180,937	193,648	207,221	221,725	237,258	253,869
Sixth	118,404	146,832	157,090	168,084	179,860	192,464	205,942
Total Salary Costs	687,250	852,221	911,879	975,686	1,043,992	1,117,089	1,195,281

APPENDIX D

ANNUAL OPERATIONS AND MAINTENANCE COSTS

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Appendix D
Annual Operations and Maintenance Costs

This appendix presents historical and projections of annual operations and maintenance costs for GOSD treatment plants and pumping stations. These facilities are listed below.

Wastewater Treatment Plants	Pumping Stations	
West Bank		
Abu Rawash	Abu Rawash	GOSD No. 4
Zenein	Boulac	GOSD No. 5
	Cheops	Junction
	El Ahram	Pyramids
	Embaba	South Muheit
	Giza	Zenein
East Bank		
Berka	Ameria	Khalag
Gabal el Asfar	Ein Shams	Koussous
Shoubra el Kheima		
South		
Helwan	Helwan	

Annual Operations and Maintenance Costs

Abu Rawash Wastewater Treatment Plant, West Bank

Operations and Maintenance Costs	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Annual Commodities Consumed							
Electricity (kwhr)	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000
Petroleum (liters)	48,000	48,000	48,000	48,000	48,000	48,000	48,000
Diesel (liters)	60,000	60,000	60,000	60,000	60,000	60,000	60,000
Oil (liters)	9,000	9,000	9,000	9,000	9,000	9,000	9,000
Lubricants (kgs)	6,100	6,100	6,100	6,100	6,100	6,100	6,100
Chlorine (tons)	3,600	3,600	3,600	3,600	3,600	3,600	3,600
Annual Commodity Costs (L.E.)							
Electricity	2,900,000	3,200,000	3,500,000	3,900,000	4,300,000	4,700,000	5,200,000
Fuels, Lubricants, and Chemicals							
Petroleum	48,000	52,800	58,080	63,840	70,080	77,280	84,960
Diesel	21,000	23,400	25,800	28,200	31,200	34,200	37,800
Oil	14,400	15,840	17,460	19,170	21,060	23,130	25,470
Lubricants	12,200	13,420	14,762	16,226	17,873	19,642	21,594
Chlorine	5,400,000	5,940,000	6,534,000	7,189,200	7,909,200	8,701,200	9,572,400
Total Fuels, Lubricants, and Chemicals	5,495,600	6,045,460	6,650,102	7,316,636	8,049,413	8,855,452	9,742,224
Total Annual Commodity Costs	8,395,600	9,245,460	10,150,102	11,216,636	12,349,413	13,555,452	14,942,224
Other Operations and Maintenance Costs							
Spare Parts	1,650,000	1,815,000	1,996,500	2,196,150	2,415,765	2,657,342	2,923,076
Other Consumables	40,000	44,000	48,400	53,240	58,564	64,420	70,862
Other Direct Operating Expenses	100,000	110,000	121,000	133,100	146,410	161,051	177,156
Total Other Operations and Maintenance Costs	1,790,000	1,969,000	2,165,900	2,382,490	2,620,739	2,882,813	3,171,094
Total Operations and Maintenance Costs	10,185,600	11,214,460	12,316,002	13,599,126	14,970,152	16,438,265	18,113,318

L22

Annual Operations and Maintenance Costs

Zenein Wastewater Treatment Plant, West Bank

Operations and Maintenance Costs	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Annual Commodities Consumed							
Electricity (kwhr)	28,000,000	28,000,000	28,000,000	28,000,000	28,000,000	28,000,000	28,000,000
Petroleum (liters)	100,000	100,000	100,000	100,000	100,000	100,000	100,000
Diesel (liters)	60,000	60,000	60,000	60,000	60,000	60,000	60,000
Oil (liters)	9,000	9,000	9,000	9,000	9,000	9,000	9,000
Lubricants (kgs)	6,100	6,100	6,100	6,100	6,100	6,100	6,100
Chlorine (tons)	1,650	1,650	1,650	1,650	1,650	1,650	1,650
Annual Commodity Costs (L.E.)							
Electricity	8,120,000	8,960,000	9,800,000	10,920,000	12,040,000	13,160,000	14,560,000
Fuels, Lubricants, and Chemicals							
Petroleum	100,000	110,000	121,000	133,000	146,000	161,000	177,000
Diesel	21,000	23,400	25,800	28,200	31,200	34,200	37,800
Oil	14,400	15,840	17,460	19,170	21,060	23,130	25,470
Lubricants	12,200	13,420	14,762	16,226	17,873	19,642	21,594
Chlorine	2,475,000	2,722,500	2,994,750	3,295,050	3,625,050	3,988,050	4,387,350
Total Fuels, Lubricants, and Chemicals	2,622,600	2,885,160	3,173,772	3,491,646	3,841,183	4,226,022	4,649,214
Total Annual Commodity Costs	10,742,600	11,845,160	12,973,772	14,411,646	15,881,183	17,386,022	19,209,214
Other Operations and Maintenance Costs							
Spare Parts	650,000	715,000	786,500	865,150	951,665	1,046,832	1,151,515
Other Consumables	150,000	165,000	181,500	199,650	219,615	241,577	265,735
Other Direct Operating Expenses	50,000	55,000	60,500	66,550	73,205	80,526	88,579
Total Other Operations and Maintenance Costs	850,000	935,000	1,028,500	1,131,350	1,244,485	1,368,935	1,505,829
Total Operations and Maintenance Costs	11,592,600	12,780,160	14,002,272	15,542,996	17,125,668	18,754,957	20,715,043

Annual Operations and Maintenance Costs

Abu Rawash Pump Station, West Bank

Operations and Maintenance Costs	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Annual Commodities Consumed							
Electricity (kwhr)	7,050,000	7,050,000	7,050,000	7,785,000	8,610,000	9,510,000	10,515,000
Petroleum (liters)	8,750	8,750	8,750	8,750	8,750	8,750	8,750
Diesel (liters)	40,000	40,000	40,000	40,000	40,000	40,000	40,000
Oil (liters)	82,500	82,500	82,500	82,500	82,500	82,500	82,500
Lubricants (kgs)	375	375	375	375	375	375	375
Chlorine (tons)	0	0	0	0	0	0	0
Annual Commodity Costs (L.E.)							
Electricity	2,044,500	2,256,000	2,467,500	3,036,150	3,702,300	4,469,700	5,467,800
Fuels, Lubricants, and Chemicals							
Petroleum	8,750	9,625	10,588	11,638	12,775	14,088	15,488
Diesel	14,000	15,600	17,200	18,800	20,800	22,800	25,200
Oil	132,000	145,200	160,050	175,725	193,050	212,025	233,475
Lubricants	750	825	908	998	1,099	1,208	1,328
Chlorine	0	0	0	0	0	0	0
Total Fuels, Lubricants, and Chemicals	155,500	171,250	188,746	207,161	227,724	250,121	275,491
Total Annual Commodity Costs	2,200,000	2,427,250	2,656,246	3,243,311	3,930,024	4,719,821	5,743,291
Other Operations and Maintenance Costs							
Spare Parts	75,000	82,500	90,750	99,825	109,808	120,789	132,868
Other Consumables	95,000	104,500	114,950	126,445	139,090	152,999	168,299
Other Direct Operating Expenses	25,000	27,500	30,250	33,275	36,603	40,263	44,289
Total Other Operations and Maintenance Costs	195,000	214,500	235,950	259,545	285,501	314,051	345,456
Total Operations and Maintenance Costs	2,395,000	2,641,750	2,892,196	3,502,856	4,215,525	5,033,872	6,088,747

Annual Operations and Maintenance Costs

Boulac Pump Station, West Bank

Operations and Maintenance Costs	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Annual Commodities Consumed							
Electricity (kwhr)	5,100,000	5,100,000	5,100,000	5,400,000	5,700,000	6,030,000	6,375,000
Petroleum (liters)	8,800	8,800	8,800	8,800	8,800	8,800	8,800
Diesel (liters)	40,000	40,000	40,000	40,000	40,000	40,000	40,000
Oil (liters)	7,200	7,200	7,200	7,200	7,200	7,200	7,200
Lubricants (kgs)	450	450	450	450	450	450	450
Chlorine (tons)	0	0	0	0	0	0	0
Annual Commodity Costs (L.E.)							
Electricity	1,479,000	1,632,000	1,785,000	2,106,000	2,451,000	2,834,100	3,315,000
Fuels, Lubricants, and Chemicals							
Petroleum	8,800	9,680	10,648	11,704	12,848	14,168	15,576
Diesel	14,000	15,600	17,200	18,800	20,800	22,800	25,200
Oil	11,520	12,672	13,968	15,336	16,848	18,504	20,376
Lubricants	900	990	1,089	1,197	1,319	1,449	1,593
Chlorine	0	0	0	0	0	0	0
Total Fuels, Lubricants, and Chemicals	35,220	38,942	42,905	47,037	51,815	56,921	62,745
Total Annual Commodity Costs	1,514,220	1,670,942	1,827,905	2,153,037	2,502,815	2,891,021	3,377,745
Other Operations and Maintenance Costs							
Spare Parts	250,000	275,000	302,500	332,750	366,025	402,628	442,891
Other Consumables	60,000	66,000	72,600	79,860	87,846	96,631	106,294
Other Direct Operating Expenses	180,000	198,000	217,800	239,580	263,538	289,892	318,881
Total Other Operations and Maintenance Costs	490,000	539,000	592,900	652,190	717,409	789,151	868,066
Total Operations and Maintenance Costs	2,004,220	2,209,942	2,420,805	2,805,227	3,220,224	3,680,172	4,245,811

Annual Operations and Maintenance Costs

Cheops Pump Station, West Bank

Operations and Maintenance Costs	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Annual Commodities Consumed							
Electricity (kwhr)	0	375,000	375,000	420,000	480,000	540,000	600,000
Petroleum (liters)	0	8,800	8,800	8,800	8,800	8,800	8,800
Diesel (liters)	0	40,000	40,000	40,000	40,000	40,000	40,000
Oil (liters)	0	4,800	4,800	4,800	4,800	4,800	4,800
Lubricants (kgs)	0	300	300	300	300	300	300
Chlorine (tons)	0	0	0	0	0	0	0
Annual Commodity Costs (L.E.)							
Electricity	0	120,000	131,250	163,800	206,400	253,800	312,000
Fuels, Lubricants, and Chemicals							
Petroleum	0	9,680	10,648	11,704	12,848	14,168	15,576
Diesel	0	15,600	17,200	18,800	20,800	22,800	25,200
Oil	0	8,448	9,312	10,224	11,232	12,336	13,584
Lubricants	0	660	726	798	879	966	1,062
Chlorine	0	0	0	0	0	0	0
Total Fuels, Lubricants, and Chemicals	0	34,388	37,886	41,526	45,759	50,270	55,422
Total Annual Commodity Costs	0	154,388	169,136	205,326	252,159	304,070	367,422
Other Operations and Maintenance Costs							
Spare Parts	0	220,000	242,000	266,200	292,820	322,102	354,312
Other Consumables	0	44,000	48,400	53,240	58,564	64,420	70,862
Other Direct Operating Expenses	0	16,500	18,150	19,965	21,962	24,158	26,574
Total Other Operations and Maintenance Costs	0	280,500	308,550	339,405	373,346	410,680	451,748
Total Operations and Maintenance Costs	0	434,888	477,686	544,731	625,505	714,750	819,170

Annual Operations and Maintenance Costs

El Ahram Pump Station, West Bank

Operations and Maintenance Costs	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Annual Commodities Consumed							
Electricity (kwhr)	2,100,000	2,100,000	2,100,000	2,235,000	2,370,000	2,520,000	2,625,000
Petroleum (liters)	8,800	8,800	8,800	8,800	8,800	8,800	8,800
Diesel (liters)	40,000	40,000	40,000	40,000	40,000	40,000	40,000
Oil (liters)	7,200	7,200	7,200	7,200	7,200	7,200	7,200
Lubricants (kgs)	450	450	450	450	450	450	450
Chlorine (tons)	0	0	0	0	0	0	0
Annual Commodity Costs (L.E.)							
Electricity	609,000	672,000	735,000	871,650	1,019,100	1,184,400	1,365,000
Fuels, Lubricants, and Chemicals							
Petroleum	8,800	9,680	10,648	11,704	12,848	14,168	15,576
Diesel	14,000	15,600	17,200	18,800	20,800	22,800	25,200
Oil	11,520	12,672	13,968	15,336	16,848	18,504	20,376
Lubricants	900	990	1,089	1,197	1,319	1,449	1,593
Chlorine	0	0	0	0	0	0	0
Total Fuels, Lubricants, and Chemicals	35,220	38,942	42,905	47,037	51,815	56,921	62,745
Total Annual Commodity Costs	644,220	710,942	777,905	918,687	1,070,915	1,241,321	1,427,745
Other Operations and Maintenance Costs							
Spare Parts	250,000	275,000	302,500	332,750	366,025	402,628	442,891
Other Consumables	60,000	66,000	72,600	79,860	87,846	96,631	106,294
Other Direct Operating Expenses	18,000	19,800	21,780	23,958	26,354	28,989	31,888
Total Other Operations and Maintenance Costs	328,000	360,800	396,880	436,568	480,225	528,248	581,073
Total Operations and Maintenance Costs	972,220	1,071,742	1,174,785	1,355,255	1,551,140	1,769,569	2,008,818

Annual Operations and Maintenance Costs

Embaba Pump Station, West Bank

Operations and Maintenance Costs	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Annual Commodities Consumed							
Electricity (kwhr)	1,725,000	1,725,000	1,725,000	1,785,000	1,845,000	1,890,000	1,965,000
Petroleum (liters)	8,800	8,800	8,800	8,800	8,800	8,800	8,800
Diesel (liters)	40,000	40,000	40,000	40,000	40,000	40,000	40,000
Oil (liters)	4,800	4,800	4,800	4,800	4,800	4,800	4,800
Lubricants (kgs)	300	300	300	300	300	300	300
Chlorine (tons)	0	0	0	0	0	0	0
Annual Commodity Costs (L.E.)							
Electricity	500,250	552,000	603,750	696,150	793,350	888,300	1,021,800
Fuels, Lubricants, and Chemicals							
Petroleum	8,800	9,680	10,648	11,704	12,848	14,168	15,576
Diesel	14,000	15,600	17,200	18,800	20,800	22,800	25,200
Oil	7,680	8,448	9,312	10,224	11,232	12,336	13,584
Lubricants	600	660	726	798	879	966	1,062
Chlorine	0	0	0	0	0	0	0
Total Fuels, Lubricants, and Chemicals	31,080	34,388	37,886	41,526	45,759	50,270	55,422
Total Annual Commodity Costs	531,330	586,388	641,636	737,676	839,109	938,570	1,077,222
Other Operations and Maintenance Costs							
Spare Parts	200,000	220,000	242,000	266,200	292,820	322,102	354,312
Other Consumables	40,000	44,000	48,400	53,240	58,564	64,420	70,862
Other Direct Operating Expenses	15,000	16,500	18,150	19,965	21,962	24,158	26,574
Total Other Operations and Maintenance Costs	255,000	280,500	308,550	339,405	373,346	410,680	451,748
Total Operations and Maintenance Costs	786,330	866,888	950,186	1,077,081	1,212,455	1,349,250	1,528,970

Annual Operations and Maintenance Costs

Giza Pump Station, West Bank

Operations and Maintenance Costs	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Annual Commodities Consumed							
Electricity (kwhr)	2,250,000	2,250,000	2,250,000	2,250,000	2,250,000	2,250,000	2,250,000
Petroleum (liters)	8,800	8,800	8,800	8,800	8,800	8,800	8,800
Diesel (liters)	40,000	40,000	40,000	40,000	40,000	40,000	40,000
Oil (liters)	9,600	9,600	9,600	9,600	9,600	9,600	9,600
Lubricants (kgs)	600	600	600	600	600	600	600
Chlorine (tons)	0	0	0	0	0	0	0
Annual Commodity Costs (L.E.)							
Electricity	652,500	720,000	787,500	877,500	967,500	1,057,500	1,170,000
Fuels, Lubricants, and Chemicals							
Petroleum	8,800	9,680	10,648	11,704	12,848	14,168	15,576
Diesel	14,000	15,600	17,200	18,800	20,800	22,800	25,200
Oil	15,360	16,896	18,624	20,448	22,464	24,672	27,168
Lubricants	1,200	1,320	1,452	1,596	1,758	1,932	2,124
Chlorine	0	0	0	0	0	0	0
Total Fuels, Lubricants, and Chemicals	39,360	43,496	47,924	52,548	57,870	63,572	70,068
Total Annual Commodity Costs	691,860	763,496	835,424	930,048	1,025,370	1,121,072	1,240,068
Other Operations and Maintenance Costs							
Spare Parts	300,000	330,000	363,000	399,300	439,230	483,153	531,468
Other Consumables	80,000	88,000	96,800	106,480	117,128	128,841	141,725
Other Direct Operating Expenses	30,000	33,000	36,300	39,930	43,923	48,315	53,147
Total Other Operations and Maintenance Costs	410,000	451,000	496,100	545,710	600,281	660,309	726,340
Total Operations and Maintenance Costs	1,101,860	1,214,496	1,331,524	1,475,758	1,625,651	1,781,381	1,966,408

Annual Operations and Maintenance Costs

GOSD No. 4 Pump Station, West Bank

Operations and Maintenance Costs	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Annual Commodities Consumed							
Electricity (kwhr)	750,000	750,000	750,000	840,000	945,000	1,065,000	1,200,000
Petroleum (liters)	8,800	8,800	8,800	8,800	8,800	8,800	8,800
Diesel (liters)	40,000	40,000	40,000	40,000	40,000	40,000	40,000
Oil (liters)	4,800	4,800	4,800	4,800	4,800	4,800	4,800
Lubricants (kgs)	300	300	300	300	300	300	300
Chlorine (tons)	0	0	0	0	0	0	0
Annual Commodity Costs (L.E.)							
Electricity	217,500	240,000	262,500	327,600	406,350	500,550	624,000
Fuels, Lubricants, and Chemicals							
Petroleum	8,800	9,680	10,648	11,704	12,848	14,168	15,576
Diesel	14,000	15,600	17,200	18,800	20,800	22,800	25,200
Oil	7,680	8,448	9,312	10,224	11,232	12,336	13,584
Lubricants	600	660	726	798	879	966	1,062
Chlorine	0	0	0	0	0	0	0
Total Fuels, Lubricants, and Chemicals	31,080	34,388	37,886	41,526	45,759	50,270	55,422
Total Annual Commodity Costs	248,580	274,388	300,386	369,126	452,109	550,820	679,422
Other Operations and Maintenance Costs							
Spare Parts	200,000	220,000	242,000	266,200	292,820	322,102	354,312
Other Consumables	40,000	44,000	48,400	53,240	58,564	64,420	70,862
Other Direct Operating Expenses	15,000	16,500	18,150	19,965	21,962	24,158	26,574
Total Other Operations and Maintenance Costs	255,000	280,500	308,550	339,405	373,346	410,680	451,748
Total Operations and Maintenance Costs	503,580	554,888	608,936	708,531	825,455	961,500	1,131,170

Annual Operations and Maintenance Costs

GOSD No. 5 Pump Station, West Bank

Operations and Maintenance Costs	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Annual Commodities Consumed							
Electricity (kwhr)	300,000	300,000	300,000	345,000	390,000	450,000	525,000
Petroleum (liters)	8,800	8,800	8,800	8,800	8,800	8,800	8,800
Diesel (liters)	40,000	40,000	40,000	40,000	40,000	40,000	40,000
Oil (liters)	9,600	9,600	9,600	9,600	9,600	9,600	9,600
Lubricants (kgs)	600	600	600	600	600	600	600
Chlorine (tons)	0	0	0	0	0	0	0
Annual Commodity Costs (L.E.)							
Electricity	87,000	96,000	105,000	134,550	167,700	211,500	273,000
Fuels, Lubricants, and Chemicals							
Petroleum	8,800	9,680	10,648	11,704	12,848	14,168	15,576
Diesel	14,000	15,600	17,200	18,800	20,800	22,800	25,200
Oil	15,360	16,896	18,624	20,448	22,464	24,672	27,168
Lubricants	1,200	1,320	1,452	1,596	1,758	1,932	2,124
Chlorine	0	0	0	0	0	0	0
Total Fuels, Lubricants, and Chemicals	39,360	43,496	47,924	52,548	57,870	63,572	70,068
Total Annual Commodity Costs	126.360	139,496	152,924	187,098	225,570	275,072	343,068
Other Operations and Maintenance Costs							
Spare Parts	300,000	330,000	363,000	399,300	439,230	483,153	531,468
Other Consumables	80,000	88,000	96,800	106,480	117,128	128,841	141,725
Other Direct Operating Expenses	30,000	33,000	36,300	39,930	43,923	48,315	53,147
Total Other Operations and Maintenance Costs	410,000	451,000	496,100	545,710	600,281	660,309	726,340
Total Operations and Maintenance Costs	536,360	590,496	649,024	732,808	825,851	935,381	1,069,408

Annual Operations and Maintenance Costs

Junction Pump Station, West Bank

Operations and Maintenance Costs	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Annual Commodities Consumed							
Electricity (kwhr)	7,050,000	7,050,000	7,050,000	7,725,000	8,475,000	9,285,000	10,185,000
Petroleum (liters)	8,800	8,800	8,800	8,800	8,800	8,800	8,800
Diesel (liters)	40,000	40,000	40,000	40,000	40,000	40,000	40,000
Oil (liters)	9,600	9,600	9,600	9,600	9,600	9,600	9,600
Lubricants (kgs)	600	600	600	600	600	600	600
Chlorine (tons)	0	0	0	0	0	0	0
Annual Commodity Costs (L.E.)							
Electricity	2,044,500	2,256,000	2,467,500	3,012,750	3,644,250	4,363,950	5,296,200
Fuels, Lubricants, and Chemicals							
Petroleum	8,800	9,680	10,648	11,704	12,848	14,168	15,576
Diesel	14,000	15,600	17,200	18,800	20,800	22,800	25,200
Oil	15,360	16,896	18,624	20,448	22,464	24,672	27,168
Lubricants	1,200	1,320	1,452	1,596	1,758	1,932	2,124
Chlorine	0	0	0	0	0	0	0
Total Fuels, Lubricants, and Chemicals	39,360	43,496	47,924	52,548	57,870	63,572	70,068
Total Annual Commodity Costs	2,083,860	2,299,496	2,515,424	3,065,298	3,702,120	4,427,522	5,366,268
Other Operations and Maintenance Costs							
Spare Parts	300,000	330,000	363,000	399,300	439,230	483,153	531,468
Other Consumables	80,000	88,000	96,800	106,480	117,128	128,841	141,725
Other Direct Operating Expenses	30,000	33,000	36,300	39,930	43,923	48,315	53,147
Total Other Operations and Maintenance Costs	410,000	451,000	496,100	545,710	600,281	660,309	726,340
Total Operations and Maintenance Costs	2,493,860	2,750,496	3,011,524	3,611,008	4,302,401	5,087,831	6,092,608

Annual Operations and Maintenance Costs

Pyramids Pump Station, West Bank

Operations and Maintenance Costs	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Annual Commodities Consumed							
Electricity (kwhr)	1,950,000	1,950,000	1,950,000	2,190,000	2,475,000	2,775,000	3,135,000
Petroleum (liters)	8,800	8,800	8,800	8,800	8,800	8,800	8,800
Diesel (liters)	40,000	40,000	40,000	40,000	40,000	40,000	40,000
Oil (liters)	4,800	4,800	4,800	4,800	4,800	4,800	4,800
Lubricants (kgs)	300	300	300	300	300	300	300
Chlorine (tons)	0	0	0	0	0	0	0
Annual Commodity Costs (L.E.)							
Electricity	565,500	624,000	682,500	854,100	1,064,250	1,304,250	1,630,200
Fuels, Lubricants, and Chemicals							
Petroleum	8,800	9,680	10,648	11,704	12,848	14,168	15,576
Diesel	14,000	15,600	17,200	18,800	20,800	22,800	25,200
Oil	7,680	8,448	9,312	10,224	11,232	12,336	13,584
Lubricants	600	660	726	798	879	966	1,062
Chlorine	0	0	0	0	0	0	0
Total Fuels, Lubricants, and Chemicals	31,080	34,388	37,886	41,526	45,759	50,270	55,422
Total Annual Commodity Costs	596,580	658,388	720,386	895,626	1,110,009	1,354,520	1,685,622
Other Operations and Maintenance Costs							
Spare Parts	300,000	330,000	363,000	399,300	439,230	483,153	531,468
Other Consumables	80,000	88,000	96,800	106,480	117,128	128,841	141,725
Other Direct Operating Expenses	30,000	33,000	36,300	39,930	43,923	48,315	53,147
Total Other Operations and Maintenance Costs	410,000	451,000	496,100	545,710	600,281	660,309	726,340
Total Operations and Maintenance Costs	1,006,580	1,109,388	1,216,486	1,441,336	1,710,290	2,014,829	2,411,962

Annual Operations and Maintenance Costs

South Muheit Pump Station, West Bank

Operations and Maintenance Costs	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Annual Commodities Consumed							
Electricity (kwhr)	5,100,000	5,100,000	5,100,000	5,460,000	5,850,000	6,270,000	6,720,000
Petroleum (liters)	8,800	8,800	8,800	8,800	8,800	8,800	8,800
Diesel (liters)	40,000	40,000	40,000	40,000	40,000	40,000	40,000
Oil (liters)	4,800	4,800	4,800	4,800	4,800	4,800	4,800
Lubricants (kgs)	300	300	300	300	300	300	300
Chlorine (tons)	0	0	0	0	0	0	0
Annual Commodity Costs (L.E.)							
Electricity	1,479,000	1,632,000	1,785,000	2,[illegible]	2,515,500	2,946,900	3,494,400
Fuels, Lubricants, and Chemicals							
Petroleum	8,800	9,680	10,648	11,704	12,848	14,168	15,576
Diesel	14,000	15,600	17,200	18,800	20,800	22,800	25,200
Oil	7,680	8,448	9,312	10,224	11,232	12,336	13,584
Lubricants	600	660	726	798	879	966	1,062
Chlorine	0	0	0	0	0	0	0
Total Fuels, Lubricants, and Chemicals	31,080	34,388	37,886	41,526	45,759	50,270	55,422
Total Annual Commodity Costs	1,510,080	1,666,388	1,822,886	2,170,926	2,561,259	2,997,170	3,549,822
Other Operations and Maintenance Costs							
Spare Parts	300,000	330,000	363,000	399,300	439,230	483,153	531,468
Other Consumables	80,000	88,000	96,800	106,480	117,128	128,841	141,725
Other Direct Operating Expenses	30,000	33,000	36,300	39,930	43,923	48,315	53,147
Total Other Operations and Maintenance Costs	410,000	451,000	496,100	545,710	600,281	660,309	726,340
Total Operations and Maintenance Costs	1,920,080	2,117,388	2,318,986	2,716,636	3,161,540	3,657,479	4,276,162

Annual Operations and Maintenance Costs

Zenein Pump Station, West Bank

Operations and Maintenance Costs	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Annual Commodities Consumed							
Electricity (kwhr)	3,450,000	3,450,000	3,450,000	3,600,000	3,780,000	3,960,000	4,140,000
Petroleum (liters)	8,800	8,800	8,800	8,800	8,800	8,800	8,800
Diesel (liters)	40,000	40,000	40,000	40,000	40,000	40,000	40,000
Oil (liters)	14,400	14,400	14,400	14,400	14,400	14,400	14,400
Lubricants (kgs)	900	900	900	900	900	900	900
Chlorine (tons)	0	0	0	0	0	0	0
Annual Commodity Costs (L.E.)							
Electricity	1,000,500	1,104,000	1,207,500	1,404,000	1,625,400	1,861,200	2,152,800
Fuels, Lubricants, and Chemicals							
Petroleum	8,800	9,680	10,648	11,704	12,848	14,168	15,576
Diesel	14,000	15,600	17,200	18,800	20,800	22,800	25,200
Oil	23,040	25,344	27,936	30,672	33,696	37,008	40,752
Lubricants	1,800	1,980	2,178	2,394	2,637	2,898	3,186
Chlorine	0	0	0	0	0	0	0
Total Fuels, Lubricants, and Chemicals	47,640	52,604	57,962	63,570	69,981	76,874	84,714
Total Annual Commodity Costs	1,048,140	1,156,604	1,265,462	1,467,570	1,695,381	1,938,074	2,237,514
Other Operations and Maintenance Costs							
Spare Parts	400,000	440,000	484,000	532,400	585,640	644,204	708,624
Other Consumables	120,000	132,000	145,200	159,720	175,692	193,261	212,587
Other Direct Operating Expenses	20,000	22,000	24,200	26,620	29,282	32,210	35,431
Total Other Operations and Maintenance Costs	540,000	594,000	653,400	718,740	790,614	869,675	956,642
Total Operations and Maintenance Costs	1,588,140	1,750,604	1,918,862	2,186,310	2,485,995	2,807,749	3,194,156

Annual Operations and Maintenance Costs

Berka Wastewater Treatment Plant, East Bank

Operations and Maintenance Costs	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Annual Commodities Consumed							
Electricity (kwhr)	28,050,000	28,050,000	28,050,000	51,000,000	51,000,000	51,000,000	51,000,000
Petroleum (liters)	120,000	120,000	120,000	120,000	120,000	120,000	120,000
Diesel (liters)	360,000	360,000	360,000	360,000	360,000	360,000	360,000
Oil (liters)	9,000	9,000	9,000	9,000	9,000	9,000	9,000
Lubricants (kgs)	6,100	6,100	6,100	6,100	6,100	6,100	6,100
Chlorine (tons)	0	0	0	3,000	3,000	3,000	3,000
Annual Commodity Costs (L.E.)							
Electricity	8,134,500	8,976,000	9,817,500	19,890,000	21,930,000	23,970,000	26,520,000
Fuels, Lubricants, and Chemicals							
Petroleum	120,000	132,000	145,200	159,600	175,200	193,200	212,400
Diesel	126,000	140,400	154,800	169,200	187,200	205,200	226,800
Oil	14,400	15,840	17,460	19,170	21,060	23,130	25,470
Lubricants	12,200	13,420	14,762	16,226	17,873	19,642	21,594
Chlorine	0	0	0	5,991,000	6,591,000	7,251,000	7,977,000
Total Fuels, Lubricants, and Chemicals	272,600	301,660	332,222	6,355,196	6,992,333	7,692,172	8,463,264
Total Annual Commodity Costs	8,407,100	9,277,660	10,149,722	26,245,196	28,922,333	31,662,172	34,983,264
Other Operations and Maintenance Costs							
Spare Parts	2,000,000	2,200,000	2,420,000	2,662,000	2,928,200	3,221,020	3,543,122
Other Consumables	400,000	440,000	484,000	532,400	585,640	644,204	708,624
Other Direct Operating Expenses	110,000	121,000	133,100	146,410	161,051	177,156	194,872
Total Other Operations and Maintenance Costs	2,510,000	2,761,000	3,037,100	3,340,810	3,674,891	4,042,380	4,446,618
Total Operations and Maintenance Costs	10,917,100	12,038,660	13,186,822	29,586,006	32,597,224	35,704,552	39,429,882

242

Annual Operations and Maintenance Costs

Gabal el Asfar Wastewater Treatment Plant, East Bank

Operations and Maintenance Costs	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Annual Commodities Consumed							
Electricity (kwhr)	18,200,000	18,200,000	18,200,000	18,200,000	85,000,000	85,000,000	85,000,000
Petroleum (liters)	24,375	24,375	24,375	24,375	300,000	300,000	300,000
Diesel (liters)	740,000	740,000	740,000	740,000	900,000	900,000	900,000
Oil (liters)	24,600	24,600	24,600	24,600	30,000	30,000	30,000
Lubricants (kgs)	16,400	16,400	16,400	16,400	20,000	20,000	20,000
Chlorine (tons)	0	0	0	0	5,000	5,000	5,000
Annual Commodity Costs (L.E.)							
Electricity	5,278,000	5,824,000	6,370,000	7,098,000	36,550,000	39,950,000	44,200,000
Fuels, Lubricants, and Chemicals							
Petroleum	24,375	26,813	29,494	32,419	438,000	483,000	531,000
Diesel	259,000	288,600	318,200	347,800	468,000	513,000	567,000
Oil	39,360	43,296	47,724	52,398	70,200	77,100	84,900
Lubricants	32,800	36,080	39,688	43,624	58,600	64,400	70,800
Chlorine	0	0	0	0	10,985,000	12,085,000	13,295,000
Total Fuels, Lubricants, and Chemicals	355,535	394,789	435,106	476,241	12,019,800	13,222,500	14,548,700
Total Annual Commodity Costs	5,633,535	6,218,789	6,805,106	7,574,241	48,569,800	53,172,500	58,748,700
Other Operations and Maintenance Costs							
Spare Parts	126,511	139,162	153,078	168,386	5,124,350	5,636,785	6,200,464
Other Consumables	133,953	147,348	162,083	178,291	1,464,100	1,610,510	1,771,561
Other Direct Operating Expenses	238,139	261,953	288,148	316,963	366,025	402,628	442,891
Total Other Operations and Maintenance Costs	498,603	548,463	603,309	663,640	6,954,475	7,649,923	8,414,916
Total Operations and Maintenance Costs	6,132,138	6,767,252	7,408,415	8,237,881	55,524,275	60,822,423	67,163,616

GH2

Annual Operations and Maintenance Costs

Shoubra el Kheima Wastewater Treatment Plant, East Bank

Operations and Maintenance Costs	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Annual Commodities Consumed							
Electricity (kwhr)	7,500,000	10,000,000	15,000,000	15,000,000	15,000,000	15,000,000	15,000,000
Petroleum (liters)	120,000	120,000	120,000	120,000	120,000	120,000	120,000
Diesel (liters)	360,000	360,000	360,000	360,000	360,000	360,000	360,000
Oil (liters)	9,000	9,000	9,000	9,000	9,000	9,000	9,000
Lubricants (kgs)	6,100	6,100	6,100	6,100	6,100	6,100	6,100
Chlorine (tons)	0	0	0	0	0	0	0
Annual Commodity Costs (L.E.)							
Electricity	2,175,000	3,200,000	5,250,000	5,850,000	6,450,000	7,050,000	7,800,000
Fuels, Lubricants, and Chemicals							
Petroleum	120,000	132,000	145,200	159,600	175,200	193,200	212,400
Diesel	126,000	140,400	154,800	169,200	187,200	205,200	226,800
Oil	14,400	15,840	17,460	19,170	21,060	23,130	25,470
Lubricants	12,200	13,420	14,762	16,226	17,873	19,642	21,594
Chlorine	0	0	0	0	0	0	0
Total Fuels, Lubricants, and Chemicals	272,600	301,660	332,222	364,196	401,333	441,172	486,264
Total Annual Commodity Costs	2,447,600	3,501,660	5,582,222	6,214,196	6,851,333	7,491,172	8,286,264
Other Operations and Maintenance Costs							
Spare Parts	2,000,000	2,200,000	2,420,000	2,662,000	2,928,200	3,221,020	3,543,122
Other Consumables	400,000	440,000	484,000	532,400	585,640	644,204	708,624
Other Direct Operating Expenses	110,000	121,000	133,100	146,410	161,051	177,156	194,872
Total Other Operations and Maintenance Costs	2,510,000	2,761,000	3,037,100	3,340,810	3,674,891	4,042,380	4,446,618
Total Operations and Maintenance Costs	4,957,600	6,262,660	8,619,322	9,555,006	10,526,224	11,533,552	12,732,882

Annual Operations and Maintenance Costs

Ameria Pump Station, East Bank

Operations and Maintenance Costs	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Annual Commodities Consumed							
Electricity (kwhr)	15,750,000	18,000,000	19,500,000	19,500,000	19,500,000	19,500,000	19,500,000
Petroleum (liters)	17,600	17,600	17,600	17,600	17,600	17,600	17,600
Diesel (liters)	270,000	270,000	270,000	270,000	270,000	270,000	270,000
Oil (liters)	20,000	20,000	20,000	20,000	20,000	20,000	20,000
Lubricants (kgs)	1,200	1,200	1,200	1,200	1,200	1,200	1,200
Chlorine (tons)	0	0	0	0	0	0	0
Annual Commodity Costs (L.E.)							
Electricity	4,567,500	5,760,000	6,825,000	7,605,000	8,385,000	9,165,000	10,140,000
Fuels, Lubricants, and Chemicals							
Petroleum	17,600	19,360	21,296	23,408	25,696	28,336	31,152
Diesel	94,500	105,300	116,100	126,900	140,400	153,900	170,100
Oil	32,000	35,200	38,800	42,600	46,800	51,400	56,600
Lubricants	2,400	2,640	2,904	3,192	3,516	3,864	4,248
Chlorine	0	0	0	0	0	0	0
Total Fuels, Lubricants, and Chemicals	146,500	162,500	179,100	196,100	216,412	237,500	262,100
Total Annual Commodity Costs	4,714,000	5,922,500	7,004,100	7,801,100	8,601,412	9,402,500	10,402,100
Other Operations and Maintenance Costs							
Spare Parts	400,000	440,000	484,000	532,400	585,640	644,204	708,624
Other Consumables	160,000	176,000	193,600	212,960	234,256	257,682	283,450
Other Direct Operating Expenses	45,000	49,500	54,450	59,895	65,885	72,474	79,721
Total Other Operations and Maintenance Costs	605,000	665,500	732,050	805,255	885,781	974,360	1,071,795
Total Operations and Maintenance Costs	5,319,000	6,588,000	7,736,150	8,606,355	9,487,193	10,376,860	11,473,895

GE

Annual Operations and Maintenance Costs

Ein Shams Pump Station, East Bank

Operations and Maintenance Costs	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Annual Commodities Consumed							
Electricity (kwhr)	3,750,000	3,750,000	3,750,000	3,750,000	3,750,000	3,750,000	3,750,000
Petroleum (liters)	8,800	8,800	8,800	8,800	8,800	8,800	8,800
Diesel (liters)	40,000	40,000	40,000	40,000	40,000	40,000	40,000
Oil (liters)	9,600	9,600	9,600	9,600	9,600	9,600	9,600
Lubricants (kgs)	600	600	600	600	600	600	600
Chlorine (tons)	0	0	0	0	0	0	0
Annual Commodity Costs (L.E.)							
Electricity	1,087,500	1,200,000	1,312,500	1,462,500	1,612,500	1,762,500	1,950,000
Fuels, Lubricants, and Chemicals							
Petroleum	8,800	9,680	10,648	11,704	12,848	14,168	15,576
Diesel	14,000	15,600	17,200	18,800	20,800	22,800	25,200
Oil	15,360	16,896	18,624	20,448	22,464	24,672	27,168
Lubricants	1,200	1,320	1,452	1,596	1,758	1,932	2,124
Chlorine	0	0	0	0	0	0	0
Total Fuels, Lubricants, and Chemicals	39,360	43,496	47,924	52,548	57,870	63,572	70,068
Total Annual Commodity Costs	1,126,860	1,243,496	1,360,424	1,515,048	1,670,370	1,826,072	2,020,068
Other Operations and Maintenance Costs							
Spare Parts	300,000	330,000	363,000	399,300	439,230	483,153	531,468
Other Consumables	80,000	88,000	96,800	106,480	117,128	128,841	141,725
Other Direct Operating Expenses	3,000	3,300	3,630	3,993	4,392	4,831	5,314
Total Other Operations and Maintenance Costs	383,000	421,300	463,430	509,773	560,750	616,825	678,507
Total Operations and Maintenance Costs	1,509,860	1,664,796	1,823,854	2,024,821	2,231,120	2,442,897	2,698,575

Annual Operations and Maintenance Costs

Khalag Pump Station, East Bank

Operations and Maintenance Costs	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Annual Commodities Consumed							
Electricity (kwhr)	0	0	0	0	15,000,000	15,000,000	15,000,000
Petroleum (liters)	0	0	0	0	12,000	12,000	12,000
Diesel (liters)	0	0	0	0	100,000	100,000	100,000
Oil (liters)	0	0	0	0	2,000	2,000	2,000
Lubricants (kgs)	0	0	0	0	1,200	1,200	1,200
Chlorine (tons)	0	0	0	0	0	0	0
Annual Commodity Costs (L.E.)							
Electricity	0	0	0	0	6,450,000	7,050,000	7,800,000
Fuels, Lubricants, and Chemicals							
Petroleum	0	0	0	0	17,520	19,320	21,240
Diesel	0	0	0	0	52,000	57,000	63,000
Oil	0	0	0	0	4,680	5,140	5,660
Lubricants	0	0	0	0	3,516	3,864	4,248
Chlorine	0	0	0	0	0	0	0
Total Fuels, Lubricants, and Chemicals	0	0	0	0	77,716	85,324	94,148
Total Annual Commodity Costs	0	0	0	0	6,527,716	7,135,324	7,894,148
Other Operations and Maintenance Costs							
Spare Parts	0	0	0	0	439,230	483,153	531,468
Other Consumables	0	0	0	0	219,615	241,577	265,735
Other Direct Operating Expenses	0	0	0	0	14,641	16,105	17,716
Total Other Operations and Maintenance Costs	0	0	0	0	673,486	740,835	814,919
Total Operations and Maintenance Costs	0	0	0	0	7,201,202	7,876,159	8,709,067

Annual Operations and Maintenance Costs

Koussous Pump Station, East Bank

Operations and Maintenance Costs	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Annual Commodities Consumed							
Electricity (kwhr)	11,250,000	16,500,000	20,250,000	20,250,000	20,250,000	20,250,000	20,250,000
Petroleum (liters)	12,000	12,000	12,000	12,000	12,000	12,000	12,000
Diesel (liters)	100,000	100,000	100,000	100,000	100,000	100,000	100,000
Oil (liters)	2,000	2,000	2,000	2,000	2,000	2,000	2,000
Lubricants (kgs)	1,200	1,200	1,200	1,200	1,200	1,200	1,200
Chlorine (tons)	0	0	0	0	0	0	0
Annual Commodity Costs (L.E.)							
Electricity	3,262,500	5,280,000	7,087,500	7,897,500	8,707,500	9,517,500	10,530,000
Fuels, Lubricants, and Chemicals							
Petroleum	12,000	13,200	14,520	15,960	17,520	19,320	21,240
Diesel	35,000	39,000	43,000	47,000	52,000	57,000	63,000
Oil	3,200	3,520	3,880	4,260	4,680	5,140	5,660
Lubricants	2,400	2,640	2,904	3,192	3,516	3,864	4,248
Chlorine	0	0	0	0	0	0	0
Total Fuels, Lubricants, and Chemicals	52,600	58,360	64,304	70,412	77,716	85,324	94,148
Total Annual Commodity Costs	3,315,100	5,338,360	7,151,804	7,967,912	8,785,216	9,602,824	10,624,148
Other Operations and Maintenance Costs							
Spare Parts	300,000	330,000	363,000	399,300	439,230	483,153	531,468
Other Consumables	150,000	165,000	181,500	199,650	219,615	241,577	265,735
Other Direct Operating Expenses	10,000	11,000	12,100	13,310	14,641	16,105	17,716
Total Other Operations and Maintenance Costs	460,000	506,000	556,600	612,260	673,486	740,835	814,919
Total Operations and Maintenance Costs	3,775,100	5,844,360	7,708,404	8,580,172	9,458,702	10,343,659	11,439,067

Annual Operations and Maintenance Costs

Helwan Wastewater Treatment Plant, South Region

Operations and Maintenance Costs	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Annual Commodities Consumed							
Electricity (kwhr)	23,100,000	24,255,000	25,468,000	26,741,000	28,078,000	29,482,000	30,956,000
Petroleum (liters)	90,000	90,000	90,000	90,000	90,000	90,000	90,000
Diesel (liters)	270,000	270,000	270,000	270,000	270,000	270,000	270,000
Oil (liters)	6,750	6,750	6,750	6,750	6,750	6,750	6,750
Lubricants (kgs)	6,100	6,100	6,100	6,100	6,100	6,100	6,100
Chlorine (tons)	900	900	900	900	900	900	900
Annual Commodity Costs (L.E.)							
Electricity	6,699,000	7,761,600	8,913,800	10,428,990	12,073,540	13,856,540	16,097,120
Fuels, Lubricants, and Chemicals							
Petroleum	90,000	99,000	108,900	119,700	131,400	144,900	159,300
Diesel	94,500	105,300	116,100	126,900	140,400	153,900	170,100
Oil	10,800	11,880	13,095	14,378	15,795	17,348	19,103
Lubricants	12,200	13,420	14,762	16,226	17,873	19,642	21,594
Chlorine	1,350,000	1,485,000	1,633,500	1,797,300	1,977,300	2,175,300	2,393,100
Total Fuels, Lubricants, and Chemicals	1,557,500	1,714,600	1,886,357	2,074,504	2,282,768	2,511,090	2,763,197
Total Annual Commodity Costs	8,256,500	9,476,200	10,800,157	12,503,494	14,356,308	16,367,630	18,860,317
Other Operations and Maintenance Costs							
Spare Parts	2,000,000	2,200,000	2,420,000	2,662,000	2,928,200	3,221,020	3,543,122
Other Consumables	300,000	330,000	363,000	399,300	439,230	483,153	531,468
Other Direct Operating Expenses	60,000	66,000	72,600	79,860	87,846	96,631	106,294
Total Other Operations and Maintenance Costs	2,360,000	2,596,000	2,855,600	3,141,160	3,455,276	3,800,804	4,180,884
Total Operations and Maintenance Costs	10,616,500	12,072,200	13,655,757	15,644,654	17,811,584	20,168,434	23,041,201

Annual Operations and Maintenance Costs

Helwan Pump Station, South Region

Operations and Maintenance Costs	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Annual Commodities Consumed							
Electricity (kwhr)	11,853,240	11,853,240	11,853,240	11,853,240	11,853,240	11,853,240	11,853,240
Petroleum (liters)	8,800	8,800	8,800	8,800	8,800	8,800	8,800
Diesel (liters)	40,000	40,000	40,000	40,000	40,000	40,000	40,000
Oil (liters)	9,600	9,600	9,600	9,600	9,600	9,600	9,600
Lubricants (kgs)	1,200	1,200	1,200	1,200	1,200	1,200	1,200
Chlorine (tons)	0	0	0	0	0	0	0
Annual Commodity Costs (L.E.)							
Electricity	3,437,440	3,793,037	4,148,634	4,622,764	5,096,893	5,571,023	6,163,685
Fuels, Lubricants, and Chemicals							
Petroleum	8,800	9,680	10,648	11,704	12,848	14,168	15,576
Diesel	14,000	15,600	17,200	18,800	20,800	22,800	25,200
Oil	15,360	16,896	18,624	20,448	22,464	24,672	27,168
Lubricants	2,400	2,640	2,904	3,192	3,516	3,864	4,248
Chlorine	0	0	0	0	0	0	0
Total Fuels, Lubricants, and Chemicals	40,560	44,816	49,376	54,144	59,628	65,504	72,192
Total Annual Commodity Costs	3,478,000	3,837,853	4,198,010	4,676,908	5,156,521	5,636,527	6,235,877
Other Operations and Maintenance Costs							
Spare Parts	600,000	660,000	726,000	798,600	878,460	966,306	1,062,937
Other Consumables	80,000	88,000	96,800	106,480	117,128	128,841	141,725
Other Direct Operating Expenses	20,000	22,000	24,200	26,620	29,282	32,210	35,431
Total Other Operations and Maintenance Costs	700,000	770,000	847,000	931,700	1,024,870	1,127,357	1,240,093
Total Operations and Maintenance Costs	4,178,000	4,607,853	5,045,010	5,608,608	6,181,391	6,763,884	7,475,970

APPENDIX E

ANNUAL DIRECT PROJECT COSTS AND CAPITAL OUTLAY COSTS

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Appendix E
Annual Direct Project Costs and Capital Outlay Costs

This appendix presents historical and projections of future annual direct project costs and capital outlay costs for GOSD treatment plants and pumping stations. The costs combine the salaries and operations and maintenance costs provided in the two prior appendices, and reflect total costs of each facility. These facilities are listed below.

Wastewater Treatment Plants	Pumping Stations	
West Bank		
Abu Rawash	Abu Rawash	GOSD No. 4
Zenein	Boulac	GOSD No. 5
	Cheops	Junction
	El Ahram	Pyramids
	Embaba	South Muheit
	Giza	Zenein
East Bank		
Berka	Ameria	Khulag
Gabal el Asfar	Ein Shams	Koussous
Shoubra el Kheima		
South		
Helwan	Helwan	

Annual Direct Project Costs and Capital Outlay Costs

Abu Rawash Wastewater Treatment Plant, West Bank
(L.E.)

Cost Category	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Direct Project Costs							
Salaries	1,319,612	1,636,379	1,750,931	1,873,450	2,004,607	2,144,964	2,295,104
Operations and Maintenance							
Electricity	2,900,000	3,200,000	3,500,000	3,900,000	4,300,000	4,700,000	5,200,000
Fuels, Lubricants, and Chemicals	5,415,600	6,045,460	6,650,102	7,316,636	8,049,413	8,855,452	9,742,224
Spare Parts and Other Consumables	1,690,000	1,859,000	2,044,900	2,249,390	2,474,329	2,721,762	2,993,938
Other Direct Operating Expenses	100,000	110,000	121,000	133,100	146,410	161,051	177,156
Total Operations and Maintenance Costs	10,185,600	11,214,460	12,316,002	13,599,126	14,970,152	16,438,265	18,113,318
Total Direct Project Costs	11,505,212	12,850,839	14,066,933	15,472,576	16,974,759	18,583,229	20,408,422
Capital Outlay Costs							
Land							
Construction	75,000,000	11,250,000	11,250,000	11,250,000	11,250,000	11,250,000	11,250,000
Equipment	19,800,000	12,300,000	12,300,000	12,300,000	12,300,000	12,300,000	12,300,000
Transportation							
Other							
Total Capital Outlay Costs	94,800,000	23,550,000	23,550,000	23,550,000	23,550,000	23,550,000	23,550,000

252

Annual Direct Project Costs and Capital Outlay Costs

Zenein Wastewater Treatment Plant, West Bank
(L.E.)

Cost Category	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Direct Project Costs							
Salaries	1,023,418	1,269,085	1,357,925	1,452,944	1,554,662	1,663,515	1,779,955
Operations and Maintenance							
Electricity	8,120,000	8,960,000	9,800,000	10,920,000	12,040,000	13,160,000	14,560,000
Fuels, Lubricants, and Chemicals	2,622,600	2,885,160	3,173,772	3,491,646	3,841,183	4,226,022	4,649,214
Spare Parts and Other Consumables	800,000	880,000	968,000	1,064,800	1,171,280	1,288,409	1,417,250
Other Direct Operating Expenses	50,000	55,000	60,500	66,550	73,205	80,526	88,579
Total Operations and Maintenance Costs	11,592,600	12,780,160	14,002,272	15,542,996	17,125,668	18,754,957	20,715,043
Total Direct Project Costs	12,616,018	14,049,245	15,360,197	16,995,940	18,680,330	20,418,472	22,494,998
Capital Outlay Costs							
Land							
Construction							
Equipment							
Transportation							
Other							
Total Capital Outlay Costs	0	0	0	0	0	0	0

Annual Direct Project Costs and Capital Outlay Costs

Abu Rawash Pump Station, West Bank
(L.E.)

Cost Category	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Direct Project Costs							
Salaries	99,707	123,641	132,296	141,553	151,463	162,068	173,412
Operations and Maintenance							
Electricity	2,044,500	2,256,000	2,467,500	3,036,150	3,702,300	4,469,700	5,467,800
Fuels, Lubricants, and Chemicals	155,500	171,250	188,746	207,161	227,724	250,121	275,491
Spare Parts and Other Consumables	170,000	187,000	205,700	226,270	248,898	273,788	301,167
Other Direct Operating Expenses	25,000	27,500	30,250	33,275	36,603	40,263	44,289
Total Operations and Maintenance Costs	2,395,000	2,641,750	2,892,196	3,502,856	4,215,525	5,033,872	6,088,747
Total Direct Project Costs	2,494,707	2,765,391	3,024,492	3,644,409	4,366,988	5,195,940	6,262,159
Capital Outlay Costs							
Land							
Construction							
Equipment							
Transportation							
Other							
Total Capital Outlay Costs	0	0	0	0	0	0	0

Annual Direct Project Costs and Capital Outlay Costs

Boulac Pump Station, West Bank
(L.E.)

Cost Category	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Direct Project Costs							
Salaries	99,707	123,641	132,296	141,553	151,463	162,068	173,412
Operations and Maintenance							
Electricity	1,479,000	1,632,000	1,785,000	2,106,000	2,451,000	2,834,100	3,315,000
Fuels, Lubricants, and Chemicals	35,220	38,942	42,905	47,037	51,815	56,921	62,745
Spare Parts and Other Consumables	310,000	341,000	375,100	412,610	453,871	499,259	549,185
Other Direct Operating Expenses	180,000	198,000	217,800	239,580	263,538	289,892	318,881
Total Operations and Maintenance Costs	2,004,220	2,209,942	2,420,805	2,805,227	3,220,224	3,680,172	4,245,811
Total Direct Project Costs	2,103,927	2,333,583	2,553,101	2,946,780	3,371,687	3,842,240	4,419,223
Capital Outlay Costs							
Land							
Construction							
Equipment							
Transportation							
Other							
Total Capital Outlay Costs	0	0	0	0	0	0	0

Annual Direct Project Costs and Capital Outlay Costs

Cheops Pump Station, West Bank
(L.E.)

Cost Category	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Direct Project Costs							
Salaries	0	176,840	189,219	202,459	216,633	231,801	248,026
Operations and Maintenance							
Electricity	0	120,000	131,250	163,800	206,400	253,800	312,000
Fuels, Lubricants, and Chemicals	0	34,388	37,886	41,526	45,759	50,270	55,422
Spare Parts and Other Consumables	0	264,000	290,400	319,440	351,384	386,522	425,174
Other Direct Operating Expenses	0	16,500	18,150	19,965	21,962	24,158	26,574
Total Operations and Maintenance Costs	0	434,888	477,686	544,731	625,505	714,750	819,170
Total Direct Project Costs	0	611,728	666,905	747,190	842,138	946,551	1,067,196
Capital Outlay Costs							
Land							
Construction							
Equipment	5,000,000	1,250,000	1,250,000	1,250,000	1,250,000	1,250,000	1,250,000
Transportation							
Other							
Total Capital Outlay Costs	5,000,000	1,250,000	1,250,000	1,250,000	1,250,000	1,250,000	1,250,000

LS2

Annual Direct Project Costs and Capital Outlay Costs

El Ahram Pump Station, West Bank
(L.E.)

Cost Category	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Direct Project Costs							
Salaries	56,806	70,442	75,373	80,647	86,293	92,335	98,798
Operations and Maintenance							
Electricity	609,000	672,000	735,000	871,650	1,019,100	1,184,400	1,365,000
Fuels, Lubricants, and Chemicals	35,220	38,942	42,905	47,037	51,815	56,921	62,745
Spare Parts and Other Consumables	310,000	341,000	375,100	412,610	453,871	499,259	549,185
Other Direct Operating Expenses	18,000	19,800	21,780	23,958	26,354	28,989	31,888
Total Operations and Maintenance Costs	972,220	1,071,742	1,174,785	1,355,255	1,551,140	1,769,569	2,008,818
Total Direct Project Costs	1,029,026	1,142,184	1,250,158	1,435,902	1,637,433	1,861,904	2,107,616
Capital Outlay Costs							
Land							
Construction							
Equipment							
Transportation							
Other							
Total Capital Outlay Costs	0	0	0	0	0	0	0

Annual Direct Project Costs and Capital Outlay Costs

Embaba Pump Station, West Bank
(L.E.)

Cost Category	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Direct Project Costs							
Salaries	142,608	176,840	189,219	202,459	216,633	231,801	248,026
Operations and Maintenance							
Electricity	500,250	552,000	603,750	696,150	793,350	888,300	1,021,800
Fuels, Lubricants, and Chemicals	31,080	34,388	37,886	41,526	45,759	50,270	55,422
Spare Parts and Other Consumables	240,000	264,000	290,400	319,440	351,384	386,522	425,174
Other Direct Operating Expenses	15,000	16,500	18,150	19,965	21,962	24,158	26,574
Total Operations and Maintenance Costs	786,330	866,888	950,186	1,077,081	1,212,455	1,349,250	1,528,970
Total Direct Project Costs	928,938	1,043,728	1,139,405	1,279,540	1,429,088	1,581,051	1,776,996
Capital Outlay Costs							
Land							
Construction							
Equipment							
Transportation							
Other							
Total Capital Outlay Costs	0	0	0	0	0	0	0

Annual Direct Project Costs and Capital Outlay Costs

Giza Pump Station, West Bank
(L.E.)

Cost Category	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Direct Project Costs							
Salaries	385,729	478,318	511,810	547,618	585,955	626,979	670,868
Operations and Maintenance							
Electricity	652,500	720,000	787,500	877,500	967,500	1,057,500	1,170,000
Fuels, Lubricants, and Chemicals	39,360	43,496	47,924	52,548	57,870	63,572	70,068
Spare Parts and Other Consumables	380,000	418,000	459,800	505,780	556,358	611,994	673,193
Other Direct Operating Expenses	30,000	33,000	36,300	39,930	43,923	48,315	53,147
Total Operations and Maintenance Costs	1,101,860	1,214,496	1,331,524	1,475,758	1,625,651	1,781,381	1,966,408
Total Direct Project Costs	1,487,589	1,692,814	1,843,334	2,023,376	2,211,606	2,408,360	2,637,276
Capital Outlay Costs							
Land							
Construction							
Equipment							
Transportation							
Other							
Total Capital Outlay Costs	0	0	0	0	0	0	0

Annual Direct Project Costs and Capital Outlay Costs

GOSD No. 4 Pump Station, West Bank
(L.E.)

Cost Category	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Direct Project Costs							
Salaries	142,608	176,840	189,219	202,459	216,633	231,801	248,026
Operations and Maintenance							
Electricity	217,500	240,000	262,500	327,600	406,350	500,550	624,000
Fuels, Lubricants, and Chemicals	31,080	34,388	37,886	41,526	45,759	50,270	55,422
Spare Parts and Other Consumables	240,000	264,000	290,400	319,440	351,384	386,522	425,174
Other Direct Operating Expenses	15,000	16,500	18,150	19,965	21,962	24,158	26,574
Total Operations and Maintenance Costs	503,580	554,888	608,936	708,531	825,455	961,500	1,131,170
Total Direct Project Costs	646,188	731,728	798,155	910,990	1,042,088	1,193,301	1,379,196
Capital Outlay Costs							
Land							
Construction							
Equipment							
Transportation							
Other							
Total Capital Outlay Costs	0	0	0	0	0	0	0

Annual Direct Project Costs and Capital Outlay Costs

GOSD No. 5 Pump Station, West Bank
(L.E.)

Cost Category	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Direct Project Costs							
Salaries	142,608	176,840	189,219	202,459	216,633	231,801	248,026
Operations and Maintenance							
Electricity	87,000	96,000	105,000	134,550	167,700	211,500	273,000
Fuels, Lubricants, and Chemicals	39,360	43,496	47,924	52,548	57,870	63,572	70,068
Spare Parts and Other Consumables	380,000	418,000	459,800	505,780	556,358	611,994	673,193
Other Direct Operating Expenses	30,000	33,000	36,300	39,930	43,923	48,315	53,147
Total Operations and Maintenance Costs	536,360	590,496	649,024	732,808	825,851	935,381	1,069,408
Total Direct Project Costs	678,968	767,336	838,243	935,267	1,042,484	1,167,182	1,317,434
Capital Outlay Costs							
Land							
Construction							
Equipment							
Transportation							
Other							
Total Capital Outlay Costs	0	0	0	0	0	0	0

Annual Direct Project Costs and Capital Outlay Costs

Junction Pump Station, West Bank
(L.E.)

Cost Category	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Direct Project Costs							
Salaries	127,517	158,127	169,196	181,035	193,709	207,272	221,780
Operations and Maintenance							
Electricity	2,044,500	2,256,000	2,467,500	3,012,750	3,644,250	4,363,950	5,296,200
Fuels, Lubricants, and Chemicals	39,360	43,496	47,924	52,548	57,870	63,572	70,068
Spare Parts and Other Consumables	380,000	418,000	459,800	505,780	556,358	611,994	673,193
Other Direct Operating Expenses	30,000	33,000	36,300	39,930	43,923	48,315	53,147
Total Operations and Maintenance Costs	2,493,860	2,750,496	3,011,524	3,611,008	4,302,401	5,087,831	6,092,608
Total Direct Project Costs	2,621,377	2,908,623	3,180,720	3,792,043	4,496,110	5,295,103	6,314,388
Capital Outlay Costs							
Land							
Construction							
Equipment							
Transportation							
Other							
Total Capital Outlay Costs	0	0	0	0	0	0	0

Annual Direct Project Costs and Capital Outlay Costs

Pyramids Pump Station, West Bank
(L.E.)

Cost Category	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Direct Project Costs							
Salaries	142,608	176,840	189,219	202,459	216,633	231,801	248,026
Operations and Maintenance							
Electricity	565,500	624,000	682,500	854,100	1,064,250	1,304,250	1,630,200
Fuels, Lubricants, and Chemicals	31,080	34,388	37,886	41,526	45,759	50,270	55,422
Spare Parts and Other Consumables	380,000	418,000	459,800	505,780	556,358	611,994	673,193
Other Direct Operating Expenses	30,000	33,000	36,300	39,930	43,923	48,315	53,147
Total Operations and Maintenance Costs	1,006,580	1,109,388	1,216,486	1,441,336	1,710,290	2,014,829	2,411,962
Total Direct Project Costs	1,149,188	1,286,228	1,405,705	1,643,795	1,926,923	2,246,630	2,659,988
Capital Outlay Costs							
Land							
Construction							
Equipment							
Transportation							
Other							
Total Capital Outlay Costs	0	0	0	0	0	0	0

Annual Direct Project Costs and Capital Outlay Costs

South Muheit Pump Station, West Bank
(L.E.)

Cost Category	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Direct Project Costs							
Salaries	127,517	158,127	169,196	181,035	193,709	207,272	221,780
Operations and Maintenance							
Electricity	1,479,000	1,632,000	1,785,000	2,129,400	2,515,500	2,946,900	3,494,400
Fuels, Lubricants, and Chemicals	31,080	34,388	37,886	41,526	45,759	50,270	55,422
Spare Parts and Other Consumables	380,000	418,000	459,800	505,780	556,358	611,994	673,193
Other Direct Operating Expenses	30,000	33,000	36,300	39,930	43,923	48,315	53,147
Total Operations and Maintenance Costs	1,920,080	2,117,388	2,318,986	2,716,636	3,161,540	3,657,479	4,276,162
Total Direct Project Costs	2,047,597	2,275,515	2,488,182	2,897,671	3,355,249	3,864,751	4,497,942
Capital Outlay Costs							
Land							
Construction							
Equipment							
Transportation							
Other							
Total Capital Outlay Costs	0	0	0	0	0	0	0

Annual Direct Project Costs and Capital Outlay Costs

Zenein Pump Station, West Bank
(L.E.)

Cost Category	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Direct Project Costs							
Salaries	142,608	176,840	189,219	202,459	216,633	231,801	248,026
Operations and Maintenance							
Electricity	1,000,500	1,104,000	1,207,500	1,404,000	1,625,400	1,861,200	2,152,800
Fuels, Lubricants, and Chemicals	47,640	52,604	57,962	63,570	69,981	76,874	84,714
Spare Parts and Other Consumables	520,000	572,000	629,200	692,120	761,332	837,465	921,211
Other Direct Operating Expenses	20,000	22,000	24,200	26,620	29,282	32,210	35,431
Total Operations and Maintenance Costs	1,588,140	1,750,604	1,918,862	2,186,310	2,485,995	2,807,749	3,194,156
Total Direct Project Costs	1,730,748	1,927,444	2,108,081	2,388,769	2,702,628	3,039,550	3,442,182
Capital Outlay Costs							
Land							
Construction							
Equipment							
Transportation							
Other							
Total Capital Outlay Costs	0	0	0	0	0	0	0

Annual Direct Project Costs and Capital Outlay Costs

Berka Wastewater Treatment Plant, East Bank
(L.E.)

Cost Category	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Direct Project Costs							
Salaries	1,314,060	1,629,494	1,743,564	2,808,471	3,005,087	3,215,494	3,440,567
Operations and Maintenance							
Electricity	8,134,500	9,976,000	9,817,500	19,890,000	21,930,000	23,970,000	26,520,000
Fuels, Lubricants, and Chemicals	272,600	301,660	332,222	6,355,196	6,992,333	7,692,172	8,463,264
Spare Parts and Other Consumables	2,400,000	2,640,000	2,904,000	3,194,400	3,513,840	3,865,224	4,251,746
Other Direct Operating Expenses	110,000	121,000	133,100	146,410	161,051	177,156	194,872
Total Operations and Maintenance Costs	10,917,100	12,038,660	13,186,822	29,586,006	32,597,224	35,704,552	39,429,882
Total Direct Project Costs	12,231,160	13,668,154	14,930,386	32,394,477	35,602,311	38,920,046	42,870,449
Capital Outlay Costs							
Land							
Construction							
Equipment							
Transportation							
Other							
Total Capital Outlay Costs	0	0	0	0	0	0	0

Annual Direct Project Costs and Capital Outlay Costs

Gabal el Asfar Wastewater Treatment Plant, East Bank
(L.E.)

Cost Category	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Direct Project Costs							
Salaries	1,116,513	1,384,527	1,481,448	1,585,110	3,053,084	3,266,853	3,495,521
Operations and Maintenance							
Electricity	5,278,000	5,824,000	6,370,000	7,098,000	36,550,000	39,950,000	44,200,000
Fuels, Lubricants, and Chemicals	355,535	394,789	435,106	476,241	12,019,800	13,222,500	14,548,700
Spare Parts and Other Consumables	260,464	286,510	315,161	346,677	6,588,450	7,247,295	7,972,025
Other Direct Operating Expenses	238,139	261,953	288,148	316,963	366,025	402,628	442,891
Total Operations and Maintenance Costs	6,132,138	6,767,252	7,408,415	8,237,881	55,524,275	60,822,423	67,163,616
Total Direct Project Costs	7,248,651	8,151,779	8,889,863	9,822,991	58,577,359	64,089,276	70,659,137
Capital Outlay Costs							
Land	1,860,000	698,000	698,000	698,000	698,000	698,000	698,000
Construction	35,000,000	66,250,000	66,250,000	66,250,000	66,250,000	66,250,000	66,250,000
Equipment	8,600,000	42,600,000	42,600,000	42,600,000	42,600,000	42,600,000	42,600,000
Transportation							
Other							
Total Capital Outlay Costs	45,460,000	109,548,000	109,548,000	109,548,000	109,548,000	109,548,000	109,548,000

Annual Direct Project Costs and Capital Outlay Costs

Shoubra el Kheima Wastewater Treatment Plant, East Bank
(L.E.)

Cost Category	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Direct Project Costs							
Salaries	1,023,418	1,269,085	1,357,925	1,452,944	1,554,662	1,663,515	1,779,955
Operations and Maintenance							
Electricity	2,175,000	3,200,000	5,250,000	5,850,000	6,450,000	7,050,000	7,800,000
Fuels, Lubricants, and Chemicals	272,600	301,660	332,222	364,196	401,333	441,172	486,264
Spare Parts and Other Consumables	2,400,000	2,640,000	2,904,000	3,194,400	3,513,840	3,865,224	4,251,746
Other Direct Operating Expenses	110,000	121,000	133,100	146,410	161,051	177,156	194,872
Total Operations and Maintenance Costs	4,957,600	6,262,660	8,619,322	9,555,006	10,526,224	11,533,552	12,732,882
Total Direct Project Costs	5,981,018	7,531,745	9,977,247	11,007,950	12,080,886	13,197,067	14,512,837
Capital Outlay Costs							
Land							
Construction							
Equipment							
Transportation							
Other							
Total Capital Outlay Costs	0	0	0	0	0	0	0

Annual Direct Project Costs and Capital Outlay Costs

Ameria Pump Station, East Bank
(L.E.)

Cost Category	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Direct Project Costs							
Salaries	792,509	982,747	1,051,542	1,125,122	1,203,890	1,288,183	1,378,351
Operations and Maintenance							
Electricity	4,567,500	5,760,000	6,825,000	7,605,000	8,385,000	9,165,000	10,140,000
Fuels, Lubricants, and Chemicals	146,500	162,500	179,100	196,100	216,412	237,500	262,100
Spare Parts and Other Consumables	560,000	616,000	677,600	745,360	819,896	901,886	992,074
Other Direct Operating Expenses	45,000	49,500	54,450	59,895	65,885	72,474	79,721
Total Operations and Maintenance Costs	5,319,000	6,588,000	7,736,150	8,606,355	9,487,193	10,376,860	11,473,895
Total Direct Project Costs	6,111,509	7,570,747	8,787,692	9,731,477	10,691,083	11,665,043	12,852,246
Capital Outlay Costs							
Land							
Construction	493,000	0	0	0	0	0	0
Equipment	400,000	0	0	0	0	0	0
Transportation							
Other							
Total Capital Outlay Costs	893,000	0	0	0	0	0	0

Annual Direct Project Costs and Capital Outlay Costs

Ein Shams Pump Station, East Bank
(L.E.)

Cost Category	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Direct Project Costs							
Salaries	609,927	756,337	809,283	865,911	926,532	991,405	1,060,800
Operations and Maintenance							
Electricity	1,087,500	1,200,000	1,312,500	1,462,500	1,612,500	1,762,500	1,950,000
Fuels, Lubricants, and Chemicals	39,360	43,496	47,924	52,548	57,870	63,572	70,068
Spare Parts and Other Consumables	380,000	418,000	459,800	505,780	556,358	611,994	673,193
Other Direct Operating Expenses	3,000	3,300	3,630	3,993	4,392	4,831	5,314
Total Operations and Maintenance Costs	1,509,860	1,664,796	1,823,854	2,024,821	2,231,120	2,442,897	2,698,575
Total Direct Project Costs	2,119,787	2,421,133	2,633,137	2,890,732	3,157,652	3,434,302	3,759,375
Capital Outlay Costs							
Land							
Construction							
Equipment							
Transportation							
Other							
Total Capital Outlay Costs	0	0	0	0	0	0	0

Annual Direct Project Costs and Capital Outlay Costs

Khalag Pump Station, East Bank
(L.E.)

Cost Category	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Direct Project Costs							
Salaries	0	0	0	0	523,358	560,002	599,200
Operations and Maintenance							
Electricity	0	0	0	0	6,450,000	7,050,000	7,800,000
Fuels, Lubricants, and Chemicals	0	0	0	0	77,716	85,324	94,148
Spare Parts and Other Consumables	0	0	0	0	658,845	724,730	797,203
Other Direct Operating Expenses	0	0	0	0	14,641	16,105	17,716
Total Operations and Maintenance Costs	0	0	0	0	7,201,202	7,876,159	8,709,067
Total Direct Project Costs	0	0	0	0	7,724,560	8,436,161	9,308,267
Capital Outlay Costs							
Land							
Construction							
Equipment							
Transportation							
Other							
Total Capital Outlay Costs	0	0	0	0	0	0	0

Annual Direct Project Costs and Capital Outlay Costs

Koussous Pump Station, East Bank
(L.E.)

Cost Category	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Direct Project Costs							
Salaries	373,517	463,178	495,602	530,281	567,405	607,133	649,630
Operations and Maintenance							
Electricity	3,262,500	5,280,000	7,087,500	7,897,500	8,707,500	9,517,500	10,530,000
Fuels, Lubricants, and Chemicals	52,600	58,360	64,304	70,412	77,716	85,324	94,148
Spare Parts and Other Consumables	450,000	495,000	544,500	598,950	658,845	724,730	797,203
Other Direct Operating Expenses	10,000	11,000	12,100	13,310	14,641	16,105	17,716
Total Operations and Maintenance Costs	3,775,100	5,844,360	7,708,404	8,580,172	9,458,702	10,343,659	11,439,067
Total Direct Project Costs	4,148,617	6,307,538	8,204,006	9,110,453	10,026,107	10,950,792	12,088,697
Capital Outlay Costs							
Land							
Construction							
Equipment							
Transportation							
Other							
Total Capital Outlay Costs	0	0	0	0	0	0	0

Annual Direct Project Costs and Capital Outlay Costs

Helwan Wastewater Treatment Plant, South Region
(L.E.)

Cost Category	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Direct Project Costs							
Salaries	359,612	445,935	477,152	510,540	546,282	584,531	625,446
Operations and Maintenance							
Electricity	6,699,000	7,761,600	8,913,800	10,428,990	12,073,540	13,856,540	16,097,120
Fuels, Lubricants, and Chemicals	1,557,500	1,714,600	1,886,357	2,074,504	2,282,768	2,511,090	2,763,197
Spare Parts and Other Consumables	2,300,000	2,530,000	2,783,000	3,061,300	3,367,430	3,704,173	4,074,590
Other Direct Operating Expenses	60,000	66,000	72,600	79,860	87,846	96,631	106,294
Total Operations and Maintenance Costs	10,616,500	12,072,200	13,655,757	15,644,654	17,811,584	20,168,434	23,041,201
Total Direct Project Costs	10,976,112	12,518,135	14,132,909	16,155,194	18,357,866	20,752,965	23,666,647
Capital Outlay Costs							
Land	10,000	0	0	0	0	0	0
Construction	539,000	0	0	0	0	0	0
Equipment	1,993,000	0	0	0	0	0	0
Transportation							
Other							
Total Capital Outlay Costs	2,542,000	0	0	0	0	0	0

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Annual Direct Project Costs and Capital Outlay Costs

Helwan Pump Station, South Region
(L.E.)

Cost Category	Fiscal Year						
	Estimated		Projected				
	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Direct Project Costs							
Salaries	687,250	852,221	911,879	975,686	1,043,992	1,117,089	1,195,281
Operations and Maintenance							
Electricity	3,437,440	3,793,037	4,148,634	4,622,764	5,096,893	5,571,023	6,163,685
Fuels, Lubricants, and Chemicals	40,560	44,816	49,376	54,144	59,628	65,504	72,192
Spare Parts and Other Consumables	680,000	748,000	822,800	905,080	995,588	1,095,147	1,204,662
Other Direct Operating Expenses	20,000	22,000	24,200	26,620	29,282	32,210	35,431
Total Operations and Maintenance Costs	4,178,000	4,607,853	5,045,010	5,608,608	6,181,391	6,763,884	7,475,970
Total Direct Project Costs	4,865,250	5,460,074	5,956,889	6,584,294	7,225,383	7,880,973	8,671,251
Capital Outlay Costs							
Land	550,000	0	0	0	0	0	0
Construction	386,000	0	0	0	0	0	0
Equipment							
Transportation							
Other							
Total Capital Outlay Costs	936,000	0	0	0	0	0	0

APPENDIX F

ALLOCATION OF REVENUE REQUIREMENTS TO CUSTOMER CLASSES

ERNST & YOUNG

Appendix F
Allocation of Revenue Requirements to Customer Classes

This appendix provides information on how revenue requirements are allocated to each customer class. The first two series of charts show: (1) the percentage of functional costs (collection, treatment, disposal, utility billing, and general administration costs) allocated to each customer class in each of the five years of the rate study, and (2) the resulting costs allocated from functional categories to each customer class each year. A one page exhibit summarizes the total costs allocated to each customer class for all five years. The final page presents the recommended wastewater surcharges for each fiscal year.

Percentage of Functional Costs Allocated to Each Customer Class

Fiscal Year 1994/95

Customer Class	Functional Cost Category				
	Collection	Treatment	Disposal	Utility Billing	General Administration
1. Domestic	70.71%	55.28%	70.71%	91.48%	70.71%
2. Government	19.43%	30.38%	19.43%	1.88%	19.43%
3. Small Factories and Shops	5.44%	8.51%	5.44%	5.72%	5.44%
4. Large Industrial Factories	1.98%	3.10%	1.98%	0.06%	1.98%
5. Tourism and Investment	1.05%	1.65%	1.05%	0.11%	1.05%
6. Worship and Charities	0.83%	0.65%	0.83%	0.66%	0.83%
7. Sports Clubs and Embassies	0.56%	0.43%	0.56%	0.09%	0.56%
Total	100.00%	100.00%	100.00%	100.00%	100.00%

278

Percentage of Functional Costs Allocated to Each Customer Class

Fiscal Year 1996/97

Customer Class	Functional Cost Category				
	Collection	Treatment	Disposal	Utility Billing	General Administration
1. Domestic	71.79%	56.59%	71.79%	91.81%	71.79%
2. Government	18.59%	29.30%	18.59%	1.78%	18.59%
3. Small Factories and Shops	5.31%	8.38%	5.31%	5.52%	5.31%
4. Large Industrial Factories	1.92%	3.03%	1.92%	0.05%	1.92%
5. Tourism and Investment	1.05%	1.65%	1.05%	0.11%	1.05%
6. Worship and Charities	0.81%	0.64%	0.81%	0.64%	0.81%
7. Sports Clubs and Embassies	0.53%	0.41%	0.53%	0.09%	0.53%
Total	100.00%	100.00%	100.00%	100.00%	100.00%

Percentage of Functional Costs Allocated to Each Customer Class

Fiscal Year 1995/96

Customer Class	Functional Cost Category				
	Collection	Treatment	Disposal	Utility Billing	General Administration
1. Domestic	71.25%	55.93%	71.25%	91.64%	71.25%
2. Government	19.01%	29.84%	19.01%	1.83%	19.01%
3. Small Factories and Shops	5.38%	8.44%	5.38%	5.62%	5.38%
4. Large Industrial Factories	1.95%	3.07%	1.95%	0.06%	1.95%
5. Tourism and Investment	1.05%	1.65%	1.05%	0.11%	1.05%
6. Worship and Charities	0.82%	0.64%	0.82%	0.65%	0.82%
7. Sports Clubs and Embassies	0.54%	0.43%	0.54%	0.09%	0.54%
Total	100.00%	100.00%	100.00%	100.00%	100.00%

Percentage of Functional Costs Allocated to Each Customer Class

Fiscal Year 1997/98

Customer Class	Functional Cost Category				
	Collection	Treatment	Disposal	Utility Billing	General Administration
1. Domestic	72.32%	57.24%	72.32%	91.97%	72.32%
2. Government	18.17%	28.76%	18.17%	1.73%	18.17%
3. Small Factories and Shops	5.25%	8.31%	5.25%	5.42%	5.25%
4. Large Industrial Factories	1.90%	3.00%	1.90%	0.05%	1.90%
5. Tourism and Investment	1.04%	1.65%	1.04%	0.11%	1.04%
6. Worship and Charities	0.80%	0.63%	0.80%	0.63%	0.80%
7. Sports Clubs and Embassies	0.52%	0.41%	0.52%	0.09%	0.52%
Total	100.00%	100.00%	100.00%	100.00%	100.00%

Percentage of Functional Costs Allocated to Each Customer Class

Fiscal Year 1998/99

Customer Class	Functional Cost Category				
	Collection	Treatment	Disposal	Utility Billing	General Administration
1. Domestic	72.85%	57.88%	72.85%	92.12%	72.85%
2. Government	17.77%	28.23%	17.77%	1.68%	17.77%
3. Small Factories and Shops	5.19%	8.24%	5.19%	5.33%	5.19%
4. Large Industrial Factories	1.87%	2.97%	1.87%	0.05%	1.87%
5. Tourism and Investment	1.04%	1.65%	1.04%	0.11%	1.04%
6. Worship and Charities	0.79%	0.63%	0.79%	0.63%	0.79%
7. Sports Clubs and Embassies	0.49%	0.40%	0.49%	0.08%	0.49%
Total	100.00%	100.00%	100.00%	100.00%	100.00%

Allocation of Functional Costs to Customer Classes

Fiscal Year 1994/95
(LE 000s)

Customer Class	Functional Cost Category					Total
	Collection	Treatment	Disposal	Utility Billing	General Administration	
1. Domestic	18,206	20,227	3,832	0	0	42,265
2. Government	5,003	11,116	1,053	0	0	17,172
3. Small Factories and Shops	1,401	3,114	295	0	0	4,810
4. Large Industrial Factories	510	1,134	107	0	0	1,751
5. Tourism and Investment	270	604	57	0	0	931
6. Worship and Charities	214	238	45	0	0	497
7. Sports Clubs and Embassies	143	157	31	0	0	331
Total	25,747	36,590	5,420	0	0	67,757

Allocation of Functional Costs to Customer Classes

Fiscal Year 1995/96
(LE 000s)

Customer Class	Functional Cost Category					Total
	Collection	Treatment	Disposal	Utility Billing	General Administration	
1. Domestic	27,688	36,018	5,538	0	0	69,244
2. Government	7,387	19,217	1,477	0	0	28,081
3. Small Factories and Shops	2,091	5,435	418	0	0	7,944
4. Large Industrial Factories	758	1,977	152	0	0	2,887
5. Tourism and Investment	408	1,063	82	0	0	1,553
6. Worship and Charities	319	412	64	0	0	795
7. Sports Clubs and Embassies	210	277	41	0	0	528
Total	38,861	64,399	7,772	0	0	111,032

Allocation of Functional Costs to Customer Classes

Fiscal Year 1996/97
(LE 000s)

Customer Class	Functional Cost Category					Total
	Collection	Treatment	Disposal	Utility Billing	General Administration	
1. Domestic	38,841	63,276	10,358	0	0	112,475
2. Government	10,058	32,762	2,682	0	0	45,502
3. Small Factories and Shops	2,873	9,370	766	0	0	13,009
4. Large Industrial Factories	1,039	3,388	277	0	0	4,704
5. Tourism and Investment	568	1,845	151	0	0	2,564
6. Worship and Charities	438	716	117	0	0	1,271
7. Sports Clubs and Embassies	287	458	77	0	0	822
Total	54,104	111,815	14,428	0	0	180,347

Allocation of Functional Costs to Customer Classes

Fiscal Year 1997/98
(LE 000s)

Customer Class	Functional Cost Category					Total
	Collection	Treatment	Disposal	Utility Billing	General Administration	
1. Domestic	76,954	85,391	13,954	0	14,516	190,815
2. Government	19,334	42,904	3,506	0	3,647	69,391
3. Small Factories and Shops	5,586	12,397	1,013	0	1,054	20,050
4. Large Industrial Factories	2,022	4,475	367	0	381	7,245
5. Tourism and Investment	1,107	2,461	201	0	209	3,978
6. Worship and Charities	851	940	154	0	161	2,106
7. Sports Clubs and Embassies	554	613	100	0	104	1,371
Total	106,408	149,181	19,295	0	20,072	294,956

Allocation of Functional Costs to Customer Classes

Fiscal Year 1998/99
(LE 000s)

Customer Class	Functional Cost Category					Total
	Collection	Treatment	Disposal	Utility Billing	General Administration	
1. Domestic	120,045	148,577	21,285	0	15,646	305,553
2. Government	29,282	72,466	5,192	0	3,816	110,756
3. Small Factories and Shops	8,552	21,152	1,516	0	1,115	32,335
4. Large Industrial Factories	3,081	7,624	546	0	402	11,653
5. Tourism and Investment	1,714	4,236	304	0	223	6,477
6. Worship and Charities	1,302	1,617	231	0	170	3,320
7. Sports Clubs and Embassies	808	1,027	143	0	105	2,083
Total	164,784	256,699	29,217	0	21,477	472,177

System–Wide Costs by Customer Class (a)

(LE 000s)

Customer Class	Fiscal Year				
	1994/95	1995/96	1996/97	1997/98	1998/99
1. Domestic	42,265	69,244	112,475	190,815	305,553
2. Government	17,172	28,081	45,502	69,391	110,756
3. Small Factories and Shops	4,810	7,944	13,009	20,050	32,335
4. Large Industrial Factories	1,751	2,887	4,704	7,245	11,653
5. Tourism and Investment	931	1,553	2,564	3,978	6,477
6. Worship and Charities	497	795	1,271	2,106	3,320
7. Sports Clubs and Embassies	331	528	822	1,371	2,083
Total	67,757	111,032	180,347	294,956	472,177

(a) Costs to be recovered by wastewater charges.

Recommended Wastewater Surcharges

Customer Class	Fiscal Year				
	1994/95	1995/96	1996/97	1997/98	1998/99
Computed Wastewater Surcharge					
1. Domestic					
0–60 cubic meters	52%	82%	130%	213%	331%
>60 cubic meters	52%	82%	130%	213%	331%
2. Government	114%	125%	165%	197%	275%
3. Small Factories and Shops	37%	61%	99%	150%	240%
4. Large Industrial Factories	28%	45%	73%	112%	178%
5. Tourism and Investment	16%	26%	41%	63%	100%
6. Worship and Charities	73%	115%	182%	297%	463%
7. Sports Clubs and Embassies	45%	71%	111%	185%	281%
Adjustments					
1. Domestic					
0–60 cubic meters	−17%	−32%	−55%	−103%	−166%
>60 cubic meters	−12%	−22%	−40%	−83%	−141%
2. Government	−14%	25%	65%	148%	260%
3. Small Factories and Shops	53%	69%	96%	145%	180%
4. Large Industrial Factories	57%	70%	87%	113%	132%
5. Tourism and Investment	59%	69%	84%	92%	95%
6. Worship and Charities	7%	−15%	−52%	−132%	−253%
7. Sports Clubs and Embassies	40%	54%	74%	105%	119%
Proposed Wastewater Surcharge					
1. Domestic					
0–60 cubic meters	35%	50%	75%	110%	165%
>60 cubic meters	40%	60%	90%	130%	190%
2. Government	100%	150%	230%	345%	535%
3. Small Factories and Shops	90%	130%	195%	295%	420%
4. Large Industrial Factories	85%	115%	160%	225%	310%
5. Tourism and Investment	75%	95%	125%	155%	195%
6. Worship and Charities	80%	100%	130%	165%	210%
7. Sports Clubs and Embassies	85%	125%	185%	290%	400%

APPENDIX G

ESTIMATED REGIONAL COSTS

ERNST & YOUNG

Appendix G
Estimated Regional Costs

This appendix presents the total and adjusted salary, operations and maintenance, capital costs, revenue offsets, total revenue requirements, projected water revenues and wastewater service charge revenues for the West Bank, East Bank, and South region. These projections are used to estimate regional based wastewater charges.

West Bank Total Costs by Line Item

(LE 000s)

Cost Category	Fiscal Year				
	1994/95	1995/96	1996/97	1997/98	1998/99
Salaries					
Direct Project Salary Costs	5,434	5,815	6,222	6,657	7,123
Direct Regional Salary Costs	5,681	6,079	6,504	6,959	7,447
Indirect Administrative Salary Costs	8,143	7,688	6,215	6,650	7,116
Total Salary Costs	19,258	19,582	18,941	20,266	21,686
Operations and Maintenance					
Direct Project Operating Costs					
Electricity	26,320	30,434	34,903	39,736	45,882
Fuels, Lubricants, and Chemicals	10,490	11,538	12,694	13,964	15,364
Spare Parts and Other Consumables	7,768	8,545	9,400	10,339	11,373
Other Direct Project Operating Expenses	711	783	861	947	1,042
Direct Regional Operating Expenses	447	492	541	595	655
Total Operations and Maintenance Costs	45,736	51,792	58,399	65,581	74,316
Capital Costs					
Maintenance Capital Projects	43,045	46,008	48,972	51,935	54,898
New Capital Projects	2,261	4,522	6,782	9,043	11,304
Existing Capital Projects	406	406	406	406	406
Reserve Fund Contributions:					
Operating	791	1,139	1,240	1,346	1,614
Debt Service	2,652	2,248	2,248	2,248	2,248
Total Capital Costs	49,155	54,323	59,648	64,978	70,470
Total Expenditures	114,149	125,697	136,988	150,825	166,472

West Bank Adjusted Costs by Line Item (a)

(LE 000s)

Cost Category	Fiscal Year				
	1994/95	1995/96	1996/97	1997/98	1998/99
Salaries					
Direct Project Salary Costs	0	0	0	6,657	7,123
Direct Regional Salary Costs	0	0	0	6,959	7,447
Indirect Administrative Salary Costs	0	0	0	6,650	7,116
Total Salary Costs	0	0	0	20,266	21,686
Operations and Maintenance					
Direct Project Operating Costs					
Electricity	17,898	26,569	32,111	39,736	45,882
Fuels, Lubricants, and Chemicals	8,392	10,384	11,678	13,964	15,364
Spare Parts and Other Consumables	6,214	7,691	8,648	10,339	11,373
Other Direct Project Operating Expenses	569	705	792	947	1,042
Direct Regional Operating Expenses	358	443	498	595	655
Total Operations and Maintenance Costs	33,431	45,792	53,727	65,581	74,316
Capital Costs					
Maintenance Capital Projects	0	0	0	2,077	54,398
New Capital Projects	0	0	0	0	0
Existing Capital Projects	0	0	0	0	0
Reserve Fund Contributions:					
Operating	0	0	0	1,346	1,614
Debt Service	0	0	0	0	0
Total Capital Costs	0	0	0	3,423	56,512
Total Adjusted Expenditures	33,431	45,792	53,727	89,270	152,514

(a) Adjusted based on autonomy assumptions.

West Bank Revenue Requirements

(LE 000s)

Item	Fiscal Year				
	1994/95	1995/96	1996/97	1997/98	1998/99
Expenditures					
Salaries	0	0	0	20,266	21,686
Operations and Maintenance	33,431	45,792	53,727	65,581	74,316
Capital	0	0	0	3,423	56,512
Total Adjusted Costs	33,431	45,792	53,727	89,270	152,514
Revenue Offsets					
Operating Revenues	6,128	5,531	4,277	6,326	6,430
Capital Revenues	63	58	46	48	51
Total Revenue Offsets	6,191	5,589	4,323	6,374	6,481
Revenue Requirements					
Salaries	0	0	0	20,266	21,686
Operations and Maintenance	27,303	40,261	49,450	59,255	67,886
Capital	(63)	(58)	(46)	3,375	56,461
Total Revenue Requirements	27,240	40,203	49,404	82,896	146,033

West Bank Revenue Requirements by Customer Class

(LE 000s)

Customer Class	Fiscal Year				
	1994/95	1995/96	1996/97	1997/98	1998/99
1. Domestic	16,952	25,073	30,811	53,636	94,356
2. Government	6,903	10,168	12,465	19,496	34,354
3. Small Factories and Shops	1,934	2,876	3,564	5,633	10,030
4. Large Industrial Factories	704	1,045	1,289	2,036	3,615
5. Tourism and Investment	375	563	702	1,117	2,009
6. Worship and Charities	200	287	348	591	1,025
7. Sports Clubs and Embassies	132	191	225	387	644
Total	27,240	40,203	49,404	82,896	146,033

Projected West Bank Water Revenues

Item	Fiscal Year				
	1994/95	1995/96	1996/97	1997/98	1998/99
Water Supply Charge per Cubic Meter (LE)					
1. Domestic					
0–60 cubic meters	0.10	0.10	0.10	0.10	0.10
>60 cubic meters	0.13	0.13	0.13	0.13	0.13
2. Government	0.20	0.20	0.20	0.20	0.20
3. Small Factories and Shops	0.23	0.23	0.23	0.23	0.23
4. Large Industrial Factories	0.31	0.31	0.31	0.31	0.31
5. Tourism and Investment	0.55	0.55	0.55	0.55	0.55
6. Worship and Charities	0.08	0.08	0.08	0.08	0.08
7. Sports Clubs and Embassies	0.13	0.13	0.13	0.13	0.13
Annual Amount Billed (LE 000s)					
1. Domestic					
0–60 cubic meters	16,110	16,690	17,291	17,914	18,559
>60 cubic meters	13,962	14,465	14,986	15,525	16,084
2. Government	14,646	14,646	14,646	14,646	14,646
3. Small Factories and Shops	4,769	4,845	4,923	5,001	5,081
4. Large Industrial Factories	2,182	2,182	2,182	2,182	2,182
5. Tourism and Investment	2,186	2,229	2,274	2,319	2,366
6. Worship and Charities	254	259	264	269	275
7. Sports Clubs and Embassies	285	285	285	285	285
Total Annual Amount Billed	54,394	55,601	56,851	58,141	59,478
Annual Amount Collected (LE 000s) (a)					
1. Domestic					
0–60 cubic meters	12,888	13,352	13,833	14,331	14,847
>60 cubic meters	11,170	11,572	11,989	12,420	12,867
2. Government	4,394	6,591	8,055	10,252	11,717
3. Small Factories and Shops	3,815	3,876	3,938	4,001	4,065
4. Large Industrial Factories	1,746	1,746	1,746	1,746	1,746
5. Tourism and Investment	1,749	1,783	1,819	1,855	1,893
6. Worship and Charities	203	207	211	215	220
7. Sports Clubs and Embassies	228	228	228	228	228
Total Annual Water Revenues	36,193	39,355	41,819	45,048	47,583

West Bank Wastewater Service Charge Revenues

(LE 000s)

Customer Class	Fiscal Year				
	1994/95	1995/96	1996/97	1997/98	1998/99
1. Domestic					
0–60 cubic meters	9,150	13,486	16,461	28,805	25,982
>60 cubic meters	7,931	11,688	14,267	24,964	25,734
2. Government	6,899	10,150	12,485	19,479	65,615
3. Small Factories and Shops	1,946	2,868	3,584	5,641	18,089
4. Large Industrial Factories	698	1,048	1,292	2,043	5,762
5. Tourism and Investment	367	571	709	1,113	3,881
6. Worship and Charities	201	288	348	591	495
7. Sports Clubs and Embassies	132	192	226	388	992
Total West Bank Service Charge Revenues	27,324	40,291	49,372	83,024	146,550

L52

East Bank Total Costs by Line Item

(LE 000s)

Cost Category	Fiscal Year				
	1994/95	1995/96	1996/97	1997/98	1998/99
Salaries					
Direct Project Salary Costs	8,328	9,854	12,424	13,295	14,225
Direct Regional Salary Costs	20,583	22,023	23,565	25,215	26,979
Indirect Administrative Salary Costs	7,824	9,396	12,065	12,910	13,813
Total Salary Costs	36,735	41,273	48,054	51,420	55,017
Operations and Maintenance					
Direct Project Operating Costs					
Electricity	49,725	64,855	107,255	117,893	131,201
Fuels, Lubricants, and Chemicals	3,327	9,644	22,185	24,405	26,854
Spare Parts and Other Consumables	11,411	12,552	20,673	22,740	25,014
Other Direct Project Operating Expenses	722	793	905	995	1,095
Direct Regional Operating Expenses	355	391	430	473	520
Total Operations and Maintenance Costs	65,540	88,235	151,448	166,506	184,684
Capital Costs					
Maintenance Capital Projects	71,280	77,347	83,414	89,481	95,548
New Capital Projects	4,590	9,180	13,771	18,361	22,951
Existing Capital Projects	824	824	824	824	824
Reserve Fund Contributions:					
Operating	1,878	4,277	11,221	2,930	3,478
Debt Service	5,429	4,603	4,603	4,603	4,603
Total Capital Costs	84,001	96,231	113,833	116,199	127,404
Total Expenditures	186,276	225,739	313,335	334,125	367,105

East Bank Adjusted Costs by Line Item (a)

(LE 000s)

Cost Category	Fiscal Year				
	1994/95	1995/96	1996/97	1997/98	1998/99
Salaries					
Direct Project Salary Costs	0	0	0	13,295	14,225
Direct Regional Salary Costs	0	0	0	25,215	26,979
Indirect Administrative Salary Costs	0	0	0	12,910	13,813
Total Salary Costs	0	0	0	51,420	55,017
Operations and Maintenance					
Direct Project Operating Costs					
Electricity	33,813	56,618	98,675	117,893	131,201
Fuels, Lubricants, and Chemicals	2,662	8,680	20,410	24,405	26,854
Spare Parts and Other Consumables	9,129	11,297	19,019	22,740	25,014
Other Direct Project Operating Expenses	578	714	833	995	1,095
Direct Regional Operating Expenses	284	352	396	473	520
Total Operations and Maintenance Costs	46,466	77,661	139,333	166,506	184,684
Capital Costs					
Maintenance Capital Projects	0	0	0	3,580	95,548
New Capital Projects	0	0	0	0	0
Existing Capital Projects	0	0	0	0	0
Reserve Fund Contributions:					
Operating	0	0	0	2,930	3,478
Debt Service	0	0	0	0	0
Total Capital Costs	0	0	0	6,510	99,026
Total Adjusted Expenditures	46,466	77,661	139,333	224,436	338,727

(a) Adjusted based on autonomy assumptions.

East Bank Revenue Requirements

(LE 000s)

Item	Fiscal Year				
	1994/95	1995/96	1996/97	1997/98	1998/99
Expenditures					
Salaries	0	0	0	51,420	55,017
Operations and Maintenance	46,466	77,661	139,333	166,506	184,684
Capital	0	0	0	6,510	99,026
Total Adjusted Costs	46,466	77,661	139,333	224,436	338,727
Revenue Offsets					
Operating Revenues	5,889	6,761	8,301	12,282	12,485
Capital Revenues	60	71	89	94	98
Total Revenue Offsets	5,949	6,832	8,390	12,376	12,583
Revenue Requirements					
Salaries	0	0	0	51,420	55,017
Operations and Maintenance	40,577	70,900	131,032	154,224	172,199
Capital	(60)	(71)	(89)	6,416	98,928
Total Revenue Requirements	40,517	70,829	130,943	212,060	326,144

East Bank Revenue Requirements by Customer Class

(LE 000s)

Customer Class	Fiscal Year				
	1994/95	1995/96	1996/97	1997/98	1998/99
1. Domestic	25,273	44,171	81,664	137,179	211,197
2. Government	10,269	17,913	33,037	49,895	76,402
3. Small Factories and Shops	2,876	5,068	9,445	14,417	22,305
4. Large Industrial Factories	1,047	1,842	3,415	5,209	8,038
5. Tourism and Investment	556	990	1,862	2,861	4,468
6. Worship and Charities	297	508	923	1,515	2,295
7. Sports Clubs and Embassies	199	337	597	984	1,439
Total	40,517	70,829	130,943	212,060	326,144

Projected East Bank Water Revenues

Item	Fiscal Year				
	1994/95	1995/96	1996/97	1997/98	1998/99
Water Supply Charge per Cubic Meter (LE)					
1. Domestic					
0–60 cubic meters	0.10	0.10	0.10	0.10	0.10
>60 cubic meters	0.13	0.13	0.13	0.13	0.13
2. Government	0.20	0.20	0.20	0.20	0.20
3. Small Factories and Shops	0.23	0.23	0.23	0.23	0.23
4. Large Industrial Factories	0.31	0.31	0.31	0.31	0.31
5. Tourism and Investment	0.55	0.55	0.55	0.55	0.55
6. Worship and Charities	0.08	0.08	0.08	0.08	0.08
7. Sports Clubs and Embassies	0.13	0.13	0.13	0.13	0.13
Annual Amount Billed (LE 000s)					
1. Domestic					
0–60 cubic meters	38,464	39,618	40,806	42,030	43,291
>60 cubic meters	33,336	34,335	35,365	36,427	37,519
2. Government	35,349	35,419	35,490	35,561	35,632
3. Small Factories and Shops	11,333	11,447	11,561	11,677	11,794
4. Large Industrial Factories	5,725	5,794	5,863	5,934	6,005
5. Tourism and Investment	5,272	5,378	5,485	5,596	5,706
6. Worship and Charities	597	603	609	616	621
7. Sports Clubs and Embassies	640	640	640	640	640
Total Annual Amount Billed	130,716	133,234	135,819	138,481	141,208
Annual Amount Collected (LE 000s) (a)					
1. Domestic					
0–60 cubic meters	30,771	31,694	32,645	33,624	34,633
>60 cubic meters	26,668	27,468	28,292	29,142	30,015
2. Government	10,605	15,938	19,520	24,893	28,505
3. Small Factories and Shops	9,067	9,158	9,249	9,341	9,435
4. Large Industrial Factories	4,580	4,635	4,690	4,747	4,804
5. Tourism and Investment	4,217	4,303	4,388	4,477	4,565
6. Worship and Charities	478	483	487	493	497
7. Sports Clubs and Embassies	512	512	512	512	512
Total Annual Water Revenues	86,898	94,191	99,783	107,229	112,966

East Bank Wastewater Service Charge Revenues

(LE 000s)

Customer Class	Fiscal Year				
	1994/95	1995/96	1996/97	1997/98	1998/99
1. Domestic					
0–60 cubic meters	13,539	23,771	43,744	73,637	55,413
>60 cubic meters	11,734	20,601	37,911	63,821	55,528
2. Government	10,287	17,851	32,989	49,786	149,651
3. Small Factories and Shops	2,901	5,037	9,434	14,385	39,155
4. Large Industrial Factories	1,053	1,854	3,424	5,222	14,892
5. Tourism and Investment	548	990	1,843	2,865	8,674
6. Worship and Charities	296	507	925	1,514	1,069
7. Sports Clubs and Embassies	200	338	599	983	2,202
Total East Bank Service Charge Revenues	40,558	70,949	130,869	212,213	326,584