EGYPT - WATER AND WASTEWATER SECTOR ASSESSMENT

Final Report

USAID / Cairo

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Summary

Review of the Urban Water and Wastewater Sector in Egypt: Findings and Recommendations for USAID - Financed Programs

AID and the GOE have made substantial investments in the water and wastewater sector. Since 1978 AID has committed more than US $1 billion in support of projects to rehabilitate and expand existing systems in Cairo, Alexandria, the Canal Cities of Ismailia, Port Said and Suez, and the Provincial Cities of Fayoum, Beni Suef and El Minyia. GOE investments in the sector have increased dramatically over the last two decades, increasing from L.E. 93.2 million in the 1960's to L.E. 620.9 million in the 1970's. In the current five year plan (1982/83-1986/87), the GOE has earmarked L.E. 3.4 billion (with facilities) for investment. This current level of investment is approximately five times the amount spent in the previous two decades, not adjusted for inflation.

These investments (1) reflect the high degree of AID and GOE interest in improving conditions in the sector, and (2) have had a significant effect on rehabilitating, upgrading and expanding physical works in the project cities. Since many of the AID investments have financed projects that are about to "come on line," the Office of Urban Administration and Development (UAD) of the United States Agency for International Development (USAID), requested a review and assessment of selected urban water and wastewater systems, and the agencies and organizations responsible for implementation and operation of the systems.

This review was conducted between February 6 and March 15, 1985, and (1) assessed the capacity of the GOE organizations in the sector to operate and maintain the physical works and (2) suggested measures that could be employed to enhance organizational effectiveness.

The findings and recommendations that appear below, and are documented in Chapters 1 through 5 of the report that follows, were reviewed with Mr. Ali el Hakim, Undersecretary for Public Utilities of the Ministry of Housing and Public Utilities, and Mr. Hazem El Abd, Chairman of the National Organization for Potable Water and Sanitary Drainage (NOPWASD) on March 13, 1985.

During the meetings held to review the Findings and Recommendations, there was general agreement that the material was a largely accurate reflection of conditions in the urban water and wastewater sector, and that most of the recommendations were appropriate. Mr. Ali el Hakim and Chaimran El Abd emphasized the objectives of the Government of Egypt in the sector, and suggested that it was imperative to strengthen the coordinating, supervisory, training and regulating roles of NOPWASD. It was noted that a strong leadership role for NOPWASD was not inconsistent with the Government of Egypt's decentralization policy, as long as this leadership was linked closely with the autonomy of the operating agencies at the local and provincial levels.

In addition to urging the development of NOPWASD, the officials requested AID assistance in (1) operations and maintenance training, (2) the development of improved revenue systems, and (3) defining a "phased" approach to meeting the existing GOE technical standards and legal mandates pertaining to the design, construction and operation of the physical works.

The Findings and Recommendations of the Team follow.

Chapter 1: Management Capability and Institutional Development

Findings

Organizations responsible for designing and building capital projects, as well as those responsible for operating and maintaining existing and planned water supply and sewerage systems, are too often weak and ineffective. This is a key constraint to improving service delivery. Contributing factors are: non-responsive, non-directive management systems; insufficient trained and dedicated management and technical staff; and, poor construction management and operations and maintenance (O&M) practices.

Donor efforts to address these constraints by financing studies and attaching management advisors to implementing organizations have met with mixed success. Consultants who saw their function as surrogate project manager(s) for foreign assisted activities have fared better than those who issued prescriptive reports recommending structural and staffing changes.

The on-going dialogue between the donor community (principally the Agency for International Development, AID) and the GOE has produced an agreement in principle to carry out institutional and financial reforms considered essential to ensuring the sustainability of AID's and the GOE's sizeable investment in the sector.

Despite the cumulative positive effect of the policy dialogue and management advisory services, a number of key constraints to improving management capability remain, including: GOE personnel policies (guaranteed employment and compensation practices) which result in overemployment, on the one hand, and a lack of trained managers and technical personnel, on the other; insufficient operational and financial autonomy; and ineffective coordination between national and local organizations with regard to planning, implementation, and operations.

Planned approaches to ameliorating these constraints include: providing institutional development assistance through the Institutional and Human Resource Development (IHRD Project); direct expatriate assistance for O and M; management advisory services and/or twinning relationships for operating agencies, and greater autonomy for operating agencies.

Recommendations

AID should continue its current dual approach to strengthening sector management capabilities -- through continued policy dialogue and the provision of management/technical advisory services.

AID should re-consider some Memorandum of Understanding (MOU) objectives -- for example, those calling for autonomy and construction management -- and modify others to reflect the current status of its thinking with regard to needed institutional and financial reforms. In order to move discussions beyond agreement in principle to MOU objectives, AID should continue a parallel dialogue with local leaders, especially the Cairo General Organization for Sanitary Drainage (CGOSD), who will be responsible for operating and maintaining the bulk of AID-financed system improvements.

While the objective of past and on-going management advisory services contracts -- to make sector organizations more effective -- remains valid, the approach taken has too often been prescriptive and not conducive to institutional development. To improve the prospects that management advisory assistance will be accepted by Egyptian leaders, AID should understand that the problem is one of organizational development, not engineering. This has implications for the mix of skills required to deliver such assistance successfully.

To improve organizational effectiveness, management assistance is required at all levels. At the national level, NOPWASD is the best hope for serving a variety of essential functions, including coordination of organizational operations and sector databases, regulation, development of curricula, setting of standards. Since the skills required to manage construction at the provincial and

local levels are lacking, NOPWASD should also retain responsibility for the design and construction of infrastructure. AID's IHRD Project should recognize the multiple roles performed by NOPWASD and tailor assistance accordingly.

While greater autonomy of local organizations does not appear justified for system development and expansion, more independent organizations have a greater likelihood of becoming effective operators. This will require building institutional O and M capabilities at the local level.

Since Egyptian leaders do not recognize management as a science or technical specialty to be approached like other assistance (e.g, engineering services), the potential outputs of management assistance are not widely appreciated. This situation may argue for providing management advice indirectly in the future. The most obvious opportunity is to include assistance directed at improving management capabilities in the anticipated expatriate O and M assistance contracts for which GOE demand is high.

Chapter 2: Training and Human Resource Development

Findings

Past efforts by the Architect and Engineering (A&E) firms have demonstrated limited successful training. Most training has been conducted as one-shot efforts; training capability has not been transfered to Egyptians. At present, it is doubtful that these firms will be able to transfer skills effectively without complementing existing professional skills with specialized training assistance.

Skill levels in water and wastewater systems are low. Entry requirements and staff selection procedures lack performance criteria; this is particularly true of staff at the operations and maintenance level where most employees cannot read or write. For engineers, training in sanitary engineering is limited in Egypt.

Current training systems and local capability for training delivery are fragmented in the sector. Resources for training exist in bits and pieces but they are not organized nor directed to achieve sectoral goals and to meet sectoral needs. There is no apparent dialogue between sector institutions and technical schools, universities, and institutes which could meet some needs. Training efforts are severely limited by pervasive management deficiencies, poor compensation practices and low employee motivation. Egyptian agencies lack an understanding of what training is and what it can do.

Recommendations

Immediate training is needed in operations and maintenance for the staff of the facilities coming on line. AID should involve existing A&E firms (combined with training specialists) in this activity. In addition, AID should facilitate the GOE effort to coordinate and focus training resources. Expatriate trainers should be paired with identified Egyptian counterparts to develop training systems and to build local capacity to train on an ongoing basis. Given the anticipated long-term training requirements in the sector. the development of training systems and local capability needs to be emphasized. No opportunity should be lost to lay the foundation for sustainability.

There is an immediate need to develop successful skill transfer and training approaches/models in the sector. Current efforts in the energy sector and others should be explored to ascertain if culturally relevant training approaches have been developed for higher level technical skills. Basic vocational training approaches appear to be working in home building but these methods appear to have limited applicability to complex problem solving and technical operations in water and wastewater.

To ensure that newly completed or rehabilitated works are started-up and operated effectively, AID should request expatriate firms to join with local Egyptian firms to provide direct O&M assistance and to train the staff of treatment plants and pump stations. The expatriate O&M contracts should run concurrently with programs to train local staff and should be phased out as local staff increase their capacity to take over the works. These operations and maintenance assistance contracts should emphasize operator training. The efforts of existing A&E contractors to train operators should clearly be labeled "training" and coordinated with the IHRD project.

AID's IHRD Project should be one mechanism for strengthening the capacity of NOPWASD to coordinate training facilities and resources and to standardize the development of curricula and training aids.

Chapter 3: Financing Project Completion and Sustainability

Findings

There have been major disparities between cost projections and actual costs. These disparities have required mid-course project re-design as well as funding increases.

There is a shortfall between available project funds and the financial requirements of potential projects. While GOE commitments have increased over the last two decades, capital funding for the

sector is uncoordinated. Donor participation in the individual capital projects of the sector does not appear in the annual budget, other than as a block provision.

It is imperative to "get a handle" on and to distinguish between "operations" and "maintenance" costs. However, there are no good sources of information on what O&M expenditures should be. Existing budget data are of limited use, and estimating O&M costs as a percentage of capital cost is not a satisfactory method. GOE efforts to estimate the recurrent cost requirements of the physical systems have been limited to recording past expenditures, rather than focused on attempting to define manpower, materials and equipment needed for the facilities involved.

The current GOE tariff proposal represents significant progress toward achieving sector goals. Still, revenue systems need major upgrading to attain the level of revenues expected from passage of the new tariff.

Recommendations

Disparities between AID cost projections and actual costs have decreased as experience increases in the sector. Still, AID should work with the GOE to establish a sectorwide cost monitoring and updating program, as well as standard cost escalation procedures and rates for A&E firms.

In conjunction with the GOE, AID should support efforts underway in the MHPU to develop a budgeting "forum" for the sector through ACPU, and to incorporate donor funding for individual projects in Chapter 3 of the annual budgets, or another appropriate summary document. This practice would be a first step toward linking planning and budgeting practices in the sector.

AID needs "hard" data on actual O&M requirements to pursue its objective of sustainability. Since only limited data are available, AID should assist the GOE in building databases.

AID should support the GOE's current tariff proposals but pursue modifications that include: (1) providing "lifeline" rates at lowest domestic consumption levels; (2) making greater use of opportunities for cross-subsidization; (3) allowing some local initiative and flexibility within the confines of national policy; (4) emphasizing ability to pay/affordability in lieu of O&M coverage in setting targets (affordability probably has been underestimated), and (5) establishing a differential wastewater surcharge for toxic industrial wastes that are high enough to provide an incentive for effluent improvement projects.

Chapter 4: System Design, Construction and Operation

Findings

With very few exceptions, most of the facilities in the sector are in very poor condition. Wastewater treatment works and pump stations are in particularly poor shape and, at the sites visited in Cairo, Alexandria, Fayoum and the Canal Cities, there is not a single wastewater treatment plant that is operating at even minimum levels of acceptability.

Examination of the AID-supported projects under construction suggests that progress is reasonably in line with current expectations but, in some cases, key components of the system may not be completed at the same time. To the degree that this will prevent US contractors from testing their equipment, this could have the potential for causing major disputes. This is especially true for some of the work in Alexandria. GOE and AID bureaucratic procedures, weaknesses in institutional and managerial structures and, in some instances, local contracting practices have contributed to the delays.

For a number of reasons, certain critical components of the systems remain unfunded, e.g. upgrading of the Cairo distribution system, interim and longer-term treatment of Ismailia wastewater, treatment and disposal of Alexandria wastewater, as well as nearly US$ 1 billion of work on Cairo's East Bank.

Review of the work performed by local and expatriate contractors suggests that the performance of Egyptian public sector companies has been less than satisfactory, either in quality of work or in meeting time schedules, for a variety of reasons -- under-capitalization, lack of construction management experience, inexperience on projects designed in the detail customary in the western world, inadequate supervision, and over-extension in a period of booming construction in Egypt. This has led AID to substitute expatriate construction firms for local contractors, -- an expensive way to address the problem.

The imminent completion of the first construction phase of AID-funded projects requires a careful consideration of the sector's ability to operate and maintain the new works adequately. This examination is imperative in light of the fact that (1) existing facilities and systems are in disrepair and (2) current operations and maintenance practices are deficient. Failure to develop the capability of Egyptian personnel to operate new works on a sustained and satisfactory basis could soon render some, if not most, of the new works ineffective.

Estimates of the O&M costs associated with the first stage works, developed in the master plans which preceded the design and construction of these works, are obsolete. Accurate and comprehensive O&M costs are urgently needed because the proposed national tariff is based on recovering a certain percentage of these costs. In addition, reliable estimates of the O&M costs are required as a critical input to the decision regarding level of wastewater treatment.

Recommendations

To ensure that AID and GOE-financed components of the systems are completed on a timely and coordinated basis, the GOE should continue to monitor and identify (1) the most critical unfunded components of the systems in order of priority, (2) estimate the cost of completing the systems, and (3) assess the consequences if the systems are not completed.

AID should review measures to ensure that expatriate A&E firms take steps to enhance the construction and O&M capacities of their private sector Egyptian partners.

In cooperation with other donors, the GOE should annually update the recurrent costs, as well as the management and training implications, of the systems under construction and proposed in the future. Obtaining information relevant to making decisions on current and future technology choices, especially those pertaining to treatment, should be a key objective of the findings.

The GOE should review and modify its position on the mandated level of wastewater treatment (currently secondary), and endorse treatment technologies that are more closely related to the operating capacity of the local utilities. (Note. AID should keep in mind that while collection/distribution systems are not easily identifiable physical projects, their failure to operate effectively does not present the foreign policy embarrassment associated with a large, inoperable water or wastewater treatment plant.) In addition, the GOE should consider phasing treatment facilities. The first focus should be on primary systems; secondary systems would follow as funds become available and institutional capabilities improve.

Chapter 5: Estimating Beneficiaries Served, Assessing Ability to Pay and Systems Impact

Findings

Estimates of the beneficiaries to be served by the AID-financed projects have been framed to determine the loads which the physical systems have to carry. The methods utilized for estimating populations vary considerably. In addition, the estimates reflect only the aggregate populations that are or will be putting demands on the system. In the master plans and project planning documents there is no analysis of the composition of the population and, since the design is not tied to census tracts or other GOE units of measurement, socio-economic data on the populations served are largely unavailable.

Since the systems are in the centers of cities, an incomplete analysis of the beneficiaries suggests that each system is serving populations with a greater ability to pay for services than the residents of the unsewered (and/or unserved) areas who are not connected to the public water and wastewater systems but pay a high percentage of household income for these services.

While water and wastewater systems contribute to better public health, it is not easy to associate reduction in mortality and morbidity indicators, if any, with efforts underway to improve urban water and wastewater systems. The linkage between good health and these systems is complex. Rigorous studies would have to be designed and conducted before any health impacts could be measured. Efforts to establish causality elsewhere have not been conclusive.

Recommendations

The unit of analysis used for estimating populations to be served by the water and wastewater systems should be comparable with those used by other GOE agencies, CAPMAS. This approach would ensure easy updating of master plans when new census data become available.

The GOE should take steps to collect more precise data on per capita consumption of water. This information, obtainable through selected metering, is required to ensure that the systems designed and built are closely related to the projected demands of the populations and the resources of the GOE.

The GOE should take steps to assess the ability to pay of the populations currently served by the system. Since one of the objectives of projects underway and proposed is to raise revenue sufficient to cover operations and maintenance costs at a minimum,

the GOE should survey a sample of current beneficiaries, as well as those unserved, to obtain more information on "ability" and "willingness" to pay for services. . Such a survey is likely to show that signficant tariff increases are warranted and can be implemented without political risk.

Coupled with other interventions, eliminating wastewater flooding could lead to improvements in health status; alone, however, it is not likely to produce measurable improvements in the rates of infant and child morbidity and mortality. If the GOE wants to enhance the impact of investments in the physical works, public awareness campaigns designed to educate the public on proper practices in (1) the collection, transport and storage of water, (2) use of the wastewater system, and (3) solid waste collection and disposal should be implemented.

Abbreviations

AGOSD	Alexandria General Organization for Sanitary Drainage
AID	Agency for International Development
AMBRIC	American British Consultants (USA: BVI, CDM; UK: Binnie, Taylor)
AWGA	Alexandria Water General Association
BOD	Biochemical Oxygen Demand (measure of organic load of wastewater)
BVI	Black and Veatch International Inc.
CCC	Canal Cities Consultants (Hazen and Sawyer, Metcalf and Eddie, and Pirnie-Harris)
CDM	Camp Dresser and McKee International
C/GOSD	Cairo General Organization for Sanitary Drainage
cmd	Cubic Meters perday (= Ml/day)
COAM	Central Agency for Administration and Management
CWO	Cairo Wastewater Organization
GOE	Government of Egypt
Km	Kilometers
l/s	Liters per second
m	meters
mg/l	milligrams per liter
ml/day	mega liters per day (= CMD)
MHPU	Ministry of Housing and Public Utilities
NOPWASD	National Organization for Potable Water and Sanitary Drainage
P.S.	Pump Station
PCD	Provincial Cities Development Project
ss	Suspended Solids (measure of solids local wastewater)
TEC	Tokyo Engineering Consultants
UAD	Office of Urban Administration and Development
UK	United Kingdom
USA	United States of America
WWCG	Wastewater Consultants Group (CH2M Hill and Metcalf and Eddie)
WWTP	Wastewater Treatment Plant
TOMOHAR	Training Office for the Ministry of Housing and Reconstruction

Introduction

At the request of the Office of Urban Administration and Development (UAD) of USAID/Cairo, a review and assessment of selected urban water and wastewater systems, and the agencies and organizations responsible for the implementation and operation of the systems, was conducted in the period February 6 to March 15, 1985.

Purpose of the Review. The review had four principal objectives:

1. to chart the progress achieved in four projects financed by AID, namely, Cairo Water Supply, Cairo Sewerage, Alexandria Wastewater and Canal Cities Water and Wastewater;

2. to assess the status of operations of agencies responsible for managing the urban water and wastewater systems, and the degree to which these agencies are functioning efficiently in the sector;

3. to review the areas of management and institutional development, training/human resource development, finance, engineering and beneficiaries, and articulate the issues that need to be addressed to ensure that urban water and wastewater facilities and systems operate effectively and continuously, and

4. to formulate recommendations useful to both AID and the GOE that (i) reflect a common understanding of the issues in the sector and a common approach to dealing with them, and (ii) define the measures needed to complete and sustain current projects.

USAID Projects Reviewed. One of the original objectives was to review the status of activities in four AID-financed projects: Cairo Water and Cairo Wastewater, Alexandria Wastewater, and Canal Cities Water and Sewerage. However, in the course of conducting the review it was determined that it would not be possible to measure the progress achieved against anticipated results. Since baseline data and other resources required to conduct a rigorous assessment were not available, the team examined the projects underway, and the institutions charged with their implementation, with an eye toward identifying factors constraining successful execution and facilitating long-term sustainability. Although the team gave special attention to the AID-financed urban water and wastewater projects -- an investment in excess of US$1 billion, elements of other donor-financed projects were reviewed as well, principally the World Bank's Alexandria Water and Beheira Water Authority Projects and Provincial Cities. (Annexes A through D of Chapter 4 are brief status reports on Cairo Wastewater, Cairo Water, Alexandria Wastewater and the Canal Cities.)

Water and Wastewater Organizations in Egypt. Since AID-financed projects are close to completion in several locations in Egypt, and USAID/Cairo is seeking assurances that the newly-built or rehabilitated water and wastewater systems will be operated and maintained properly, the Team placed special emphasis on reviewing the structure, capacities and objectives of the organizations in the sector. Some of these organizations have national scope, e.g. NOPWASD; others operate only in one location, e.g. CGOSD.

The Cairo Wastewater Organization (CWO), established in 1981, plans, designs and constructs foreign-funded wastewater projects in Greater Cairo.

The General Organization for Greater Cairo Water Supply (GOGCWS), set up in 1979, plans, designs, constructs, operates and maintains water supply systems in Cairo.

The Cairo General Organization for Sanitary Drainage (CGOSD), organized in 1981, operates and maintains the wastewater program in the Greater Cairo area.

The Alexandria General Organization for Sanitary Drainage (AGOSD), set up in 1979, is responsible for planning, developing, operating and maintaining all wastewater projects in the Alexandria Governorate.

The Alexandria Water General Authority (AWGA), originally organized by the British as a private sector company, plans, develops, operates and maintains all water supply activities in the Alexandria governorate.

The Suez Canal Authority (SCA) is responsible for developing, designing, constructing, operating and maintaining water supply systems in the Canal Cities.

The National Organization for Potable Water and Sanitary Drainage (NOPWASD), established in 1981, is responsible for capital projects in water and wastewater in the provincial cities and wastewater projects in the Canal Cities.

Operations and maintenance of the other urban water and wastewater systems is the responsibility of local public works departments. Financing comes from the budgets of the governorates.

Team Composition. Team members and their institutional affiliation are listed below according to area of responsibility.

1. Management Capability and Institutional Development
   John B. Tomaro, Research Triangle Institute, (Team leader)
   Monica K. Sinding, AID/Near East Bureau/Project Development
   Tarek Selim, USAID/Cairo

2. Training and Human Resource Development
   Daniel B. Edwards, Training Resources Group
   Joy Pollock, USAID/Cairo

3. Financing Project Completion and Sustainability
   James S. Baker, Independent Consultant

4. Physical Works: Design, Construction and Operation
   Donald E. Cullivan, Independent Consultant
   Mounir S. Neamatalla, Environmental Quality Int'l
   Nabil Saba, USAID/Cairo
   Medhat Wissa, USAID/Cairo

5. Estimating Beneficiaries Served, Assessing Ability to Pay and Systems Impact
   Sherif El-Hakim, Sherif El-Hakim & Associates
   Mahmoud Hussein, Sherif El-Hakim & Associates
   Mona El-Shafei, USAID/Cairo
   Kaz Kawata, USAID/Near East Bureau

Those listed made written contribution to the sector review. Many others provided material and reviewed the findings, and assisted in defining both the scope of work and the issues of central concern to AID and the GOE. The team wishes to express its appreciation to Michael Croston and Bill Rappold of TAMS, Tarek Selim of USAID/Cairo and Leo St. Michel of WASH for their interest and invaluable assistance.

Review Methodology. The team's findings and recommendations are based on a thorough review and analysis of the documents listed in the bibliography, and the information obtained during interviews and site visits. The individuals interviewed and the locations visited by the team are listed in Appendix 1.1

Chapter Sequence. The report places primary emphasis on issues related to project sustainability. Since the GOE is responsible for operating and maintaining the AID-financed systems, as well as other donor-financed programs in the water and wastewater sector, the

first chapter discusses the capabilities of the organizations and recommends steps necessary to improve operational capacity. The chapter on training and human resource development reviews existing training efforts and outlines measures to enhance the performance of the managers and staff of the utilities.

Chapter three concludes that the GOE must improve its level of information on the financial requirements for operations and maintenance in the sector. Chapter four comments on the quality and completeness of construction, documents unfunded components of the systems, and suggests that the GOE look very closely at the implications of mandating secondary treatment for wastewater. The final chapter examines in cursory fashion the methods employed to estimate the beneficiaries to be served by proposed water and wastewater designs, and suggests that current projects serve residents who can afford to pay more for water and wastewater services.

Appendix 1.1

Organizations Visited, Individuals Interviewed By Water and Wastewater Review Team February 6 - March 15, 1985

Ministry of Housing and Public Utilities (MHPU)
- Ahmed Fouad El Gohary, First Undersecretary
- Ali Hussein El Hakim, Undersecretary for Public Utilities

Advisory Committee for Public Utilities
- Abdel Moneim Ashmawy

Ministry of Development, New Communities and Land Reclamation

Training Organization of the Ministry of Housing and Reconstruction (TOMOHAR)
- Said Abd El Kader, President
- Ali Abdel Fattah Nawaito, Undersecretary of State, Training Sector
- Hassan El Sahhar, General Manager for Training

Tippetts-Abbett-McCarthy-Stratton (TAMS), advisors
- Peter Jolowicz, Project Manager
- Alfred H. Ashworth, Municipal Engineer
- William Rappold, Training Advisor
- Michael Croston, Finance and Management Advisory

National Organization for Potable Water and Sanitary Drainage (NOPWASD)
- General Hazem El Abd, Chairman
- Magd Abdel Rehim, Deputy Chairman (retired)
- Hattim, Finance Manager
- Youssef Hannah, Head - Research and Studies (retired)
- Michel Elias, Head, Training

Central Agency for Organization and Administration
- Hassan Tawfik, Chairman
- Beheza Helmi, General Manager - Foreign Relations

Alexandria Water General Authority (AWGA)
- Mohamed A. Marzouk, Chairman
- Youssef Naguib Iskaros, General Manager - Projects
- Victor Tawfik Bishay, General Manager - Planning

Alexandria General Organiation for Sanitary Drainage (AGOSD)
- Moustafa El Nekhely, Chairman
- Mohamed Harfoush, Director - Financial Affairs
- Ali El Mallawny, Director - Foreign Liaison
- Maher Abdel Aziz, Director - Design and Planning

Consultants/Contractors

1. Wastewater Consulting Group (WWCG)
   Fred Harem, Project Manager
   Vernon D. Thompson, Director - Construction
   Warren H. Rockwell
   Dale L. King, Operations Coordinator
   A. Sami Abd El Kawi
   George Edwards, Claims Officer

2. Camp, Dresser and McKee (CDM)
   George Beckford, Project Manager
   Lenny Gutierrez

3. Perini Construction Corporation
   Frank Murray, Chief of Party

USAID/Alexandria
Maurice Bishy, Representative

General Organization for Greater Cairo Water Supply (GOGCWS)
Hussein Talaat Eid, Chairman

Consultants/Contractors

1. James M. Montgomery
   Norman G. Hixson, Vice President
   John R. Sproat, Jr. Principal Engineer

2. Howard Harbert Jones
   John D. Greene, Project Manager (Rod El Farag)

3. ES-Parsons
   William McGinnis, Chief of Party
   Ian Wilson, Construction Superviser

Greater Cairo Organization for Sanitary Drainage (CGOSD)
Attala Safwat, Chairman

Cairo Wastewater Organization (CWO)
General Engineer, Galal Zaki, Chairman
Mohamed Abdel Halim, Director - Planning
Mohamed Hefnawy, Manager - Financial Affairs

Consultants/Contractors

1. AMBRIC
   - Willis Skinner, Project Manager
   - Jeremy Goad, Deputy Project Manager
   - John Grimes, Technical Coordinator
   - Roger Wood, Chief Engineer
   - Thomas D. Hall, Chief Engineer
   - Charles Dragga, Training
   - Matthew Antil, Training
   - Robert Wendt, Training
   - Paul Howard, Unsewered Areas

2. British Water International (BWI)
   - Keith Fox, Financial Advisor
   - John Hall, Financial Advisor

Beheira Water Company (BWC)

- Taher Hafaz Allah, Chairman
- Sayed Abel Aziz, Manager - Distribution
- Ali Rifaat Alzokm, Director of Training

Consultants

1. Binnie-Taylor
   - Riley

World Bank Mission

- Peter Ware, Division Chief - EMENA
- Mario Zelaya, Water and Wastewater Projects

Suez Canal Authority - Ismailia

- Mohamed Bahaa El Din, Director - Public Works Department
- Mohamed Hussein Fahmy, Chief Engineer - Public Works

Consultants/Contractors

1. Canal Cities Consultants
   - Russell C. Holt, Project Director
   - Robert I. McDormand, Project Engineer
   - Papken V. Janjigiah, Construction Manager
   - Terry Driscol, Training Advisory
   - Knut Platou, Engineer

2. Harbert Jones
   - Robert Slaughter, Chief of Party

Ismailia Public Works Department - Wastewater
Engineer Ferris
Engineer Magda

Provincial Cities - Fayoum City Council
Ibrahim Mosa Ibrahim, Deputy Chairman
Ahmed El Badwey, Utilities Chief Engineer

Consultants/Contractors
1. Wilbur Smith and Associates
Robert Harbison, Chief of Party
Eng. Samir Sayed, Training
Dr. Ahmed Sabri, Training
John Thompson, Resident Advisor, Fayoum
Eng. Garib Sawi, Resident Engineer, Fayoum

High Institute of Public Health - Alexandria University
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Flemming Heegaard, HRD Consultant
Maurice Porter, Engineering Consultant

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Norbert Hirschhorn, M.D. Chief of Party

Chapter 1
Management Capability and Institutional Development

A. Background

A key constraint to developing water and wastewater systems in Egypt is the weakness and ineffectiveness of the organizations responsible for designing and building capital projects, and for operating existing and planned water supply and sewerage systems. This observation has been made in numerous consultant reports, as well as the USAID Sector Assessment (1983) and the World Bank Sector Memorandum (January 13, 1984).

This review, along with other reports and studies on facilities design and construction, systems operation and maintenance, and management structure, documents three critical problems: (1) weak and non-responsive, non-directive management systems, (2) the absence of an adequate supply of trained and dedicated management and technical staff, and (3) poor construction management and operation and maintenance practices.

Failure to address deficiencies in the operational quality and content of national and local systems is attributed to:

(1) GOE personnel policies that produce overstaffing and poor performance in the water and wastewater sector;

(2) GOE subsidy practices that fix tariffs at levels insufficient to cover operations and maintenance costs of utilities; and

(3) GOE organizational policies that restrict the degree of authority of local organizations.

In large part, organizations in the ector have not performed adequately because government policies and practices militate against effective management.

1. Capacity of National and Local Organizations to Plan Capital Projects, Contract for and Supervise Construction. AID's large, phased investment in the sector has been targeted on rehabilitating and expanding existing systems in Cairo, Alexandria, the Canal Cities of Suez, Ismailia and Port Said, and more recently the Provincial Cities of Fayoum, Beni Suef and El Minya. At certain of these sites, funds are or will be sufficient to address water production and distribution, and wastewater treatment.

Executing the work generated by these investments has challenged the capacities of responsible national and local authorities. In general, the agencies responsible for developing and executing capital projects lack experience in project planning, contracting and construction management.

Project Planning. Although the organizations responsible for capital development have project planning departments, their planning capacity is very weak and ineffective. Most utilize a "committee approach" to project planning, rather than delegate authority to a specific department. Planning responsibility is scattered among several line managers. Technical decisions are commonly made by consensus at the highest levels of the organization.

Managers up and down the line deal with major and minor matters but, at the same time, are reluctant to delegate or accept full responsibility for any decision. Too often, experienced managers, who can define the key functions and objectives of the organization, are largely unavailable. In addition, personnel with the experience needed to monitor execution are in very short supply. Operationally, the absence of effective project planning delays decision-making, as well as the rate of project implementation.

Contracting Practices. The contracting practices employed by the agencies of the Government of Egypt have a significant effect on the quality of the work performed, and the manner in which it is conducted.

The fact that in this sector both the utilities and the public sector contractors operate under the aegis of the same ministry creates a relationship of conflicting loyalties between the parties. This may explain the apparent difference in the degree of control that the water and wastewater utilities have over private and public sector Egyptian companies contracted to execute capital development projects. As a result, private sector companies seem to produce work of higher quality in a shorter period of time than the public sector companies.

Yet, the national government has developed financial and administrative policies which favor public sector companies, and the GOE has a direct stake in their viability. This reality limits the freedom of sector organization's to choose private over public sector companies and to supervise them effectively.

Construction Management. The concensus approach to project planning spills over into construction management practices. While most organizations responsible for capital projects have an implementation unit, the management of project activities is generally fragmented. Lines of authority are confused and there are no well-defined procedures for supervising the construction program.

Furthermore, too often supervisory personnel at the construction sites are young, inexperienced engineers unfamiliar with construction management and without authority to make changes in work procedures or construction practices, or require compliance with plans and specifications. In addition, since most of these engineers are largely unsupervised by senior level personnel, all matters pertaining to construction must be referred to a higher authority for resolution. This management practice produces delays in construction and ultimately increases the cost of the completed system.

2. Capacity of the National/Local Organizations to Operate and Maintain Water and Wastewater Systems. The Operations and Maintenance Departments of the agencies responsible for water supply and wastewater collection and treatment are commonly divided in two divisions: (1) water or wastewater treatment plants, and (2) collection or distribution networks.

The water treatment plants are generally better operated than the wastewater treatment plants. There appear to be few formal or informal procedures, however, for operating any water treatment plants. Water quality testing for example, is done sporadically at most plants, sometimes only once a day, and procedures for clarifying the water or metering its production are carried out haphazardly.

Few, if any, wastewater treatment plants in Egypt are operating properly. In some cases, it appears that the wastewater completely by-passes the plant (e.g. Alexandria East Treatment Plant); in other cases, the wastewater appears to course through the plant's structure without receiving any significant degree of treatment (e.g., Ismailia Abu Atwa Wastewater treatment plant). In still others, the portion of the wastewater that receives any treatment (e.g. Cairo/Zenein and Fayoum Wastewater Treatment Plants) is mixed with untreated sewage when it exits the plant.

Maintenance requirements for the water distribution system are less rigorous than those of the wastewater system. Still, inspite of the difference in operational requirements, both systems suffer from the same deficiencies.

In general, there are no formal systems and procedures for maintenance which might best be termed "emergency maintenance". Indeed, it is the efforts of a few dedicated operators and managers, rather than established procedures, that keep the systems functioning. Moreover, given the little training, low salaries and the absence of financial and material support, as well as the large and increasing demands on the systems, the work accomplished by the maintenance crews of the utilities, e.g., pump station operators and sewer cleaners, is commendable. Still, without a systematic approach to operations and maintenance, heroic efforts will only keep the networks operational for a limited period of time.

B. Discussion

1. The Contribution of Past and On-going Attempts to Enhance Capacity. The original Project Papers for AID-financed sector projects acknowledged the need to enhance institutional capabilities to manage the construction phase of the program, as well as to operate and maintain the completed facilities. However, in the rush to obligate funds and initiate design and construction, it was decided that the analysis required to design institutional development programs would be undertaken simultaneously with the launch of the design/construction phases of the projects.

To the degree that certain financial and institutional requirements were understood -- e.g. the need for revenue generation through some form of tariffs, strong implementing agencies, and trained manpower, these were addressed in covenants in the project agreements. For instance, covenants in the 1977 agreement for the Cairo Water Project included the general requirement that GOGCWS review and discuss with AID the recommendations of the management and tariff consultant and the more specific requirement to establish a training program for management and administration, and a financial plan, based on user charges for water sufficient for

GOGCWS to generate adequate revenues to cover, at a minimum, operation and maintenance expenses, debt service and/or real depreciation allowances. Also by way of example, the amended Canal Cities Water and Sewerage Project (1983) required the GOE and NOPWASD to provide, at six month intervals, plans for the introduction of wastewater tariffs that included the schedules and levels of such tariffs. Reliance on covenants has not achieved the reforms which AID considered important for two reasons: (1) AID has not been able to enforce compliance, and (2) there is little evidence to suggest that the GOE ever attached any importance to the convenants.

In the absence of progress, AID and the World Bank have made repeated attempts to address critical issues in policy discussions with the GOE. These discussions have occurred most often in conjunction with project design; often AID and IBRD positions were supported by consultant recommendations made on project appraisal/design missions. For instance, in the course of designing the Bank's Beheira Project, Coopers-Lybrand studied management issues related to the formation of a semi-autonomous water company at the provincial level. Based on the consultants' recommendations, the Bank negotiated certain institutional reforms with the GOE, including the formation of an autonomous water company with the authority to manage its own service delivery program.

In addition, beginning with some of its earliest projects, AID budgeted for management advisory services to recommend organizational improvements. In some cases, the GOE entered into contracts with U.S. firms. Over time, a two-track approach was in effect: studies and direct assistance under the aegis of projects, as well as an on-going dialogue with GOE officials concerning the generalized need for reform within the sector.

The Policy Dialogue Track. AID formalized its policy dialogue with the GOE in early 1983 with a commitment by the AID Administrator to provide $1.2 billion of assistance over the period FY 1982-87 in return for certain financial and institutional reforms considered essential to enhance the GOE's ability to construct, operate and maintain the resulting infrastructure. Following this rather non-specific pledge, the Mission negotiated a Memorandum of Understanding (MOU) which was signed by the Administrator and President Mubarek in January, 1983. The MOU which re-iterated AID's intent to provide substantial sector support, required the GOE to:

- provide adequate facilities for training and technical services to support the sector, and an incentive system to maintain and recruit qualified staff;

- establish autonomous local water and wastewater organizations, with the authority to retain service revenues for their own operating needs;

- implement tariff increases to cover the cost of water and wastewater operations, maintenance, debt service, and routine improvements, as well as appropriate increases in the size of operations, maintenance, and investment budgets to fund the sector; and

- retain, during the program, a construction management firm to ensure on-time completion of the projects.

In addition, the MOU provided for an annual joint review of progress toward achieving these objectives.

The 1984 review was disappointing. At a preliminary session the chairmen of various local operating organizations reported progress to date on construction. In the follow-up session between the Mission Director Stone and Minister Kafrawi, progress was reported, some of which (e.g. an increase in Cairo water tariffs) was never implemented. As a consequence, prior to the 1985 review, the Mission prepared a series of matrices which set forth goals for achieving MOU objectives by 1991 (the presumed completion date of sector projects), as well as interim annual targets. These intermediate and final targets were pre-negotiated with MHPU Undersecretary for Water and Wastewater and agreed to in a session chaired by Minister Sedki and Mission Director Kimball on February 21, 1985.

The matrices provide for:

- The introduction of increases in water tariffs sufficient to cover 35% of estimated O and M costs in 1985 and, increasing progressively to cover 100% of such costs in 1991, as well as a 10% surcharge for wastewater;

- study of O and M costs;

- expatriate O and M services linked to training for counterparts;

- immediate training for system operators and the design of longer-term training programs for managers, as well as operators;

- expatriate advisors to MHPU/ACPU and NOPWASD in the area of institutional and human resources development.

- provision for organization chairmen to use 10% of collections for incentive payments to water workers, in addition to the funds now available under Law 26/1983 for wastewater worker incentives.

While many actions remain to be taken to achieve these targets, the Mission is confident that Minister Sedki is committed to achieving reforms. The fact that the GOE agreed, at least in principle, to the benchmarks suggests considerable improvement in its understanding of the extent and nature of the problems which plague sector institutions.

The Management Services Track. AID included funding for management studies and management advisory services in some of the earliest projects in the sector. In addition, for the past ten years the GOE has used its own foreign exchange to acquire the services of a management advisor for the then Ministry of Housing and Reconstruction, now the Ministry of Development. In general, these activities have been designed to (1) study sector organizations and recommend improvements; and (2) provide sector institutions with expatriate assistance in managing donor-assisted construction projects.

TAMS. The national level Advisory Committee for Reconstruction (ACR) now attached to the Ministry of Development contracted for the advisory services of Tippetts-Abbett-McCarthy-Stratton (TAMS). For nearly ten years the ACR has used its own foreign exchange resources to pay for TAMS consultants who bill at the rate of approximately $1 million per year. As advisors to what is itself an advisory group, TAMS has translated the needs and methods of donor agencies to the Egyptians.

Initially, TAMS advisors undertook a number of studies of GOE capabilities and made recommendations regarding Ministry organiztion and staffing. It is unclear whether the resulting reports were read, much less given serious consideration. The TAMS role therefore evolved into one of performing project management functions for foreign-financed projects on behalf of the Ministry. In this capacity TAMS assisted the Ministry in reviewing and approving master plans, project reports, and so forth. In effect, TAMS consultants functioned as surrogate project managers preparing terms of reference, selecting consultants, negotiating contracts, fulfilling the requirements of foreign funding agencies, guiding the consultants' work, and writing final approval letters for the signature of the Chairman.

TAMS' role has changed somewhat over the past several years. Increasingly, TAMS helps the ACR organize its own thoughts and commit them to paper. Currently, TAMS reports that its consultants listen more and work with ACR members to help them put their ideas "in the right form". Thus, when AID recently prepared a draft terms of reference (TOR) for consultants to the new Advisory Committee for Public Utilities (ACPU) to be financed under AID's planned IHRD Project, TAMS assisted the Ministry to translate key elements into Arabic and commit ACPU reactions to paper.

In addition, TAMS sees its role as advising the ACR with certain of its own initiatives. In the area of training, TAMS is helping the Ministry to develop a national training plan, and NOPWASD to develop training aids. In the area of engineering, TAMS is assisting the Ministry to revise, update and unify standards. In the area of planning, financial and institutional management, TAMS completed a review of sector organizations to help the Ministry determine its own function and formulate policy regarding the structure of local operating organizations. TAMS now hopes to enhance the Ministry's capacity to plan, monitor and control its programs through preparation of a financial plan as the basis for operational plans.

BVI-ATK Studies. The only other significant attempt to influence sector organizations at the national level was a major AID-financed management and tariff study. In 1978, the Ministry of Housing and Reconstruction contracted with Black and Veatch International and A.T. Kearney, Inc. (BVI-ATK) for management and tariff studies relative to water and sewerage utilities in Egypt.

BVI-ATK produced eight interrelated studies in the Management section concerning procedures and methods in five functional areas: project planning, O and M, billing and collecting, procurement and inventory control, and mapping and record-keeping. Each area was reviewed to determine the way in which work was assigned and controlled. Separate volumes covered distinct areas of management concern.

Although the resulting mammoth study included an executive summary, the report has largely been ignored by the GOE and only to a lesser extent by the donor community. It has also been suggested that the report was too voluminous and perhaps overly prescriptive.

Management Advisors. Efforts to attach management advisors to the various local operating organizations have met with mixed success. When AID learned that a new implementing agency was to be established for the Alexandria Wastewater Expansion Project on the eve of signing the project agreement, it insisted that the GOE accept an added component of management advisory services. Somewhat reluctantly, AGOSD contracted with Boyle Engineering Corporation, in association with Arthur Young and Co. Apparently Boyle initially conceived of its role as a consulting one: diagnosing the patient, recommending a cure, suggesting procedures to be implemented and training to be performed, and then "fading away". However, in short order, Boyle concluded that the "education, training, customs, work habits, language skills, and accepted levels of sanitary and safety conditions in Alexandria were too deeply rooted to expect changes to occur merely from reading "consultants reports" (Boyle Engineering Corporation, Diagnostic Review of AGOSD, August 1981).

An accompanying management diagnostic review of AGOSD prepared by Arthur Young supported the conclusion of the consultant who suggested the establishment of a shadow organization in which key positions would be staffed with both AGOSD personnel and consultants working "side-by-side to do one job". By assigning an experienced expatriate consultant on a full-time basis to a counterpart with the appropriate level of authority, responsibility, and funding, it was thought possible to accomplish the objectives of the organization. Thus, managerial actions would be accomplished in the course of modifying the organization and its management and operational systems and technical procedures. Boyle/Young anticipated that the consultant role would be phased out as transfer of technology occured.

The Boyle/Young contract may have been doomed from the start. AGOSD was resentful of the last minute AID-imposed requirement for a management consultant. In addition, there were personality conflicts between the consultants and their counterparts who were resentful that "American solutions" were promoted. As a consequence, in early 1984 the new AGOSD Chairman terminated the Boyle contract, and has been unwilling to consider a replacement advisor. The Boyle/Young experience is known widely throughout Egypt and is cited frequently as an example of the type of assistance which is not desired in the future.

When ODA agreed to provide 50 million pounds sterling to support the rehabilitation and expansion of Cairo's East Bank wastewater system, it made known its interest in attaching advisors to the fledgling CWO. In 1983, British Water International (BWI) sent a team of two financial advisors and two engineers to assist CWO. Like their TAMS counterparts, the ODA-financed consultants began with a number of analytical studies of the organization. These recommended changes in structure and staffing, as well as operations and procedures. According to the senior financial advisor, the studies were never responded to and quite possibly never read at all.

In relatively short order, the role of the BWI consultants therefore evolved into performing financial and engineering tasks for CWO. In effect, BWI advisors served as surrogate staff, supplementing CWO's meager management resources. In this capacity the BWI consultants have performed selected project management functions related to the British-and-American-financed Cairo wastewater system expansion, including assisting the Egyptians to review AMBRIC designs and plans. (AID has not financed management advisory services for Cairo Sewerage, although funding is available for this purpose under the follow-on project. The CGOSD Chairman recently indicated an interest in advisory services.)

Slightly less than a year ago, the General Organization for the Greater Cairo Water Supply (GOGCWS) signed a contract with James M. Montgomery, Inc. (JMM) to undertake a series of reports regarding institutional improvement programs. JMM will prepare reports in the areas of organization and management, finance and accounting, water production and quality control, engineering and planning, and network O and M and construction. In coordination with GOGCWS, JMM plans to undertake a thorough review of the programs, systems and procedures of the organization to identify the areas needing improvement. It is too early to judge JMM's success, although a series of reports on institutional development have been completed. Informal reports indicate that JMM consultants have been received well by its counterparts.

Conclusion. With the possible exception of JMM, donor efforts to finance studies and attach management advisors to implementing organizations have met with mixed success. Without exception, efforts of outsiders to analyze Egyptian institutions and prescribe changes in policy and/or procedures, organization, or staffing changes appear to have fallen on deaf ears. Many consultants report that their studies were never read and their recommendations never addressed.

However, those consultants who saw their function as surrogate project managers for foreign-assisted activities -- e.g. TAMS and BWI -- have fared better. Especially in the early days of the large donor funded programs, Egyptian implementing agencies were forced to rely on outside assistance to meet foreign funding agency requirments, in addition to managing multi-million dollar design and construction contracts. In time, some (notably TAMS) have found themselves increasingly in an advisory capacity -- interpreting donor requirements, translating consultant and foreign funding agency documents, committing Egyptian comments and approvals to paper.

The two-track approach to institutional development -- through policy dialogue and management services -- has had some effect on Egyptian perceptions of the need for intitutional reform. The apparent emerging consensus among the Egyptians and donors about the need to make certain reforms should be attributed in part to the cumulative efforts of management advisors to promote institutional development. The remarkably similar findings regarding the need for institutional reforms have gained considerable currency, not only among the implementing agencies but also among policy-makers. Heightened Egyptian awareness of the need for institutional reform is also to some considerable degree a function of timing. As the new infrastructure "comes on line" in the near future, Egyptian managers will be faced with the responsibility for O and M, and foreign funding agencies will want to know the operational status of their not inconsiderable capital investments.

2. Constraints to Increasing Institutional Capacity. Data indicate a number of key constraints to improving management capability. The most important seem to be:

(1) GOE guaranteed employment policies which lead to overemployment;

(2) lack of trained supervisory personnel due to non-competitive wages and benefits and low status ascribed to the sector; and

(3) insufficient coordination among sector institutions, coupled with inadequate delegations of responsibility to operating agencies.

GOE personnel policies are such that incentives and disincentives are minimal in water and wastewater institutions at both the national and local levels. This is the result of two sets of related policies: guaranteed employment, coupled with very low wages and few, if any, rewards for good performance.

Since 1964, it has been GOE policy to guarantee employment for graduates of universities and institutes. After the 1973 war, military conscripts were also guaranteed employment. As a consequence of these policies, the Ministry of Manpower and Training invites applications from eligible graduates and solicits requests for graduates from government agencies and enterprises. Since funds are automatically approved for financing agreed appointments, demand is generally high.

A 1983 ILO report indicated that the proportion of graduates seeking jobs under the guaranteed employment scheme rose from 42% to 51% between 1972 and 1979. The Central Agency for Organization and Management reports that the proportion has recently decreased to roughly 25%. Still, because water/wastewater institutions are viewed as employers of last resort, the guaranteed employment policy has had the effect of placing large numbers of employees on the rolls of Egyptian utilities.

There is a five-part salary structure in the Egyptian public sector, beginning with basic salary. The ratio of the highest to lowest basic salaries is about 6:1. Basic salaries are supplemented by: (1) salary adjustments that recognize social and economic considerations (e.g. marital status, number of children, etc.) and cost of living allowances; (2) regular supplementary payments (for place of work, conditions and location of work) which cannot exceed 100% of basic salary; (3) irregular supplementary payments, including overtime, awards for extra effort, incentives, and miscellaneous payment (e.g. for attending meetings, training, etc.); and (4) non-monetary supplements for those in special work settings, including transport, uniforms, meals, etc. At the highest levels, there are also representational and other allowances.

The government argues that salaries for public sector workers have kept up with or exceeded inflation. For the period 1978-1982, increases have been considerable: basic salaries increased 16%, supplementary payments increased 42%, and average salaries increased 22%, while the consumer price index increased by 15% annually. Nonetheless, pay for government workers continues to be substantially lower than private sector compensation prompting the better employees to leave public service.

GOE compensation practices have been particularly hard on workers in the water/wastewater sector. It was not until 1983 that Law 26/1983 provided for extra pay for wastewater workers. The new law provides for: an allowance of up to 60% of basic salary for work conditions, including risk; food allowances; overtime of between 25-50% of basic salary, depending on whether workers are on day or night shifts; and bonuses for good performance. It appears that

these allowances are provided uniformly to sector workers without regard to actual conditions of employment or merit. In Fayoum, city officials report that the allowances have made employment in wastewater utilities so much more attractive that many public employees are now anxious to move into the sector.

In the case of water utility workers, no special allowances beyond overtime and merit pay now exist. However, in their most recent discussions of policy reforms with AID, GOE officials indicated that increased water tariffs will include a provision for utilities to set aside up to 10% of collections to pay incentives to water workers.

These improvements notwithstanding, the GOE guaranteed employment policy and compensation practices have a two-fold effect on public sector workers. On the one hand, utilities have a glut of poorly performing, unskilled and marginally skilled workers, and too few skilled technicians and managers, on the other. Until the private sector expands sufficiently to absorb Egypt's large and growing labor force, these practices and their effects are unlikely to change. As a consequence, the best hope for improving levels of compensation and the quality of work seems to lie in reconstituting public utilities as public sector companies. Because such companies are not as constrained by GOE policies, it would be possible to increase compensation significantly. At present, government workers on the average get 50-60% over basic salary (in the form of allowances and incentives), while public organization workers receive 80-100% on the average, and employees of public sector companies receive 100-120% over basic salary.

In addition to the over-riding problem of over-employment, it is generally agreed that, except for the SCA water operations, the water and wastewater agencies underutilize the talents of managers, supervisory staff and workers. While there is an oversupply of laborers, most agencies do not have a sufficient number of well-trained middle managers. Low salary levels explain a portion of this phenomenon; the absence of management and skill training programs exacerbates this problem.

Operational and financial constraints are also prime inhibitors to organizational effectiveness and efficiency. A multiplicity of agencies and levels of government has direct or indirect powers in the management or supervison of the utilities. The utilities' authority is limited in terms of budgeting, planning, wages and benefits, organizational structure, job describtion, etc. In addition, the authorities do not have control over tariffs, nor is there a strict relationship between the funds approved by the Ministries of Finance and Planning, and the capital projects or O and M requirements of the utilities.

Finally, the absence of coordination among the water and wastewater authorities is a constraint to effective operations in the sector. In addition to the fact that there is no coordination of network planning and implementation, there is no common research underway to upgrade water and wastewater treatment technology in Egypt, or to define least cost solutions to systems design, installation and maintenance.

With the exception of Cairo and Alexandria, coordinating the preparation and implementation of the general plans for water supply and sanitary drainage is one of the responsibilities of NOPWASD. However, since water and wastewater programs in Cairo and Alexandria are beyond the jurisdiction of NOPWASD, and the agency is not highly regarded by the local authorities, because it has failed to perform as expected, coordination of policy analysis, research and operations is effectively lacking.[1]

At present, NOPWASD does not have the capacity to do strategic planning or to coordinate and document the activities of the local public works departments. It is difficult to determine whether there are planners on the NOPWASD's staff. The majority of the professionals are engineers who are concentrating on designing and constructing local water and sanitary systems. (See Appendix 1.2).

The absence of an effective degree of coordination and cooperation among the national and local organizations severely limits the ability of the Ministry of Housing and Public Utilities to define policy and programs on a sector-wide basis. Although the recent reorganization which created the MHPU was carried out in part to focus national attention on specific sectors, overall coordination remains fragmentary and the Ministry's ability to formulate policy and plan and evaluate programs is at best embryonic.

3. Planned Approaches to Ameliorating Constraints.

Institutional Development Advisory Services. AID is currently developing with the GOE an Institutional and Human Resource Development (IHRD) Project with the objective of strengthening national and local organizations responsible for developing, operating, maintaining, and managing water and wastewater systems. This effort will be guided by several shared AID-GOE principles, including:

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[1] NOPWASD is charged with "preparing the national policy and plans for water supply and sanitary drainage, performing the necessary studies, and preparing designs and supervising the construction of the projects that cannot be done by the local authorities or serve more than one governorate". The agency is also to "coordinate the plans of water supply with those of sanitary drainage, to establish and enforce standards, specifications and technical conditions, and perform the necessary studies and applied research." (Presidential Decree 197/1981)

(1) the assumption that the activities of the sector should be focused in a single Ministry;

(2) a perception that local agencies and organiztions should be strengthened to achieve the GOE's long-term goal of assigning greater accountability and responsibility to these entities; and

(3) the need to strengthen significantly NOPWASD's ability to: advise local operating organizations, provide training, serve in a regulatory capacity, and function as the national focus for the collection and dissemination of basic data on the sector.

The IHRD project will provide consultant services to the Ministry and its Advisory Committee (ACPU), as well as to NOPWASD directly and local operating organizations indirectly. The Ministry consultant will provide support and advisory services on all matters related to the Ministry's responsibility for water and wastewater.

With regard to the IHRD Project, the consultant will:

(1) assist the Ministry and NOPWASD to identify counterpart Egyptian staff to work with the advisors;

(2) coordinate with other Ministries, the Governorates, and the local operating organizations;

(3) monitor and evaluate project progress; and

(4) review and comment on project recommendations.

In addition, the advisors will comment on matters of policy relating to water and wastewater, help coordinate foreign assistance to the sector, and provide general advisory services to the Ministry.

The initial contract period will be for two years with possible extension up to eight years, subject to AID and GOE review and approval. In effect, this consultant will provide for the Ministry of Housing and Public Utilities the type of advisory assistance which TAMS has provided for the Ministry of Housing and Reconstruction and is now providing to the Ministry of Development.

A second consultant, funded under the IHRD Project, will develop a phased program (initially for two years with the possibility of extension) to strenthen national and local organizations responsible for developing, operating and maintaining water and wastewater systems throughout the country. The initial two years will be devoted to designing a consulting strategy and building an advisory capacity for these organizations. Subject to AID-GOE approval, the design period will lead to a request to implement the consulting strategy.

It is envisioned that advisors will be required to address the following areas: management, training, planning and engineering, operations and maintenance, and commercial and financial.[2] The GOE is currently reviewing the draft terms of reference for the advisory consultant to identify and prioritize tasks and outputs in each of these areas.

The July 1984 reorganization of the GOE split the Ministry of Housing and Reconstruction into two new ministries: Housing and Public Utilities, under the direction of Minister Sedki and Development under Minister Kafrawi. This reorganization occured while the IHRD Project was under development and considerably slowed down the process of developing the project. Nonetheless, the GOE appears committed to acquiring advisory services. With TAMS assistance, the ACPU translated the proposed terms of reference into Arabic, reviewed the consultancy objectives, and established its own priorities for consultancy outputs. The care with which the Ministry has reviewed the Terms of Reference may be indicative of a growing concern over the need to strengthen sectoral institutions, beginning with the Ministry and its agencies, such as NOPWASD, and including local operating organizations. It is to be hoped that AID will be able to capitalize on this momentum by providing advisors of the type and within the timeframe desired by the GOE.

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[2] Chapter 3 recommends that the IHRD project include pilot projects aimed at quantifying O&M requirements and developing prototypical revenue systems.

Direct Assistance in Operations and Maintenance. As construction nears completion, there is an emerging consensus that expatriate assistance will be required for system start-up. Various A&E proposals address the need to provide interim assistance in initiating operations and maintenance of the greatly expanded and considerably more sophisticated infrastructure. The CWO and CGOSD chairmen have expilcity requested direct assistance in Operations for the Cairo West Bank Project. In other projects, it is less clear that the operating organizations recognize the need for assistance, although consulting engineers seem uniformly agreed that some form of Operations and Maintenance assistance is required.

Given likely construction completion schedules, AID and GOE have some time to consider the form of technical assistance. Early indications are that AID will link the requirement for direct Operations assistance with the local operating organizations need for institutional and human resource development. This is essential if the GOE is to be weaned of its need for expensive expatriate O and M assistance.

To the extent that this requirement is approached developmentally -- i.e., with a concern for transferring skills to Egyptian counterparts as quickly as possible -- it will require a variety of possible providers of direct Operations assistance cum training. In order to accomplish system start-up and develop counterpart capabilities to sustain operations and maintenance simultaneously, a number of skills, including those related to training and institutional development, will be required to supplement engineering know-how. Thus, the anticipated expatriate assistance contracts will afford an additional opportunity to overcome institutional weaknesses at the local operating organization level.

Other Advisory Approaches. In addition to on-going project-funded management advisory services contracts, several of the more recent Project Papers and project amendments include funding for management advisors. When the Canal Cities Water and Sewerage PP was amended in 1983, provisions for advisors on wastewater were defined. More recently, the PP for Cairo Sewerage II anticipated attaching AID-financed management advisors to CWO. Although the GOE has not elected to exercise either of these options, the opportunity exists to provide advisors directly to these operating organizations.

As an alternative, USAID/Cairo recently began exploring the possibility of establishing twinning relationships between local operating organizations and U.S. utilities. Both institutional support and training could be supplied through such arrangements. A number of U.S. utilities have expressed interest and AID is examining the approach. In addition, AID has encouraged the utilities to consider how each might associate with other firms which contract to provide direct O and M assistance.

Autonomy. For some time, the GOE has considered giving local operating organizations greater autonomy from central government control as a means of amelioriating constraints to institutional development. Autonomy has been promoted by some as a mechanism whereby constraints in hiring and firing, compensation and retaining collections can be eliminated.

In its Beheira Project, the World Bank promoted the notion of decentralizing responsibility for operations and maintenance of water utilities to the provincial level, and stimultaneiously consolidating responsibility for service delivery throughout the province in the new provincial water companies. In 1981, the GOE agreed to test this approach and the Beheira Water Company (BWC) was formed. It is now official GOE policy to promote autonomy. Most recently, the Ministry of Housing and Public Utilities received a letter form the Prime Minister instructing it to reconstitute the Cairo and Alexandria Water Authorities as public sector companies. If the change occurs, both agencies would be able to retain tariff collections.

In the Beheira model, autonomy has its own particular meaning in the context of the Egyptian water sector. Provincial water facilities are operated by BWC, a Governorate joint stock company formed by Governor's decree under the provisions of public sector company law 60/1971, as amended. BWC, the first public utility to be formed under this legal framework, was established as a first major step in a GOE decentralization effort, and in response to World Bank pressure. The Company is receiving Bank financing for physical facilities and technical assistance.

The public sector company law allows BWC to set up its own personnel and internal regulations. Company assests incude all the public water operations in the province, including NOPWASD's regional facilities, eight municipal water departments, and about 50 rural borehole schemes. BWC is under the authority of the Governor as Chairman of its General Assembly which reviews and approves major policy decisions, annual budgets, accounts and borrowings. The Company's Board is responsible for establishing internal regulations regarding organization, management, staffing, accounting and financial systems. The Chairman of the Board is the BWC's chief executive. In addition, the company is empowered to retain tariffs collected and to utilize these revenues to meet O and M costs.

One of the more significant features of BWC's autonomy is that it could be selective in determining the employees to be absorbed in taking over the responsibilities for the various municipal and rural water units in the Governorate. As a result, BWC's staffing should be relatively leaner and more competent than most organizations in the sector.

In practice, BWC is still dependent upon the central government in a number of important ways. First, the Governor is an appointee of the Central Government. In addition, NOPWASD develops the system and hands over responsibility for O and M to BWC upon completion. Finally, tariff collections still fall far short of O and M requirements. Hence, BWC, like other Egyptian utilities, must seek annual budget allocations to make up the deficit.

When BWC was formed, the GOE undertook an obligation to budget sufficient funds to make up the deficit between collections and O and M requirements. In its first year of operation (1982/83), with NOPWASD assistance, BWC attempted to project O and M requirements as the basis for formulating its request for budget allocation. However, these projections were discarded in the ensuing negotiations between the Company and the Ministry of Finance which ultimately provided a significantly reduced subsidy. It was reported that last year BWC abandoned the effort to project O and M requirements. With NOPWASD assistance, BWC goes instead directly to the Ministry of Finance to negotiate its annual budget subsidy.

Although the GOE autonomy policy, as reflected in the Beheira model, might better be characterized as semi-autonomy, it receives general support from Egyptians working in the sector. In the Egyptian context, "Autonomy" refers to the centralization of some authority and responsibility at the provincial level, not the lowest levels. This approach is seen as having forged the link at the local level between service delivery and collections, and between O and M requirements and tariff collections/budget subsidies. The notion of autonomy is clearly popular with provincial leaders. The feisty chairman of the Beheira Company is anxious for an even greater delegation of authority. In Fayoum, members of the mayor's staff indicated their desire to become independent like BWC.

In addition, there is an expectation that decentralization may lead to better service delivery because of the closer proximity of the service provider to its clients. BY consolidating small rural water operations at the provincial level, it may be possible to deliver a higher quality of service.

AID has been somewhat ambivalent in its attitude toward the Egyptian autonomy policy. When the policy dialogue commenced, autonomy was a key objective. The MOU called for the establishment of autonomous local water and wastewater organizations with authority to retain service revenues for their own operating needs.

More recently, the Mission backed away from endorsing the policy. In the 1985 benchmarks, the Mission called for an evaluation of the Beheira project in 1986, leading to adjustment in the GOE autonomy concept. This change in the AID position reflects a recognition that autonomy is only partial, inasmuch as provincial entities still rely on NOPWASD for construction and on the national budget for operating deficits.

AID's recent hesitancy to endorse autonomy also reflects a concern that greater autonomy may weaken the claim of local operating organizations on national resources, including financial and institutional support. As a result, for the time being AID is taking a wait-and-see attitude toward autonomy. The World Bank, on the other hand, continues to support the notion which is central to the success of its Beheira Project.

C. Conclusions and Recommendations

1. Sector Management Capabilities. Management practices and organizational structures in the sector are charactrized by:

(1) considerable fragmentation of authority and responsibility;

(2) managers who are technically weak and largely unable to define, implement and monitor the program;

(3) organization/management practices shaped by culture, not function, and favoring committee consensus-building and decision-making;

(4) little delegation of decision-making authority and very little communication across and among departments and between and among managers, and

(5) personnel from top to bottom who are not stimulated to perform by the traditional incentives -- pay, perks and promotions -- that create pride and generate high standards of performance.

It is important to remember that when AID launched its program ten years ago, investments were placed with organizations which had not existed or had only minimal experience in managing large construction programs or operating modern systems. In most cases, the organizations charged with constructing, operating and

maintaining modern systems had passed their entire operational history developing, managing and learning about systems that had been designed in the first quarter of the twentieth century. In addition to being unfamiliar with many of the technical and operational requirements of planning, constructing and operating the new systems, the agencies were required to operate as public sector authorities without financial independence or full authority over their practices and programs.

AID and other donors have made repeated efforts to provide the organizations with the assistance needed to diagnose and correct management deficiencies. The landscape is strewn with what one Egyptian manager refers to as "sensible and reasonable" recommendations; few, however, have been considered "practical" within the Egyptian context, or officially embraced.

Still, the management assistance provided and the approaches taken to improve the practices and organizational efficiency of agencies and general conditions in the sector have not been without effect. The structures and practices of the agencies are evolving, slowly and almost imperceptibly, as the critical issues raised by the donors, e.g., autonomy, tariff policy, organizational structure etc. are discussed and move toward resolution.

2. Two-Track Approach. AID's dual approach to strengthening sector institutional capabilities -- through continued policy dialogue and the provision of management advisory services -- appears valid. Although the policy dialogue has been largely one-sided and institutional development activities have not met with universal success, there has been a cumulative position effect. For example, there is an increasing GOE acceptance of the need to improve institutional capacity at both the national and local levels, most often expressed as a desire for training.

Policy Dialogue - The MOU was AID's attempt to spell out the institutional and financial reforms which had been hinted at when the AID Administrator promised $1.2 billion of support for the sector over the period 1982-87. However, AID's failure to address these issues earlier when sector projects were designed and construction initiated, left it in a weak position in relation to establishing targets for reforming 1982, much less to quantify expected GOE performance.

As a result, AID's MOU objectives in some cases -- e.g. the requirement to establish autonomous local institutions and the requirement for the GOE to secure the services of a construction manager -- were premature. AID has subsequently backed away from both. AID has met with greater success in articulating and

promoting its objectives regarding tariffs and manpower development. However, it has taken until 1985 to engage the GOE in a discussion of quantifiable targets, and even this discussion has been fairly one-sided.

Still, the discussion has been largely confined to national level policy-makers. Despite the limitations of autonomy in the Egyptian context, AID should focus on parallel dialogue with local organization leaders who will soon confront the responsibility for operating and maintaining greatly expanded infrastructure systems.

Institutional Development - The objective of past and on-going management advisory services contracts -- to make national and local sector organizations more effective -- remains valid. However, the approach taken was too often not conducive to institutional development, and efforts at institutional assistance met, at best, with mixed success. A partial explanation lies in the prescriptive, highly "Amercanized" approach taken by some advisors and resisted by most GOE counterparts.

Another aspect of the explanation is that Egyptian leaders do not recognize management as a science or a technical specialty to be approached like other assistance, for instance, engineering services. Management assistance services deal with problems which are difficult to define and resolve, and the state of the art is unclear. Furthermore, successful technical assistance geared to institutional development requires a thorough understanding of the society, culture, and institutions involved. The outputs of such assistance, which lack the precision of engineering solutions, are difficult to assess and usually require behavioral changes in the recipient.

3. An Approach to Delivering Management Advisory Assistance. In order to improve the prospects that management advisory assistance will be accepted by Egyptian leaders, it is essential to recognize that the problem is one of organizational development not engineering. This has implications for style. For instance, it argues against reports which are overly analytical and prescriptive. It argues for an approach which organizational development specialists call "process consultation". This style is characterized by a high degree of mutual problem solving and "buying in" by the recipients of technical assistance.

This conclusion also suggests the skills which are required to deliver management assistance successfully. Rather than relying on engineering firms to broaden their perspective to include institutional development, AID should look toward a variety of U.S. providers of management advisory services -- including management consultants, academia, and utilities themselves, in addition to the more traditional A&E's.

Finally, because successful technical assistance related to institutional development requires behavioral changes in the recipient, a strong case can be made for "Egyptianizing" AID-financed institutional development efforts by requiring a formal association between U.S. and Egyptian contractors. Although it has not been possible to survey all potential Egyptian management advisors, there is some indication that they exist in growing numbers. To the extent that they are inexperienced, it may be necessary to structure the arrangement in such a way that the American partners in effect bring the Egyptian partners along by consciously transferring management skills to them.

4. Recipients of Management Assistance. In order to enhance effectiveness, management advisory services are required at all levels of the Egyptian water/wastewater sector.

At the national level, NOPWASD is "the only game in town". Although it is weak, it has a greater concentration of skills than the plethora of local institutions, possibly including CWO, CGOSD and AGOSD. It also has the greatest potential for serving a variety of functions, including coordination, regulation of the sector, development of curricula, and setting standards, as well as retaining responsibility for the design and construction of infrastructure at the provincial and local levels.

AID should continue the strategy of strengthening NOPWASD. In addition, the new IHRD Project should recognize the multiplicity of roles NOPWASD performs and tailor technical assistance accordingly. AID should ensure that NOPWASD develops skills in policy analysis, program planning and coordination, and evaluation. At present NOPWASD is almost wholly absorbed in designing and providing water and wastewater facilities to localities throughout Egypt. Most of the organization's staff is involved in engineering and project implementation functions; little time is spent on sector planning, training or policy analysis. For its part, the GOE should re-assert NOPWASD's national responsibilities and assure that AID-financed advisors have strong GOE counterparts.[3]

5. Local Autonomy. At the local level, institutional development efforts should be directed at more independent organizations. Given the paucity of project management skills in Egypt and the foreseeable relatively long-term dependency of local organizations on national subsidies, autonomy does not make sense for system development. (A strengthened NOPWASD is in a better position to implement design and construction.) However, greater local responsibility for system operations and maintenance does make sense. AID should, therefore, continue to build institutional capabilities at the local level to manage operations and maintenance.

6. The Argument for Indirect Management Assistance. Although MHPU and NOPWASD have expressed an interest in receiving advisory services through AID's IHRD Project, there is little general acceptance of the need for institutional development and improved management capabilities, especially at the local level. In part, as has been suggested, this is because the state of the art is unclear and outputs are elusive. In addition, the low level of demand for services related to institutional development at the local level may be attributed to past experience with management advisory services contracts. The Boyle experience in Alexandria was particularly bad, but other firms have also met with rejection when they moved beyond a surrogate project management role to prescribe organizational reform.

This residue of resentment argues for providing management advice in directly in the future. The most obvious opportunity is the sought-after expatriate O and M assistance. It has been recommended elsewhere that for direct O and M assistance to be developmental it must strive to transfer skills as rapidly as possible through an institutional/human resource development approach to service delivery. The O and M assistance contracts may therefore present the most obvious opportunity for AID to support the provision of management assistance at the local operating agency level in the near future.

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[3] Efforts should be made to increase the degree of cooperation and information sharing among those ministries that are fundamentally involved in sector activities, namely, the MHPU, the Ministry of Planning and International Cooperation, and the Ministry of Finance. In this connection, it would be useful to have representatives from MPIC and the Ministry of Finance on the Advisory Committee for Public Utilities (ACPU) attached to the Ministry of Housing and Public Utilities.

Appendix 1.2

National Organization for Potable Water
and Sanitary Drainage (NOPWASD
Manpower Numbers
1984

Classification	Number
Director/General Managers	30
Engineers	226
Legal Officers	15
Surveyors	3
Researchers	4
Public Relations Experts	4
Accountants and Financial Experts	41
Management/Administration Staff	45
Skilled Labourers	145
Unskilled Labourers	322
Clerks and Typists	322
Other unskilled	205
Total	1362

Source: JICA Study of Sharqia Governorate 1984

Chapter 2
Training and Human Resource Development [1]

A. Background

Since most of the organizations in the sector have been largely unable to develop and implement projects or maintain physical systems adequately, AID has attempted to enhance institutional capacity by training Egyptian personnel. Through contracts with management consultants and A&E firms AID has made training available to improve organizational performance and to strengthen the capacity of each sector authority to cope creatively with a changing and uncertain environment. The immediate objective of training has been to achieve more effective organizational action measured as increased efficiency in the implementation, operation and maintenance of the physical works.

The training components of the projects in the sector have been defined and conducted by expatriates who have attempted to work through Egyptian counterparts to implement an operational model common to water and wastewater organizations found in developed nations. Training has been viewed as an important, if not a central, component of project implementation. It has offered an opportunity to establish good relationships between expatriates and host country professionals and to build the operational capacities of the Egyptian institutions.[2]

None of the AID-financed projects are exclusively training projects, although all the most recent project contain training components. Indeed, over time, training has become increasingly important. As more physcial works approach completion, there is an awareness on the part of both AID and GOE officials that available staff do not have the expertise sufficient to ensure that the works in place and about to "come on line" will be operated and maintained properly. In addition, resources available to train the staff of the water and wastewater organizations are few and scattered. In order to achieve the training goals of the sector, (1) managers, planners and operators responsible for the physical works must be trained and, more importantly, (2) the trainers responsible for developing and maintaining the programs that can build the capacity of the staff on a continuous basis.

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[1] For a glossary of Human Resource Development (HRD) and Training terms, see Appendix 2.1.

[2] A status report of all training conducted by local agencies and contractors, as well as a description of each agency's training department where one exists, is contained in the "Urban Administration and Development Training Status Report," March 1985. Data for this report are summarized in the Tables of Appendix 2.2.

The importance of a personnel system that motivates staff and rewards good performance is readily acknowledged. Current employment policies and practices in Egypt do not reward performance or inculcate a sense of pride in the workers.[3] These policies can, however, only be changed by officials at the national level who do not suggest that any reform is likely. Improvement in organizational performance will have to be achieved through mechanisms that are available within the current policy environment and specific to the sector.

B. Discussion

1. Training in the Sector. Local capability to provide the training needed to prepare the staff to manage organizations and to operate and maintain physical works is limited. In addition, training in management, construction supervision and operations and maintenance provided by expatriate firms appears to have had limited effect.

Training activities in the sector can be summarized as follows:

Local Training Capacity. Training structures in the sector are virtually non-existent. In addition, the few qualified trainers available to the sector are not situated in a single counterpart training facility. Sector-specific training resources (materials, personnel, schools/institutes) are uncoordinated and training approaches are not well-focused.

Expatriate Training Assistance. Training has been conducted largely by A&E or management consulting firms. Both have attempted to identify certain categories of managers and staff and to transfer to each group a set of skills. In general, training has been short-term and has emphasized the development of a set of technical skills relevant to the operation and maintenance of components of the physical works (e.g., sewer cleaning). Management training has been attempted with little success.

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[3] Until recently all utilities were required to employ all persons sent by the central personnel agency. It has been the government's policy to guarantee employment to all university and institute students, veterans. As a result, none of the agencies are staffed according to engineering estimates. Many individuals are carried on the personnel rolls without tasks; many do not appear for work. The Central Organization for Administration and Management indicates that this practice is no longer in effect for public utilities, but the residual effects are still felt in the sector.

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Training in the AID projects has been delivered primarily by US expatriate technicians. Only limited supported has come from Egyptian counterparts. Most of the US trainers have been technical specialists; there have been few "trainers" or "human resource development" specialists.

2. AID-supported training activities. Training in the AID projects began first in Alexandria in 1979. The initial phase was conducted in the early half of this decade; efforts continue in all of the projects, with the exception of the Canal Cities. The tables in Appendix 2.2 summarize the project training activities to date.

3. Estimate of the impact of training. The training activities/components of the AID-sponsored projects have not produced the results anticipated or assumed in the project designs which were extremely weak in identifying anticipated results. Training has, however, exposed the management and staff of water and wastewater organizations to different approaches to managing utilities and to design, construction and operation of the physical works. In general, however, the skills transferred through training have not been applied at the work site in part because of (1) weaknesses in the design and delivery of the training programs and (2) constraints posed by governmental policies and organizational practices.

Weakness in Program Design and Delivery

- The training programs have been designed and delivered by expatriate firms which, as a rule, do not have staff strengths in human resource development.

- The training provided has focused on improving the capacity of management and staff to perform more effectively. However, training did not develop a cadre of Egyptian professionals to take responsibility for developing and providing training on a continuous basis.

- Most training programs have exposed trainees to new materials for very short periods of time. There has been little follow-up to determine what has been mastered or to reinforce what has been presented.

- Training has been done primarily in English using water and wastewater models and methods from more developed countries. Many of the materials (manuals, management systems) have been translated into Arabic without taking into account the level of need and understanding.

Constraints Posed by Governmental Policies and Organizational Practices

- Government employment policies which regard water and wastewater organizations as a "dumping grounds" for labor, and personnel practices which do not foster initiative and performance mitigate against personal and professional development in the sector.

- Organizations have not made training a priority. Most do not assign counterparts to participate in the design and execution of the training programs.

- Training, especially overseas training, is considered a personal and professional reward and not a means for improving job performance. Overseas training is frequently given to employees who are to be promoted or to change jobs. (For example, four of six employees who recently went abroad for training were promoted or left the agency on their return to Egypt.)

- Learning and improved job performance are not rewarded at the job site. Since job classifications are relatively inflexible, learning new skills does not necessarily guarantee that they will be utilized. (For example, laborers who were trained to operate pumps were not allowed to utilize their skills on return to their agency.)

4. Constraints to the Development and Delivery of Effective Training

-- Lack of clearly established goals within each agency and the sector.

Good training is conducted to correct performance discrepancies or problems. If organizational goals are not established or, if established, not communicated, training efforts can be ineffective. In the absence of management direction, training is sometimes conducted "for training's sake," under the mistaken assumption that any training is better than no training.

Currently, in even the best run utilities, there is a lack of understanding that training is a management tool related to management goals. Training is viewed positively as something that everyone should have. However, the conduct of training is perceived as a ritual or rite of passage; everyone should sit in a classroom and listen to a lecture.

-- Inadequate Information and Analysis of Workforce Needs

A training strategy requires reliable estimates of workforce requiring training for each skill category, (e.g. how many engineers, technicians, laborers, supervisors are required to operate and maintain facilities). These data are inadequate, unreliable or unavailable. For example:

- The NOPWASD central training department estimates that there are 37,000 total employees in the water/wastewater sector. They project a total need of 95,000 leaving a shortfall of 58,000 employees. NOPWASD estimates that 37,000 employees in operations and maintenance alone need training. These data are based upon gross estimates and bear little relation to staffing requirements supplied by the various consultants.

- TAMS estimates that 16,000 total staff will be needed to operate utilities in an efficient, cost effective manner by the year 1988. The TAMS breakdown includes estimates by agency and skill category. To meet the need, TAMS estimates that 2,700 operations and maintenance personnel will need to be trained in each of the next five years 1985-1990.

- AMBRIC has made a preliminary estimate of future workforce needed to operate and maintain the Cairo wastewater system. Cairo alone will require 2,216 trained people at a constant staffing level until 1989 when the staffing requirement will increase due to increased system capability.

While an accurate workforce survey has never been conducted, indications are that at the technician level and below, most of the personnel working for the public agencies cannot read and write. This is, however, not true of entry level workers for the SCA which requires a minimum of secondary or trade school training for entry. SCA also requires a three-month qualification period for technicians and below, and a two year qualification period for engineers. In the other agencies, personnel policies do not require literacy as a condition of employment. The sector is given low status as an employment opportunity.

-- The lack of understanding of training technology

Most GOE managers comment that all their personnel need training, and that training should focus on the operators and the lower levels. GOE officials have no expressed interest in management training, except for the Central Organization for Administration and Management, a group charged with promoting effective management throughout government agencies.

Currently, training is viewed as a panacea for a series of performance problems. Training is not seen as a strategy for correcting performance discrepancies.

In addition, models of successful performance-based training and practice have not been developed and demonstrated by any agency or consultant working in the sector. Two exceptions may be AMBRIC's program to train draftsmen and pump station crews. In this case, counterparts have been identified and assigned, and the methodology has been carefully selected to include models and complete instruction in Arabic.

-- Lack of training counterparts

Although the primary focus of current AID projects has been to build or rehabilitate capital works, it has been assumed that skills will be transfered. However, training by foreign consultants working with translators (or even with local consultants training in Arabic) on a one-time basis has not had sustained impact. This type of training has been conducted in the Canal Cities, Alexandria, Cairo, the Provincial Cities, and more is planned through current contracts and contract amendments.

Staff turnover in the sector is a constant reality and indications are that good trainers will be difficult to find and keep. A person who transfers skills or facilitates learning must not only be technically excellent, s/he must also understand how people learn. Currently there is no special incentive for a person to want to become a trainer or for an agency to retain individuals who develop training skills. GOE officials have suggested that anyone receiving special training to become a trainer may be required to remain as a government trainer for a minimum of five years. This policy may deter people from becoming trainers. It would be preferable for top management to support the development of trainers by offering training, good compensation and a promising career track.

-- The absence of motivation and reward

Understanding and pinpointing the causes, conditions and parameters of what motivates employees to perform requires professional knowledge of the culture and is beyond the scope of this review. However, it is clear that training alone will not motivate people. Training may provide skills and make people feel important for a brief time, but training does not reward, support, supervise, or hold people accountable for performance. These are management and supervisory issues.

During this review, a consistent pattern of employee motivation and reward emerged. In utilities where management practices and salary compensation are strong, utilities are maintained (SCA, and Beheira Water Company to a lesser degree). In the large public utilities where compensation is sufficient, but supervision and management direction are confused, motivation (as reflected by work output and the state of O and M) is poor.

Law 26/1983 for sewerage and sanitary workers provides a risk allowance of 60 percent of basic salary plus a food allowance and overtime pay of up to 25 percent for daytime and overtime pay for up to 50 percent for night work. The application of this law has not demonstrated that sewerage workers have increased productivity or are more highly motivated than before. There is some evidence, however, that utility workers want these benefits and are willing to join wastewater organizations to get them.

5. Existing Training Resources (selected). Several institutes and educational centers were visited to determine (1) the degree to which each could conduct one or more of the following training activities, namely, management training, design and construction, and operations and maintenance, and (2) whether such training would precede employment (pre-service) or be carried out on-the-job (in-service).

Among the institutions visited were the Training Organization of the Ministry of Housing and Reconstruction (TOMOHAR), the High Institute for Environmental Health at Alexandria University, the Sadat Academy of Management Sciences (SAMS) and the Development Research and Technological Planning Center at Cairo University.

TOMOHAR. The Training Organization of the Ministry of Housing and Reconstruction (TOMOHAR), provides basic skills training for the building trades industry (bricklaying, basic wiring, basic plumbing, metal work and welding, cement form making, plastering and painting).[4] TOMOHAR has a network of approximately 30 vocational training centers throughout Egypt. Current plans are to expand to 65 centers.

TOMOHAR's Gesr El Suez training center contains a special unit that trains all trainers for the TOMOHAR system. Plans are underway to develop two additional locations for training of trainers, one in Alexandria and the other in Port Said. The staff of TOMOHAR have received extensive vocational training preparation through GTZ-funded internships and special programs in Germany. Curriculum development and training methods and modules have been provided by the ILO.

In the past year, TOMOHAR has been training the Gesr El Suez staff in skill training methods using a basic four step process (discuss, demonstrate, practice, evaluate). This methodology, which is standard vocational training, appears to be effective for simple trade skills; it would need to be considerably broadened to train workers in the more sophisticated water and wastewater sector.

TOMOHAR's core training staff of four is familiar with such techniques as job analysis, developing a training profile, writing performance objectives, and designing skill training and simple audio visuals. These skills are directly applicable to designing a performance-based program. This is the only group visited which has an applied, successful model for skill transfer.

TOMOHAR has

- skill training methods and models;
- extensive physical facilities (dormitories, workshops, classrooms) which could be rented or used by water/wastewater institutions;

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[4] TOMOHAR is currently in the Ministry of Development and Reconstruction, formerly the Ministry of Housing and Reconstruction. All utilities and NOPWASD are in the Ministry of Housing and Public Utilities. Consideration is being given within the GOE to broaden TOMOHAR's role to include the Ministry of Housing and Public Utilities, and to integrate it in some way with NOPWASD as a training resource.

- a staff who could assist other trainers to develop training departments, and

- the ability to provide a portion of the basic skill training for utilities (such as pipelaying and repair, valves, sample taking, meter repair).[5]

TOMOHAR appears to offer the type of training that could prepare personnel for low-level jobs in the sector as well as improve the performance of those already employed in this job classification.

The High Institute of Public Health, Alexandria University. Although there are currently no undergraduate degree programs in environmental engineering in Egypt, the High Institute offers post graduate courses in environmental sciences. Courses in water and wastewater treatment are available, if sufficient demand exists. Courses at the High Institute are offered both as part of a Masters or Doctoral program, or can be taken outside of degree programs. If sufficient demand and financing exist, the High Institute appears willing to provide engineering training and to tailor the courses to address specific needs.

The Sadat Academy for Management Sciences (SAMS). SAMS offers degree programs and specific courses outside of degree programs. SAMS has also developed a series of extensive case studies on management problems in the Egyptian context. Interview data indicate that SAMS has provided Egyptian-oriented management science courses.

Although some faculty experienced in designing and presenting courses on management have left SAMS, three or four of the current faculty are senior, experienced management trainers. They are occasionally available as consultants to industry and could design training that is responsive to sector needs. SAMS' staff could prepare new managers and update those currently in place.

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[5] It is not recommended that TOMOHAR provide more advanced training such as water treatment process control, engineering training, O and M of complex pumps and machinery etc. using their basic vocational training method.

Universities and Institutes. A cursory review of institutions of higher learning indicates that none of the four major universities (Cairo University, Ain Shams, Suez Canal University, Alexandria University) offers degree programs in sanitary or environmental engineering. While engineering students tend to pursue a degree in civil engineering, a more prestigious degree providing access to better career opportunities, programs also exist in electrical, architectural, and mechanical specialities. Sanitary engineering is generally part of the civil engineering program.

Institutions of higher learning do not provide performance-based training geared to real problems in the workplace. Their approach is usually theoretical and focused on preparing students to enter a field of employment. It is unclear whether universities and institutes can provide practical in-service training for engineers, or if the faculty would be willing to develop case studies and carry out on-the-job consultation within the context of a training program. Engineers require this type of training. If these institutions are used as training resources for the sector, training expertise focused on the in-service situation should be linked with the academic environment to ensure that the maximum practical impact is achieved. This would require training specialists and academics to work together.

Development Research and Technological Planning Center at Cairo University. Affiliated with Cairo University, the Center has resources (staff, word-processing and simultaneous translation facilities, etc.) that can be used to design, plan and implement programs to meet training objectives. The Center can draw on its own services, the technical and support services of Cairo University, and the facilities of outside Egyptian and foreign consultants to construct programs responsive to the needs of the sector in general, or to specific organizations in the sector.

6. Analysis of Proposed Training Activities. AID is currently reviewing a series of training proposals, and developing a major Institutional/Human Resource Development Project (IHRD). Also under review are contract amendments and proposals from the A&E firms to provide training to projects in the Canal Cities, Alexandria, Cairo, as well as Cairo's General Organization for Sanitary Drainage. In addition, the TAMS training consultant has developed a proposal to establish a training resource center.

IHRD Project. The Terms of Reference (TOR) for this project are currently under review and a Project Paper (PP) is being developed. The proposed project could be a vehicle for defining, developing and institutionalizing training systems in the sector. The project will need to distinguish between the short-term training needs that will be met by other projects and the long-term requirements for pre-service and in-service training in management, design and construction, and operations and maintenance.

Contract Amendments A&E Requests to Conduct Training. Current proposals from A&E firms have a similar pattern, and most have the same deficiencies.

- The proposals either do not specify a "training of trainers" component or, if mentioned, do not describe how this will be accomplished. Training Egyptian counterparts is an opportunity to begin to develop a training system.

- None of the current proposals suggests the impact of training. Most emphasize the importance of carrying out lengthly needs assessment. Needs assessment is important, but can be integrated with on-going training. Critical training areas are known to both the GOE agencies and the A&E firms.

TAMS Proposal for a Training Resources Center. A concept paper for a Training Resources Center was developed by the TAMS training consultant in February 1984. The National Water and Wastewater Committee, an interagency group organized under the sponsorship of the Ministry of Housing and Reconstruction, reviewed this proposal which later floundered when the ministry was reorganized and the training committee was disbanded.

As proposed, the Training Resources Center would have been set up under NOPWASD to coordinate, set standards and promote training in the sector. The center would also provide direct O&M in-service training and develop training materials.

It is not clear whether this approach is part of a larger strategy to develop training capability throughout all organizations in the sector. In addition, there is no mention of developing HRD officers in each agency (an essential need), providing supervisory training for middle and lower level staff (another key need) or training trainers for the various organizations.

The idea of a Training Resources Center has served the very useful purpose of stimulating discussion among the agencies involved. Currently GOE officials in each of the agencies believe that O&M training is best handled close to the operating systems, not in a central facility. At the same time there is some recognition of the need to develop training models, resources, and standards, and to train trainers centrally. This activity is considered by some to be an appropriate role for a national organization like NOPWASD.

C. Conclusions and Recommendations

Current GOE employment policies and organizational practices constrain program effectiveness. Still, with a strong GOE commitment to improving the technical and managerial capacity of personnel in the sector there are good prospects for ensuring that rehabilitated and newly constructed physical works can be operated and maintained properly. Unless the GOE is committed to upgrading the performance of sector organizations, AID assistance of any magnitude will have minimum long-term impact.

Enhancing institutional performance will require the GOE (1) to train individuals in key technical and managerial areas before serving and while in the service of sector organizations and (2) to allow each individual to employ the new knowledge and skills derived from training. In addition, the GOE must commit to developing trainers who can assess workforce needs, develop appropriate training models and train management and staff on an ongoing basis.

In the context of defining a program to develop personnel and improve organizational performance in the water and wastewater sector, AID and the GOE should agree on the basic criteria for the program. In addition to defining the basic goals of all organizations working in the sector, agreement should be reached on the following points.

The GOE should:

1. nominate a chief Human Resource Development (HRD) officer for the sector. S/he should serve at the undersecretary level of the Ministry of Housing and Public Utilities and be responsible for all workforce programs in the sector;

2. appoint a high level HRD officer in each sector organization. Training officers should be carefully chosen, instructed and supported. These should be highly motivated individuals and the counterparts for staff of AID's IHRD project. Each organization in the sector should understand and provide performance-based training;

3. ensure that training actually transfers practical, usable, on-the-job skills and supports organizational goals.[6] Training should be targeted to the individuals and jobs where performance discrepancies exist. Training should take cultural variables into account.

4. ensure that Egyptians participate, deliver, plan and manage training. Expatriate trainers should concentrate on improving the skills of the HRD officers and training staff of the the sector organizations, and

5. ensure that sixty to seventy percent of those trained remain on the job and use the newly learned skills for at least three years. In addition, job performance should be assessed after training.

AID should:

add training expertise to the mix of skills on the Urban Administration and Development (UAD) staff. The new AID projects in the sector are as much training and institutional development activities as engineering. State-of-the art training technology requires in-depth knowledge of the field. AID should require that training is available in order to ensure that investments are soundly conceived and properly monitored.

With these agreements in place the GOE and AID can move to develop and establish (1) the training model, (2) the training structure and (3) the training programs.

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[6] For example, the management of a utility could decide to focus on pump maintenance for six months and present a special training program. The ministry could make one wastewater treatment plant fully operational and train everybody in the plant. This activity would use training to achieve a management goal.

1. Training model. Before selecting the training model appropriate for the water and wastewater sector, those in place in other sectors in Egypt should be reviewed. There is some evidence that the electric utility is developing a comprehensive training model for pre-service and in-service training. This model is being set up with the complete support of the ministry, and has been reviewed with technical schools and universities throughout Egypt.

In addition to examining this training model, approaches utilitized by the Egyptian Army to install and maintain the telelphone system should be examined to determine the extent to which certain components could be incorporated in the model chosen for the water and wastewater sector.

The model developed for the sector would identify the structure in which training takes place and the content of the programs presented.

2. Training structure. The training structure indicates the arrangement among the organizations responsible for training and the nature of the training provided. The structure should include all organizations, institutes, universities, authorities, etc., that have any role in the training process. The role of each organization and the interactions among them should be defined. The structure assesses each unit according to whether it provides pre-service or in-service training and the type (management, design and construction, operations and maintenance) and degree (high, middle, low) of training provided.

A review of the structure in place among the agencies currently involved in training in the sector suggests that the capacity of each is limited and that the linkage among sector-specific agencies and those outside the sector but with resources useful to the sector, is minimal. In principle, NOPWASD is charged with establishing and supporting a training structure thoughout the sector. However, NOPWASD has only two people assigned as trainers, the training budget is very small and the agency has only limited audio-visual equipment and training material.

Officials associated with water and wastewater organizations in the Canal Cities, Alexandria, Beheira and Fayoum appear to have no confidence in the ability of NOPWASD to coordinate training in the sector. At the moment, each agency wants to go its own way. There is a crtical need, therefore, to define the proper role of each agency and the linkage among them. It is suggested that NOPWASD coordinate the national training program but give special emphasis to training (1) trainers and (2) upper-level managers and technicians.

It is essential to assess the extent to which any given Egyptian institution can contribute to enhancing the capacity of individuals and organizations working in the water and wastewater sector. At present, data needed to guage a given organization's ability to conduct pre-service and in-service training in mangement, design and construction, and operations and maintenance are not readily available. It would be useful to develop a matrix along the lines suggested below to identify organizations within and outside the sector that can play appropriate roles.

	Training Organization	
Job Category	Pre-service	In-Service
Management		
Design/Construction		
Operations/Maintenace		

An analysis of the training capacities of all institutions within and available to the sector, coupled with more general data on workforce supply, should provide information on the number and type of trained personnel who can be made available to the sector within any given period of time. It should also indicate whether the organizations responsible for training have all the skills necessary or whether there is a need to develop their capacities.

An additional analysis of the operational demands of the physical works of the sector organizations, coupled with a review of the skill levels of current staff, should generate data on the number of personnel who need training, as well as information on the job categories most in need of competent staff. A matrix of the type outlined below might be a useful tool for determining the degree of correspondence between required and available personnel.

	Personnel		
Job Category	Required	Available	Difference
Management			
Design/Construction			
Operations/Maintenance			

Comparing the results derived from analyzing personnel needs and training capacities should suggest (1) who needs to be trained, (2) what kind of training should be provided and (3) where the training should take place. These analyses are of fundamental importance in developing the content of the training programs.

In general, training should be centralized where the demand is lowest. Top managers, engineers, training and HRD officers should be trained at central locations. This practice will ensure economies of scale, inter-agency communication and opportunities for establishing uniform procedures and standards for management, design and construction, and operations and maintenance. Where there is a demand for large numbers of personnel with relatively low-level skills, e.g., pump operators, training should take place at local training centers attached to the agencies.

Skills which can be developed through vocational training approaches, e.g., meter repair, welding, plumbing, should be obtained through organizations like TOMOHAR since there is no need to duplicate existing or easily adaptable programs.

While it is recognized that none of the agencies in the sector have the resources needed to carry out effective training, it is not too early to begin to outline the structure of training in the sector.

NOPWASD. NOPWASD should define and coordinate all training activities in the sector, assign the necessary resources (human and financial) at the local level, and carry out the following specific tasks:

- train the managers of sector organizations;
- train HRD officers and trainers;
- coordinate the training of sanitary engineers and arrange for post-graduate engineering training where academic programs are required;
- develop training materials, guides and audio-visual training aids for the sector;
- manage a central coordination committee comprised of representatives from each major agency in the sector and universities, technical trade schools and institutes to inform them of sectoral needs for curriculum;
- develop and manage certification programs for skilled positions in the sector;
- coordinate and train agency personnel in workforce planning procedures; (Workforce data should be collected and summarized from each agency by NOPWASD. These data should form the basis for rolling five-year workforce plans for the sector as a whole.), and
- evaluate training results and maintain training information records, and a central training library.

Local agencies. Each local agency should have a training department which works in a regional training facility. Some agencies would share the facility, e.g. Beheira and Alexandria agencies, Canal Cities Agencies and Governorates, Provincial Cities, Cairo.[7] TOMOHAR facilities could be used or adapted for use by many of these agencies.

Local agency training departments should:

- carry out on-going needs assessment for training with technical assistance from NOPWASD or an outside consultants;
- conduct Operations and Maintenance training and skill training for trades and crafts (when not trained by TOMOHAR). This curriculum should include all process control elements in water and wastewater treatment and distribution, and maintenance of the collection system. Each facility should have practical skills workshops containing cutaway models and training aids. In addition, local training should integrate supervised (or guided) on-the-job training with classroom instruction.
- evaluate training and maintain a training information system.

The training system design would use local training center facilities and one central facility. Local facilities would be staffed by the training departments of each participating agency. The staff of the training centers should belong to the local agency. The central training facility would be managed by NOPWASD.

3. Training programs. Since there are deficiences in the abilities of the organizations in the sector to provide training, as well as in the array of training programs on hand, efforts must be made (1) to improve the capacity of the institutions to conduct training and (2) to define and establish effective training programs. While it is premature to suggest the content of the program, it is appropriate to suggest the principles that should be kept in mind and the needs that should be addressed immediately and over the long-term.

Principles. All training must be directly responsive to the defined needs and performance problems of the agencies operating in the sector. Training should be designed to improve the overall effectiveness of the sector agencies, and top management must understand and support training programs.

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[7] In the case of the governorates, measures should be taken to ensure that sufficient resources are available to fund recurrent training costs. It may be necessary for NOPWASD to operate these training centers for the initial project years.

The training systems should work together as a coordinated whole. Centralization or decentralization of training is not a major concern; structuring the training system so that limited resources are used to meet the needs of the sector is the fundamental objective.

Needs to address. In the immediate future training is required in operations and maintenance.

Expatriate trainers from existing A&E firms should work with Egyptian counterparts to conduct the "start-up operations". The development of training systems and local capability needs to begin now. No opportunity should be lost to lay the foundation for sustainability.

These start-up training activities provide a good opportunity to specify the skills and behaviors needed (at all levels) to operate and maintain works. This is the first step in designing performance-based training.

Start-up training should require the A&E's to provide training specialists to back-stop technical personnel who will do training, but are not by professional trainers. Experimentation to determine which training methods are effective within the culture and within local constraints (e.g. level of literacy should be encouraged).

Given the low skill levels of employees, special strategies for O and M training must be designed that use a high degree of visual, practical, and supervised on-the-job training, and a great deal of follow-up. Class room programs with one field demonstration and a short practice period will not prove effective. Check lists and written job aids will not prove effective either, unless they are visually communicative. Attacking the basic literacy problem directly is a longer term option, along with upgrading entrance requirements and adopting a certification program. It seems clear that the traditional vocational school training approach, which depends on written material, will not work as a training strategy for O and M in Egypt.

Efforts to impose "canned" training modules, using standard films and supplies from stateside vocational training programs should be avoided. Training must be tailor-made locally if the Egyptian agencies are going to begin to "own it". Egyptian training officers must be included in all steps of training program development.

Training for shift supervisors and managers should be integrated into these efforts. Supervisors should know what needs to be done to ensure that skills enhancement is supported and that workers are held accountable for applying what they learn.

NOPWASD and each agency in the sector should select training officers and begin to put in place the foundation of a training system. Limited training equipment (models, films, manuals) should be made available by AID. In addition, advisors skilled in setting up training systems and technical trainers experience in improving job skills in operations and maintenance should be made available to work with Egyptian trainers.

In the Mid-Term - Egyptian trainers should continue to develop worker skills in operations and maintenance while local capacity in management, design and construction is improved through the assistance of Egyptian trainers and outside consultants. These efforts are "training technical assistance," and should be coordinated through the longer term IHRD project effort.

Over the Long-Term - The IHRD project may be the vehicle for establishing continuous training activities in the sector. Training departments and training centers should be developed strategically. Each agency should establish a staff capable of providing training on a continuous basis. NOPWASD should develop a senior HRD officer for each agency and train trainers for each agency. Technical assistance over at least seven to ten years may be required to ensure that NOPWASD reaches this objective.[8]

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[8] It may be possible to provide a single HRD/Training of Trainers contractor to assist NOPWASD and the individual agencies for training of trainers. However, each O and M training effort should also provide training assistance to each training department. It will be very important that the terms of reference for these technical assistance contracts provide compatible training specifications to avoid confusion and competing approaches.

Appendix 2.1

Human Resource Development and Training Terms

I. General Definitions:

Training: An intervention of structured learning used as a management tool. Training is an intentionally designed learning event based upon an analysis of performance discrepancies (needs assessment). Effective training will correct performance problems if the discrepancy is based upon skill or knowledge and conducted effectively.

Training can be effective as a management tool if management goals and directions, as defined and training needs are analyzed.

Human Resources Development: The full range of activities which encompass developing human potential and productivity in organizations. HRD includes activities such as workforce planning, training, education, incentive programs, motivation, safety, and related activities.

Training Officer: A professional trainer, or training specialist, completely versed and skilled in the full range of training methods. S/he is able to both determine training needs, and design and conduct training. A trainer is distinct from a specific technical trainer who has knowledge in a subject area such as engineering, office systems etc. However, some training officers are specialized both in a subject area and learning technology.

HRD Officer: A Human Resources Development Officer is a senior management position in an organization (equivalent to a division manager) who oversees the series of HRD functions in a organization. This often includes supervisory responsibility for training programs and staff, workforce development and planning, personnel, safety, retirement, and human resource forecasting, planning and allocation.

Technical Trainer: A person with a specific subject area expertise who transfers skills to others. A Technical trainer may often work in conjunction or with the guidance of a training specialist.

Management Trainer: A person with a specific subject matter area expertise in management sciences: supervision, management training etc.

Management Training: Training for managers and supervisors usually involving instruction in skills needed to plan, direct, lead, and control work. Management training is learning how to improve job performance in the cultural setting. It does not necessarily imply training for top managers; a shift supervisor, lead worker or anyone who exercises leadership to get work done is a candidate for management training. This term is sometimes called supervisory training. Supervisory training is a subset of management training.

Administrative Training: Training for staff in policies, procedures, systems (e.g. procedures for memoranda routing, filing systems,). Administrative training focused on learning procedures in administrative settings rather than learning how to get work done through others, which is management-related. The two terms are often confused and used interchangebly.

Training of Trainers (TOT): There are two basic types of TOT: training for training officers in the skills and techniques of training technology: and training supervisors, to transfer what they know on the job to others. The latter type of TOT is often used to transfer skills within an organization under the assumption that training others is a normal work responsibility of supervisors.

Skill Training: Training designed to improve physical, psychomotor skills. Skill training may include conceptual understanding and theory.

Performance-Based Training: Training specifically designed to correct a performance problem. Performance based training is based upon an analysis of the gaps between current and desired performance (performance standards or competency must be established as a baseline).

II Common Tools used in Training Technology

Needs Assessment: A diagnostic devices used to define training needs, set training goals and priorities, and design training programs. If one knows the current situation and the desired outcome or performance, training can be designed to fill the gap.

Performance Problem Solving: A diagnostic procedure which determines the gap between current and desired job performance and gaps options for filling the gap. Training may be one measure for correcting the situation.

Task Analyis: A diagnostic procedure which details all the specific tasks and skills needed to carry out a procedure. Each procedure is analysed for frequency and difficulty. This data is then used to design training.

Training Design: A training design is a specific set of instructions which a trainer uses to conduct a training session. It contains goals, objectives, step by step procedures with a schedule for each step. Good designs follow proper learning sequences.

Training Module: A collection of training designs or training sessions packaged together to address a single subject area or set of related skills.

Training Aid: Any device used by a trainer which helps participants learn. Common examples are flip charts, tools, audio-visuals etc.

Job Aid: A device designed to help a person remember how to do a job. Job aids can be a simple picture or a complicated check list or operations manual.

Appendix 2.2 (a)

Summary of Training Activities in the
Water and Wastewater Sector
March, 1985

Project #:	263-0048
Organization:	Cairo General Organization for Sanitary Drainage
Consultant:	AMBRIC
Project Activity:	Training
Training Period:	1980 - 81
Approach:	Classroom, Practical and Off-Shore Training
Subject (s):	English Language Pump Station Operations Wastewater Treatment Plant Operations Sewer Cleaning Off-Shore Training

I. Training Targets/Objectives	Training Activities
1. English language orientation and/or review for upper-level GOSSD engineers, scientists, management and technicians.	1. 200 GOSSD personnel attended 144 hours of basic English training and 36 hours of technical English training.
2. Pump station training for GOSSD engineers/manager.	2. 45 GOSSD engineers/managers trained for 60 hours in pump station design, operation, maintenance and safety through classroom and practical instruction.
3. Pump station O+M training for GOSSD operators and technicians.	3. 26 GOSSD operators/technicians received practical O+M training from AMBRIC staff and two of the GOSSD engineers that participated in the pump station - engineer/manager training.
4. Wastewater treatment plant design and operation training for chemist and engineers.	4. 65 GOSSD chemists/engineers, received 6 hours of design and 28 hours of operations classroom training.

5. Sewer cleaning equipment training for GOSSD maintenance personnel. TV sewer monitoring training for supervisors.

5. 400 GOSSD sewer maintenance personnel received practical training in the operation and maintenance of USAID-funded sewer cleaning equipment. GOSSD supervisors received additional practical training in TV inspection techniques.

6. ODA - funded off-shore training in the U.K. for GOSSD engineers and scientists in system O+M.

6. 20 GOSSD engineers/scientists participated in a 6-week U.K. course on wastewater systems operations and maintenance. 2/3 practical training and 1/3 classroom training.

II. Other Training Output

1. Preparation of Arabic/English O+M manuals.

ID# 1472D

Appendix 2.2 (b)

Summary of Training Activities in the
Water and Wastewater Sector
March, 1985

Project #: 263-0048
Organization: Cairo General Organization for Sanitary Drainage
Consultant: AMBRIC
Project Activity: Training
Training Period: 1 year, 1984 - 1985
Approach: Informal Technical Assistance
Subject (s): Sewer Cleaning for Middle Management

I. Training Targets/Objectives	Training Activities
1. Technical assistance to GOSD's middle management sewer cleaning personnel to improve sewer cleaning operations and maintenance procedures.	1. Since GOSD has no middle management personnel assigned to the sewer cleaning operations, technical assistance is being provided to personnel in preventive maintenance techniques.
2. To support previous 1980 efforts in training operator personnel in the use of Sewer cleaning equipment .	2. Unused sewer cleaning equipment is currently being brought into operation.

Appendix 2.2 (c)

Summary of Training Activities in the
Water and Wastewater Sector
March, 1985

Project #:	263-0048
Organization:	Cairo General Organization for Sanitary Drainage
Consultant:	AMBRIC
Project Activity:	Training
Training Period:	1 year, 1984 - 1985
Approach:	Classroom and Practical Training
Subject (s):	Pump Station Operation and Maintenance Pump Station Supervision

I. Training Targets/Objectives	Training Activities
1. To train operators of rehabilitated pump stations in correct operations and maintenance procedures.	1985 implementation
2. To train pump station supervisors and area engineers in proper O&M procedures and reinforcement/retraining procedures.	
3. GOSD counterpart participation in the design, planning and delivery of the training program.	

II. Other Training Outputs

The development of standard operating procedures, mechanical and electrical handouts, and checklists.

ID#1472D

Appendix 2.2 (d)

Summary of Training Activities in the
Water and Wastewater Sector
March, 1985

Project #:	263-0038
Organization:	General Organization for Greater Cairo Water Supply
Consultant:	ES-Parsons
Project Activity:	Training
Training Period:	3 Months in 1982 - 86
Approach:	Off-Shore and Classroom/Practical Training
Subject:	Leak Detection

I. Training Targets/Objectives	Training Activities
1. To provide off-shore training to supervisory engineers in the operation of electronic leak detection equipment, and to gain the skills necessary to train operators in the use of the equipment.	1. 6 supervisory engineers received 2 weeks of classroom training and 2 weeks of practical training in the use of electronic leak detection equipment, in the U.S.
2. To train supervisors and technicians to operate leak detection equipment with the assistance of off-shore trained supervisory engineers.	2. 10 managers, 3 supervisors and 50 operators were trained in the use of the equipment in 2-day classroom and 4-day practical training sessions during a 2 month program. Training was conducted by the consultant staff and 2 of the supervisory engineers trained in the U.S.

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Appendix 2.2 (e)

Summary of Training Activities in the
Water and Wastewater Sector
March, 1985

Project #:	263-0038
Organization:	General Organization for Greater Cairo Water Supply
Consultant:	ES-Parsons
Project Activity:	Training
Training Period:	1 Month in 1984
Approach:	Classroom and Practical Training
Subject:	Water Treatment Plant Operations/Start-up

I. Training Targets/Objectives	Training Activities
1. To provide practical start-up training for water treatment plant staff in the operation of clarifiers completed during stage I .	1. 20 water treatment plant personnel (plant manager, engineers, operators and laborers) received 4 weeks of theoretical and practical training in the operation of clarifiers.

Appendix 2.2 (f)

Summary of Training Activities in the
Water and Wastewater Sector
March, 1985

Project #:	263-0038
Organization:	General Organization for Greater Cairo Water Supply
Consultant:	James M. Montgomery
Project Activity:	Management and Technical Advisory Service
Training Period:	1984 - 86
Approach:	Informal Technical Assistance and Off-Shore Training
Subject(s):	Pilot Metering Program Water Wastage Program Off-Shore Training

I. Training Targets/Objectives	Training Activities
1. To train supervisors and staff in the installation and maintainance of water meters in a pilot metering program.	1985 implementation
2. To train supervisors and staff in water wastage control using the USAID financed leak detection equipment purchased in 1982.	
3. To train water meter field survey teams in data collection.	
4. Off-shore participant training in the U.S. for 8 technical and administrative middle-to-upper level managers, in both classroom and practical training.	

II. Other Training Output
Translation of leak detection equipment manuals into Arabic.

ID#1497D

Appendix 2.2 (g)

Summary of Training Activities in the
Water and Wastewater Sector
March, 1985

Project #:	263-0089
Organization:	Alexandria General Organization for Sanitary Drainage
Consultant:	Camp, Dresser and McKee
Project Activity:	Training
Training Period:	1978 - 81
Approach:	Practical Training and Informal Technical Assistance
Subject (s):	Design Engineers Practiced Training for Sewer Cleaning Operations and, Sewer Cleaning Maintenance for Engineers

I. Training Targets/Objectives	Training Activities
1. Practical training in CDM's design office for AGOSD design engineers.	1. 5 AGOSD design engineers received practical training in CDM's design office.
2. Practical training in sewer cleaning operations.	2. AGOSD sewer maintenance personnel received practical training and technical assistance in the operation and maintenance of USAID-financed sewer cleaning equipment.
3. Practical training in the maintenance and repair of sewer cleaning equipment.	

ID#1472D

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Appendix 2.2 (h)

Summary of Training Activities in the
Water and Wastewater Sector
March, 1985

Project #:	263-0100
Organization:	Alexandria General Organization for Sanitary Drainage
Consultant:	Boyle Engineering Corporation/Arthur Young and Company
Project Activity:	Management and Technical Advisory Services
Training Period:	1981 - 84
Approach:	Classroom and Practical Training
Subject (s):	Operations and Maintenance Sewer Cleaning Safety Construction Management Design

I. Training Targets/Objectives	Training Activities
1. To provide practical, on-the-job training in the areas of operations and maintenance, sewer cleaning and safety.	1. a) Daily practical training for AGOSD's Operations and Maintenance Division. This included equipment training for forklifts, cranes, pump station operations and treatment plant operations. b) A practical training in the use and application of safety equipment c) Practical training in the operation of sewer cleaning equipment.
2. To provide formal classroom training to AGOSD construction managers, resident engineers and inspectors, design managers and O+M personnel.	2. A total of 2,263 AGOSD hours received of training in: a) Construction management: 314 - hours b) Resident construction engineers: 1345 hours c) Design engineers: 143 hours d) Operations and maintenance: 371 hours e) General management training: 90 hours.

Appendix 2.2 (i)

Summary of Training Activities in the
Water and Wastewater Sector
March, 1985

Project #:	263-0100
Organization:	Alexandria General Organization for Sanitary Drainage
Consultant:	Wastewater Consultants Group
Project Activity:	Training
Training Period:	1982 - 86
Approach:	Practical, Classroom and Off-Shore Training
Subject (s):	Industrial Laboratory Specialty Workshop

I. Training Targets/Objectives	Training Activities
1. To train personnel in the use of industrial laboratory equipment.	1. Practical industrial laboratory equipment training for AGOSD personnel at the East treatment plant.
2. Informal speciality workshops for AGOSD personnel.	2. Informal workshops for AGOSD management in tunnelling and outfall design/construction, pipeline materials and corrosion protection.
3. To organize for AGOSD management personnel an off-shore training seminar / study tour of U.S. wastewater facilities .	3. 4 AGOSD director generals participated in a 20 day U.S. study/training tour of four U.S. metropolitan areas to observe O+M procedures, specialized equipment, construction activities and management systems.
4. To familiarize AGOSD resident engineers and inspectors regarding procedures on contract claims and change orders.	4. Classroom training currently being delivered.

II. Other Training Outputs

The preparation of English/Arabic claims management manuals.

Appendix 2.2 (j)

Summary of Training Activities in the
Water and Wastewater Sector
March, 1985

Project #:	263-0048
Organization:	Suez Canal Authority for the city of Ismailia, Port Said, and Suez
Consultant:	Canal Cities Consultant
Project Activity:	Training
Training Period:	1981 - 82
Approach:	Classroom and Practical Training
Subject (s):	Water Treatment System Operations and Maintenance

I. Training Targets/Objectives

1. To provide classroom and practical training to plant operation and distribution system supervisors and operators.

Training Activities

1. Classroom training was presented in the 3 cities. Practical training in water treatment plant operations, distribution systems and laboratory procedures to SCA personnel.

II. Other Training Outputs

1. An Arabic/English water distribution system training manual was produced

Appendix 2.2 (k)

Summary of Training Activities in the
Water and Wastewater Sector
March, 1985

Project #:	263-0048
Organization (s):	National Organization for Potable Water and Sanitary Drainage for the cities of Ismailia, Port Said, and Suez
Consultant:	Canal Cities Consultants
Project Activity:	Training
Training Period:	1981 - 1982
Approach:	Classroom and Practical Training, and Off-Shore Training
Subject (s):	Wastewater System Operations and Maintenance

I. Training Targets/Objectives	Training Activities
1. To provide wastewater personnel classroom training in operations and maintenance, design, construction, administration and inspection.	1. 93 hours of classroom training was provided to operators and engineers in collection system O+M, pumping station O+M, and primary and secondary wastewater treatment plant operations. laborer safety training was offered in Ismailia and design training was offered in Port Said only.
2. To provide practical training to wastewater personnel.	2. Practical training was provided to supervisors, technicians and laborers in the areas of sewer cleaning, sewer inspection, electrical and mechanical repair, and pump station operation.
3. To attend off-shore training courses and visit operational wastewater facilities in the U.S.	3. 4 engineers attended practical training and observational travel wastewater system at Florida for 6 weeks.

II. Other Training Outputs

A collection system operation and maintenance manual, a wastewater utility management, and a collections systems safety audio visual program were produced.

Appendix 2.2 (1)

Summary of Training Activities in the
Water and Wastewater Sector
March, 1985

Project #:	263-0127
Organization:	Beni Suef, Minia and Fayoum Municipalities
Consultant:	Wilbur Smith and Associates
Project Activity:	Training
Training Period:	1982 - 1986
Approach:	Classroom and practical Training
Subject (s):	Management Technical/Engineering Operations and Maintenance

I. Training Targets/Objectives	Training Activities
Year 1: 1. To meet the priority training needs to develop necessary infrastructure.	Year 1: 1. 226 trainees attended 10 courses conducted by the consultant staff and local organizations in English language, management and technical training.
Year 2: 2. To train personnel for water and wastewater operations and maintenance, city management and the training of trainers.	Year 2: 2. 311 trainees attended 16 courses conducted by the consultant staff and local organizations in English language, project management training, and water/wastewater and other engineering and workshop training.

II. Other Training Outputs

1. Arabic/English training manuals and training aids were developed for courses conducted during the first two years of training, and for the third year wastewater and water systems training.

Chapter 3
Financing Project Completion and Sustainability

A. Background

The financial aspects of USAID's program in the Egyptian water supply and wastewater sector have been reviewed to identify the most important financial issues and to specify realistically attainable targets which reflect a balance of USAID and GOE perspectives. Two principal outputs are sought, namely (1) to facilitate completion of ongoing and future projects and (2) to enhance the sustainability of projects through improved financial performance in the sector.

As some of the physical works supported by AID approach completion, the need to ensure that the GOE (1) makes capital available to complement the AID investments, (2) finances the design and construction of currently unfunded, but essential, components of the networks (e.g., the branch tunnels of the East Bank of Cairo), and (3) generates the revenues sufficient to operate and maintain the system adequately increases. Since the existing networks were allowed to deteriorate badly and little, if any, new construction was done in the period 1956-1980, the magnitude of the investment needed to rehabilitate and expand the urban systems to accommodate the needs of the existing and expanding urban populations is staggering. Of the total budget of the AID-financed projects, AID is contributing more than US$ 1 billion. The total budget for current projects is more than L.E. 5 billion and the amount required to upgrade and/or construct urban networks throughout Egypt is in excess of L.E. 10 billion. AID and GOE resources available for investment in the water and wastewater sector are limited.

Demands for investment are increasing. This requires AID and the GOE to review the current projects and to enact measures that will ensure their timely, cost-effective execution and sustained operation. The principal financial areas should be analyzed to begin to estimate the resources needed to complete and sustain the AID-financed projects, and to suggest approaches appropriate to securing the investment. Three areas of inquiry were addressed in this review:

1. Financial issues in project implementation
2. Measuring operating and maintenance requirements
3. Tariffs and the cost recovery potential

The findings in each area are summarized below, and the conclusions appear at the end of this chapter.

B. Discussion

1. Financial Issues in Project Implementation - Construction of the Physical Works

Cost Estimating. Virtually without exception, the first AID-financed projects in the sector experienced delays and cost overruns, caused by a number of factors which do not fit a common theme. The history of the Rod El Farag Plant is illustrative. The final contract price for the water treatment plant based on a reduced scope of work was more than three time the original estimated cost. In addition there was a $6 million error in the design engineer's estimated costs for pipe, valves and fittings.

There is no consistent reason for these difficulties in projecting costs. Inexperience in estimating for work in the sector may have contributed to the earlier tendencies toward underestimation of costs. Cost escalation factors were not consistent from project to project. Furthermore, the rapid escalation of construction prices and the scarcity of construction resources due to other Middle East "Petro" based influences were not foreseen. Early assumptions concerning the adequacy and delivery of Egyptian engineering services, construction capabilities and construction materials also proved to be too optimistic. The result has been upward pressure on costs since offshore services and materials had to be substituted.

Delay-induced cost increases were also encountered, for a variety of technical, policy and logistical reasons. The Provincial Cities Project is illustrative. An unescalated preliminary cost estimate received more credence than was warranted given the level of engineering that produced it.

To date, AID staff have been hard pressed to meet the most urgent program objective -- obligating authorized funds and meeting U.S. commitments to Egypt in a manner that approximates an optimum portfolio in the sector.

A series of recent events, possibly consitituting a trend, could result in a tendency toward overestimation of costs. The slowdown in the demand for construction resources in other Middle-Eastern countries has resulted in the return of many Egyptian construction workers and firms to an active and competitive role in the Egyptian

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market. Similarly, many foreign firms have experienced reductions in their Middle Eastern workloads and are in each of alternative markets for unemployed workforce, equipment and working capital. Inflation of foreign costs is also declining; the U.S. inflation rate, for example, has declined to the vicinity of 4 percent per year over the past two years, and shows no indication of a return to the double digit levels of previous years.

There is, however, reason to believe that cost estimating performance can be improved over the coming years. Many of the factors underlying the previous difficulties have been or are in the process of being resolved:

1. There is an accumulated body of knowledge, though not yet well organized within AID, concerning construction in the sector such as unit costs, potential sources of delay and the availability of labor and materials.

2. A corps of experienced contractors has been developed who, at least for the near term, operate in a much more competitive environment.

3. AID project and technical staffing has been increased, allowing greater opportunities for technical control and oversight, and possibly permitting more attention to cost monitoring and updating of cost projections.

4. The five year maximum life of all projects, which may have resulted in over-optimistic project completion schedules for some projects, has now been raised to ten years.

Experience to date suggests, however, that systematic, detailed and sectorwide approach to projecting construction costs has been lacking. Furthermore, little attention has been given to updating cost projections periodically to reflect such factors as (1) unit prices being quoted that reflect the competitiveness within the current construction marketplace, (2) shifts in trends in inflation in Egypt and abroad and (3) delays in implementation of project elements.

Without developing and updating cost projections, utilities in the sector, concerned national level GOE organizations and USAID will not be able to take advantage of the expanded knowledge of construction in the sector. Predictable events and measured actual economic performance would be ignored. In addition, there would be no ability to produce the best possible forecast of costs. For

example, the cost escalation factors for Cairo wastewater projects applied in AMBRIC's Design Inception Report were 15 percent per year for foreign costs and 25 percent per year for local costs from 1981. These cost projections are still widely cited and provide the basis for current assumptions on funding needs, despite the fact that events of the past 4 or 5 years may have significantly changed them.

It would be advantageous to feed updated factors into a cost projection program for each project, and periodically produce revised estimates of costs for individual projects and the sector as a whole. The elements for such a program are being formulated within UAD's engineering unit and cost estimating guidelines have been drafted. These efforts warrant consideration by mission management for full development and implementation.

The addition of a more detailed, systematic and sectorwide approach to cost estimating, including frequent updating of cost projections, would make future experiences with cost projections much more satisfactory. AID should consider establishing such a system inhouse, supported by prescribed inputs (data packages) from A&Es and, in cooperation with the GOE for use by the GOE when analyzing and estimating projects in the sector.

Funding - Measuring the Gap. Estimating the level of future funding requirements in the Egyptian water and wastewater sector is very difficult. The sector is faced with seemingly contradictory circumstances. For example, the five year plan is widely acknowledged to understate financial requirements on the one hand, yet is underexpended on the other.[1] This may reflect the sector's absorptive capacity as well as an evolving maturity which allows the sector to define its needs more clearly. While the GOE previously placed high priority on sector projects, there are recent indications that emphasis may be shifting away from the sector.

Table 3.1 presents comparative data showing several projections of water and wastewater investment requirements.

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[1] Total expenditures for the major cities for FY 82/83 were LE 235 million and for FY 83/84 were LE 327 million. It should also be noted that CWO expenditures for FY 83/84 were only LE 35.7 million. Source: Ministry of Housing and Public Utilities (MHPU).

Table 3.1
Projected Water and Wastewater Expenditures[2]
1985-1991

	1985	1986	1987	1988	1989	1990	1991
			L.E. Millions				
1. World Bank Estimate	600	700	800	900	1,000	1,100	1,200
2. Five Year Plan	500	550	600		(see note 3)		
3. Cairo Wastewater	600	650	700	750	800	-	-

Among the various estimates and revised projections, the five year plan reflects likely actual expenditures in the near term, at least until the sector strengthens its capacity to perform. If performance improves, the present concern over a funding gap diminishes. The fact remains that there is a substantial gap between the ability of the GOE and sector organizations to generate funding, and the level of investment needed.

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2 Source, Arab Republic of Egypt, Water Supply and Sewerage Sector Memorandum. The World Bank, January 1984. The investment level chosen between low and medium service levels was escalated at 10 percent per year from base year (1983) and rounded.

The amounts shown are indicative of the expenditure levels that must be achieved in order to complete the project(s) by 1989 as anticipated. CWO expenditures were only LE 35.7 million in FY 83/84; it's FY 84/85 budget request of LE 296 million was cut to LE 171 million. Donor funding is included in these amounts, but unspecified in GOE budget documents. Spreading implementation over a longer period will likely result in significant cost increases from added price escalation.

3 Gradual increases in expenditures are assumed. Early indications from the Ministry of Housing and Public Utilities are that revised estimates for the major utilities will be in the range of LE 7,000 million for the remainder of the decade. An additional LE 1,000 million has been identified by the provincial governorates.

AID has endeavored to build-up funding capabilities by including conditions, covenants and terms in various agreements. This effort has been aimed at increasing the revenues of the various utilities to achieve self-sufficiency. AID continues to encourage the GOE to make progress in this area.

Although the near term target for tariffs outlined in the MOU seems unrealistically high, the ultimate long term goal -- generating sufficient funds from current income to self-finance a contribution to the ongoing investment program of 10 to 20 percent of capital costs -- is certainly a worthy goal. Still, in an economy where self-suficiency is the exception rather than the rule, the development of commercially viable water and wastewater utilities can only be achieved gradually.[4]

Since this practice is likely followed in all GOE sectors, AID would have to determine whether or not the issue is significant enough to pursue government-wide; at present, it seems unlikely that special attention would be requested for this sector alone.

Funding-Procedural Issues. The AID Mission is currently identifying "benchmarks" or indicators which can be incorporated into Project Agreements for the purpose of guaranteeing that certain GOE responsibilities will be fulfilled at specified intervals. The amount of funds obligated under a project agreement will be broken-down into discrete phases. Funds for each phase will be tied to fulfillment of the agreed upon benchmark. If strenuously enforced, this approach will clearly benefit AID in achieving its goals and in securing GOE compliance with the covenants.

Within the GOE, TAMS, advisors to the staff of the MHPU, are in the process of preparing recommendations concerning ways to improve planning and management in the sector. Following an evaluation of the sector in 1984, TAMS concluded that physical planning and operational managerial planning are virtually absent -- except for those instances where master plans provide some guidance -- and

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[4] Other potential sources of funding for investments are limited. Existing taxes, such as the land/property tax, have many fundamental weaknesses and are not uniformly administered. An increase in the tax would not guarantee increased support for the sector because the funds would be deposited in the general treasury and sector entities would still have to vie with other GOE entities for funding through the budgeting process.

warrant priority attention. Although these staff recommendations are incomplete, it is reported that these will urge that a corporate planning program be instituted in each utility and for the sector as a whole. The focus of this effort would be on goal setting and financial planning for operations and maintenance.[5]

TAMS points out that the method of organizing and presenting Chapter three expenditure budget figures fails to indicate the level of donor funding available for individual projects. In effect, GOE funding requirements are overstated by implication. Until donor practicipation is included in the budget presentations, the GOE's actual budgetary commitments to projects and to the sector will continue to be poorly defined.[6]

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[5] See the following discussion on "Measuring Operating and Maintenance Requirements," and Chapter 1.

[6] Since this practice is likely followed in all GOE sectors, AID would have to determine whether or not the issue is substantial enough to prusue government-wide; it seems unlikely that special attention would be requested for this sector alone.

Both the revenue and expenditure budgets of the GOE are divided into four chapters or babs (doors). Chapters One and Two of the revenue budget are used to finance current expenditures; Chapters Three and Four are used to finance capital expenditures. Chapter One of the revenue budget includes general revenues derived from taxes. Chapter Two is "Current Revenues and Transfers" and consists of fees, service charges, interest received and surpluses from activities that are transferred to government accounts. Chapter Three contains own-source revenues for capital uses, and Chapter Four lists borrowed resources for capital purposes.

The expenditure budget also has four chapters. Chapter One is wages; Chapter Two denotes all current, non-wage expenditures. Chapter Three contains capital purchases and projects, and Chapter Four relfects debt repayment.

For a more complete discussion of the GOE budget refer to William F. Fix, "Budget Structure for the Government of Egypt," Working Paper 167, College of Business Administration, The University of Tennessee, Knoxville, March 1983.

In summary, it is difficult to assess the actual requirements for funds in the sector. The likelihood of annual expenditures showing any major upward shift in the near term is questionable. This conclusion is admitedly judgemental but based on past performances, and possible lessening of the relative priority given the sector by the GOE, and fundamental resource constraints.

AID's objective -- to encourage the GOE to develop commercially viable water and wastewater utilities -- is correct and proper. The generation of self-financed funds would clearly indicate sufficient financial strength to support capital programs through a combination of long-term borrowing, funds generated from current sources and minimal equity contributions from government and customers. Still, it will be a long time before the funding requirements of the sector can be met in this manner.

2. Measuring Operating and Maintenance Requirements. There is a clear and immediate need to begin to gain a better understanding of O and M requirements, measured in financial terms. Any contribution that AID can make to quantifying O&M requirements will improve the prospects of project "sustainability".

If project facilities are to perform as intended on a continuing basis, O&M is the top priority. Observers of the situation have generally assumed that O and M budgets have been inadequate in the past, have recommended that the GOE should be urged to boost existing levels, and to recognize that major future funding will be needed to support the newly constructed facilities. It has been assumed that existing O&M deficiencies and future needs can be accommodated simply by increasing O&M funding.

The realities of the sector and the GOE budgeting system do not support such an assumption. There is little if anything to be learned from a study of current and past budget allocations for O&M. In no case does the funding represent a standard of good practice. The commentary on O & M in Chapter One of the annual GOE budget is provided as an example GOGCWS's operating budget (Chapter One and Chapter Two less interest expenses) and has a very high proportion of staffing costs (88 percent)[7]. Many if not most of these employees are (conservatively) "underemployed" and, of those regularly reporting to work, there is little reason to suspect that they bear any relationship to the required numbers and types of skills. Few appear to be conducting appropriate tasks or are supported by the appropriate materials, equipment and supplies.

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[7] A true measure of funds devoted to O&M would require subtraction of funds included in Chapters One and Two which are devoted to engineering, administration, finance, legal and other supporting services.

Budgets are generally established in close approximation of the previous year's allocation. Budget increases basically represent increases in staffing, salaries or both. This was the case with the increase (for the major cities) in the Chapter One and Chapter Two amounts from LE 77 million for FY 82-83 to LE 113 million in FY 83-84.[8] Since the governorates do not budget separately for this sector, O and M costs in these jurisdictions are not readily available.[9]

AID and the GOE clearly need some "hard" financial data, based on demonstrated requirements for manpower, materials, and equipment, to support efforts to enhance the sustainability of the systems. Estimates based on a percentage of the cost of the new assets or the value of the existing assets simply do not meet that need. Such estimates are based on gross averages in other economic and cultural environments; they do not shed any light on the make-up of the costs they portray. Operating and maintenance requirements need to be developed systematically and should be based on the technical features and overall size of the facilities. As a first step, it is useful to begin to think of "operations" as a separate and distinct process from "maintenance".

Operating costs are less difficult to estimate with reasonable accuracy since they are largely based on quantifiable factors. For example, engineering estimates can be made of the electric power consumption based on knowledge of the volume of water produced, quantities of wastewater to be pumped, pumping head and pump efficiencies. Chemical requirements can also be estimated based on known or assumed factors of production/treatment. The composition and size of operating crews can be estimated based on an engineering assessment of the facilities and the number of shifts required for continuous operation, even giving due consideration to Egyptian customs and work schedules. A & E firms can prepare operating cost estimates for facilities under construction, along with estimates of the optimum operating requirements of existing facilities as well. AID should require project A&Es to prepare and/or update these estimates.

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8 ibid.

9 It should be noted that the standard GOE accounting systems could, with minor modifications in each utility, be adapted for use in developing cost accounting systems, without sacrificing the ability to maintain compliance with all central government reporting requirements.

Maintenance costs, however, are not as easily developed. There is a requirement to identify maintenance costs for repairing existing facilities which are in disrepair because of deferred maintenance practices. In some instances, these costs will be of such magnitude that the facilities will need rehabilitation and the costs will have to processed through Chapter Three of the budget. In other instances, the cost estimates represent the beginning backlog of maintenance work. After determining the maintenance backlog, on-going servicing, preventive maintenance and routine requirements should be identified. Once again, the facilities to be maintained provide the basis for estimating needed resources.

For treatment and pumping facilities, the number of motors, pumps and filters and the size of grit chambers provide examples of workload indicators. For distribution/collection systems, the number of kilometers of pipe, numbers of manholes or valves can be determined as well as basic needs for equipment, transport, materials, supplies, tools and spare parts, all within the Egyptian context.

The GOE needs to develop O and M cost parameters based on such a systematic evaluation of O and M requirements. AID could assist by giving top priority to this issue in the proposed IHRD Project[10]. This activity would be wholly consistent with the objectives of the IHRD Project which calls for the generation of specific quantitative and qualitative requirements for O&M training, and the development of improved O&M budget estimates and management systems. The principal steps to be taken would be:

1. Develop operating cost estimates for all facilities, existing and under development, updating master plan data where available, perhaps with the assistance of A & E firms currently under contract;

2. Conduct a systematic evaluation of the existing maintenance backlog throughout the nation, again updating master plan data where available, and

3. Design and conduct several pilot projects aimed at identifying realistic workload indicators and estimates of maintenance resources in financial terms required on a physical unit basis. GOE commitments to support the build-up of "model" operating and maintenance units should be obtained. Communities in the pilot studies, several each in water supply and wastewater, should be carefully selected to be as representative as possible.

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10. See Sec D, Operating and Maintenance Tasks and Sec E, Commercial and Financial Tasks, of the Draft TOR.

The knowledge gained from such an exercise will provide the basis for (1) setting targets for developing O and M capabilities in each utility in the sector and (2) justifying the budget allocations required as such capabilities are developed. In addition, this information will provide a basis for determining overall training requirements and for making intelligent assessments of proposals for providing O and M contract assistance.

3. Tariffs and the Cost Recovery Potential

Past Tariff Recommendations. Previously prepared planning documents are consistent in stating that tariff structures should be amended to reflect more closely the true costs of the services. However, policy guidelines have not been established to achieve socially feasible amendments.

The generally recommended approach adopted towards cost recovery has been by analysis of the costs of implementing the service rather than focussing on the ability of the beneficiaries to pay.

Recent Tariff Actions. AID has repeatedly encouraged the GOE to increase tariffs which have generally remained unchanged since the early 1960's. Following a detailed and extended review of the tariff situation, the Ministry of Housing and Public Utility's Advisory Commission on Public Utilities (ACPU) has recommended a national tariff policy, defined as covering 100 percent of O and M costs by 1991. A 10 percent surcharge for wastewater services is added to the water charge; provincial governors would have the authority to increase the surcharge percentage in future years. The recommended tariffs will soon be reviewed by the Higher Committee for Policy and Economic Affairs and then submitted to the Cabinet for approval. It is understood that review and approval by the People's Assembly will not be required.

In response to World Bank pressure, independent action on tariffs took place in Alexandria. An increase in tariffs was approved in late 1984 and the new tariffs have reportedly been implemented. The adjustment was proposed by AWGA (Alexandria Water General Authority) and approved, with modifications, by the Local Assembly. In its deliberations of AWGA's proposed tariffs, the Local Assembly was sensitive to the needs to:

1. continue very low tariffs for the lower levels of domestic consumption;
2. establish the first consumption levels (blocks) in increments of 10 cubic meters, and
3. establish a limitation (apparently on itself) prohibiting any further tariff increases during the coming three years.

Table 3.2 presents a comparison of the National Tariff Study proposals reflecting tariffs in Alexandria, Cairo, the Canal Cities and the Provincial Cities.

A review of water and wastewater tariff practices in Egypt suggests that:

1. the concept of establishing consumption blocks with progressive unit charges is new,

2. political considerations, as evidenced by the actions of local assemblies, are keyed primarily to concerns for the lower income groups of domestic consumers, with little resistence to higher tariffs for industrial and commercial customer categories, and

3. differential tariff charges between customer categories have generally not been employed for the purposes of cross-subsidization, (Alexandria is a notable exception).

Tariff Structuring. Presently, any improvement that can be achieved in the area of pricing policy must be welcomed. However, if presented with the opportunity to comment on the current tariff proposal, AID may wish to make note of the benefits of alternative approaches to charging domestic customers. One beneficial change would be to establish initial consumption blocks of $10m^3$ each, up to $30m^3$. This would permit establishment of "life line" (very low) charges for the minimum levels of consumption that meet basic domestic needs. This approach might enable the GOE to avoid encountering widespread opposition and resistance at the local level which might force the government to retract the tariff increases.

Other aspects of current tariff proposals that warrant further consideration include: (1) whether or not the "national" tariff policy should be flexible enough to allow local modifications, (2) establishment of the ultimate target for revenue generation at 100 percent of O and M costs and, (3) definition of the method for staging increases. A National Tariff policy implies the existence of a number of conditions that currently do not exist, such as:

- uniform levels of service
- uniform costs of providing service
- comparable economic conditions, and
- ability of the central government to enforce compliance

Table 3.2
Comparison of Recent Water Tariff
Cosnsiderations with Existing
or Former Policies (1)

Category Consump. Level	Nat'l Study Recommended	Alex. Prop.	Alex. Appro.	Alex Prev.	Cairo	SCA	Prov.	Beheira Exist.	Beheira Prop.
Domestic (2)									
0 - 10 m^3/mo.		4.0	1.0	1.0					
11 - 20	3.0		2.0						
21 - 30			3.0	1.52	1.2	1.8	2.5	2.0	7.0
31 - 50	5.0	6.0	5.0						
51 - above									
Average Domestic	N/A	N/A	2.6	1.4	1.2	1.8	2.5	2.0	7.0
Tourism Industrial Commerical (Representative)	10.0	15.0	15.0	10.0	1.18	1.8	2.5	2.0	12.0 (3)
Overall Average Effective Tariff	NA	NA	7.6	4.8	NA	NA	NA	2.0	NA

NA = Not Available

Notes: (1) An industrial wastewater surcharge of 3 pt/m^3 was dropped in 1961. The current national study proposal calls for a 10 percent wastewater surcharge on all customers.

(2) All communities provide water free at public stand pipes.

(3) For consumption above the first 10 m^3 which are billed at 15.0 pt/m^3.

If a national policy is to be established, it seems preferable that the policy take into account various regional and local factors, possibly establishing minimum tariff levels and allowing local authorities to adjust tariffs within an approved frame of reference. It seems inconsistent with the stated policy favoring autonomous local utilities to prescribe a fixed national tariff plan.

The current proposal pegs tariffs at levels that will generate 100 percent recovery of O and M costs by 1991, beginning with 35 percent cost recovery. Review of planning documents consistently confirm that the existing tariff structure is not related to actual costs, and that revenues generated from water sales cover less than 1/3 of the O&M costs. It is clear that applying uniform national tariffs will generate different proportions of O and M cost recovery. The manner in which O and M costs are defined will also influence the proportion of coverage as well as the budgetary commitments.[11]

It would be preferable, under a national tariff policy, to relate tariffs to "ability to pay" rather than O and M costs; the latter are so variable, currently underfunded and subject to varying definitions. In addition, since tariffs have been kept at such a low level for such a long time, there must be a significantly higher level of affordability than is generally acknowledged.

At the risk of suggesting still further study and analysis, socio-economic data should be collected from representative regions in Egypt. This type of data can be collected in conjunction with data on leakage. The latter type of study is being planned in Cairo. Its scope could be expanded to include house-to-house surveys designed to gather socio-economic data as well as basic information on water usage.

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11 O and M. O and M costs would normally include depreciation, but accurate asset accounts are generally not available and no utility possesses depreciation data based on the replacement value of the assets in place. The same definition omits interest which is included in Chapter 2 and should therefore be omitted in defining O and M costs under the GOE system.

For some time to come, the ability to pay for water and wastewater services among the served population has been and will likely be considerably greater than the charges imposed by government. It is the government's perception that the "willingness to pay" appropriate tariffs does not yet exist because (1) the public is accustomed to paying virtually nothing for the service and (2) the level of service is inadequate and needs upgrading. A plan whereby tariff increases are staged might be a way to bridge the gaps in service and time. Staging allows time for measurable improvements in service to be made in parallel with gradual increases in tariffs, and to cover the large increase needed in small increments over a relatively long period of time. This approach has been incorporated in the GOE plan and should be supported. Making small but frequent, i.e., semi-annual, increases in the tariff should be encouraged. (See Conclusions and Recommendations in Chapter 5.)

Strengthening Revenue Systems. At present, revenue systems throughout Egypt are in a general state of disarray. Most meters are either not working or under-registering. Large quantities of water are either lost through leakage or otherwise unbilled. Illegal or otherwise unbilled connections remain undetected and large accounts, often those of government agencies and enterprises, are in arrears.

Current indications are that the GOE plans to increase tariffs gradually to more meaningful levels. However, token increases in collections can be expected unless the revenue systems in the sector are drastically upgraded. Technical programs are underway and planned to address the problem of leakage. The objective of a revenue system is to assure that the water actually reaching the customer is accurately measured and promptly billed, and that payment is obtained within a reasonable period of time.

Metering is the keystone of any revenue system that attempts to prevent wasteage, meet basic human needs at "lifeline" costs and redistribute a larger share of the burdens of cost recovery to those consumers having commercial, industrial or institutional purposes, or domestic usage in excess of basic household needs. While metering places certain demands on the utility and its customers, its advantages usually far outweigh the disadvantages. In Egypt at present, it may be premature for AID to support a national program to upgrade metering. The estimate of the cost of meters for Cairo alone is US$100 million. Supporting this activity suggests that fewer resources would be available to upgrade systems or to expand networks to reach unserved populations. It may be more appropriate for AID to review the results of the pilot metering program in Cairo before supporting a national effort.

In the long term, however, metering is essential. The proposed IHRD Project could provide the focus for such an effort.[12] This would involve the development of a centralized meter management system (procurements, testing, repair, warehousing and distribution) under NOPWASD's control. Prototypical revenue systems would be designed, implemented, tested and evaluated in selected communities as pilot projects. These would be coordinated with ongoing efforts, such as the JMM management assistance work being done for GOGCWS, and would focus on the fundamental meter reading, billing and collection functions and control systems, employing computer assistance if appropriate.

This effort should include development of approaches for integrating the sewerage surcharge into the revenue system. Consideration needs to be given, for example, as to whether only those water customers connected to the sewerage system would be billed or whether all water customers would be assessed the surcharge. There have apparently been no discussions between water and wastewater agencies on how the surcharge would be implemented, although the BVI-ATK management and tariff studies for water and wastewater systems addressed this matter in 1979. Steps for integrating the sewerage surcharge would, therefore, be another product of the revenue system development process, requiring individual consideration in the major cities, with standardized general approaches for the provincial governorates and small cities.

Tariff Covenants. AID typically covenants tariff increases in agreements with the GOE. The tariff covenant contained in the MOU is particularly strong, specifying that (1) budget allocations for both O and M and investment must be increased, (2) tariff increases shall provide for sufficient revenue to cover O&M costs, debt service and routine improvements, and (3) all such increases shall be completed by 1989. Assuming that O and M is defined to include depreciation, as it is specified in some other AID covenants, water and wastewater utilities -- both are covered by the stipulation -- would be required to generate rates of return on the average value of net fixed assets in operation that would at least be in the range of 6to 8 percent with debt service coverage (ratio) likely in excess of 1.5 to 1. The overall commitment expected of the GOE seems unrealistic, if not impossible to achieve within a four year period. It would seem appropriate for AID to acknowledge formally a somewhat lower expectation at some appropriate time.

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12 Section E, Commercial and Financial Tasks of the Draft TOR is applicable.

Wastewater Surcharge. The wastewater surcharge in the proposed national plan apparently makes no distinction between normal domestic wastewater and industrial wastes which may be highly toxic and detrimental to the municipal collection and treatment systems. At some point, the possibility of implementing an industrial pollution tax for those industries that produce toxic wastes (unsuitable for disposition in the municipal systems) should be considered. This "effluent tax" should be designed to encourage industries to undertake pretreatment or process engineering modifications, to render their effluents suitable for the municipal system. As currently proposed, the wastewater surcharge assumes that all wastes are basically equal in strength, solids and toxicity. The surcharge produces no incentive for industries to undertake needed pretreatment measures. AID may wish to pursue this matter on an appropriate future occasion.

C. Conclusions and Recommendations

1. Project Implementation. During the early years of AID's involvement in the sector, there was a general inability to secure accurate projections of project costs. This difficulty can be avoided in the future because of the experience gained by A&Es and contractors, a general maturing of the sector organizations and the strengthening of Mission staffing. To be fully realized, however, further improvements in cost estimating performance should be supported through the development within AID of an internal cost monitoring, control and updating system for AID financed projects, and by the establishment of cost estimating standards to be followed by all A&E's.

It is difficult to assess the actual funding requirements for the sector, but it seems most likely that increases in expenditures will be gradual in spite of the projected near term implementation of very large projects. Procedurally, AID's current plan for tying funding authorizations to "benchmarks" should enhance its ability to achieve its objectives. Current GOE capital budgeting for the sector is uncoordinated and individual requests are not realistically developed based on good planning. The approved GOE budgets do not reflect the amount of donor funding included by project. This practice makes it difficult to assess actual GOE funding commitments.

In close collaboration with appropriate GOE officials, AID should consider developing an internal cost estimating, monitoring and updating program for AID-financed projects in the sector. This program should contain:

1. a computer bank of the detailed construction and operation cost estimates for all active projects, submitted initially to AID by A&Es in packages according to a standard format prescribed by AID;

2. all pertinent information including unit costs, inflationary trends and project delays to use in periodic updates of all project cost estimates for the sector, and

3. standard procedures for cost escalation, using standard escaltion rates for foreign exchange and local currency, that should be followed by all A&Es to ensure uniform application of AID's policies.

AID should also continue to tie achievements of certain benchmarks to the process of obligating and committing funds, making certain to establish targets that can reasonably be achieved.

AID should support the concept of an organized sector approach for the development of capital budgets within the GOE perhaps using ACPU as the coordinating forum. In this context, AID should support a change in the budgeting process which would give greater recognition of (and visibility to) the extent of donor financing available for sector projects.

AID should continue to support the long-term objective of developing financially self-supporting water and wastewater utilities.

2. O&M Requirements. There is a concensus that O&M is the top priority near term objective. AID needs "hard data" upon which to base its proposals and funding targets, and to clearly define its potential role in assisting GOE. Existing budget data are of no help nor are the "ball park" type estimates which calculate O&M requirements as a percentage of capital costs based on experience in other countries.

O&M cost estimates must be developed systematically based on the specific technical features of the facilities involved. Since there are no existing models of good practice for O&M in Egypt, model programs must be established and carefully evaluated so that (1) training needs and (2) funding requirements can be projected sectorwide.

The GOE should build a database containing the costs of the resources needed for the conduct of strong O&M programs throughout the sector. These data should distinguish between costs for "operations" and those for "maintenance," and be developed or updated from engineering studies of the technical features and operating parameters for each facility.

The GOE should conduct a systematic sector-wide inventory of the existing maintenance backlog, again using master plan studies as a point of departure where such are available. Guidelines for the preparation of rehabilitation projects should be developed in those instances wherein the extent of deferred maintenance is of sufficient magnitude and/or severity.

In the proposed IHRD project AID should place high priority on the design and conduct of O&M pilot projects for water and wastewater in several cities for the purpose of developing realistic workload indicators and measures of resource needs. This effort will provide for the development of resource/performance standards in terms of costs per physical unit. AID should obtain the active participation of GOE staff and GOE support, in LE costs, of building these model systems.

3. Tariffs. AID's expectations in the area of tariff implementation seem unrealistically high. If implemented, however, the tariff proposals under consideration would represent significant progress toward increased revenue generation in the sector. AID should encourage and support this step, keeping in mind that refinements in structuring similar to those utilized in Alexandria, could be beneficial. Other suggestions generally involve allowing additional flexibility for localities in tariff setting (under prescribed minimums), de-emphasizing O&M as a measure of progress in tariff staging and considering more frequent, and smaller, steps in the staging plan. Implementation of an industrial effluent or pollution tax should also be considered as an incentive for industries to reduce the solids, strength and toxicity of their discharges.

The general state of disarray of revenue systems throughout the nation requires priority attention. These systems must be upgraded to support the prospective tariff staging program currently under consideration. Metering is the keystone of these systems; prototypical designs can and should be developed and tested for general implementation.

While expressing basic support for the proposed national tariff plan, AID should encourage the GOE to consider a plan structured to provide (1) small increments (say 10 cubic meters each for the first three steps) with very low consumption charges for the beginning steps, and (2) sufficient differentiation in customer categories and consumption blocks to enhance cross-subsidization. A tariff based on "lifeline" rates with consumption blocks would represent a progressive approach to resource generation in contrast to the current system.

AID should support the incorporation of flexibility in the design of the national tariff plan to allow local initiative for increases or modifications as long as specified minimums are met (possibly specified in terms of the minimum acceptable average effective tariff), and allow regional or local variations based on service levels or local economic conditions.

AID should continue supporting tariff implementation through staging, but emphasizing a long-range goal of measuring progress in terms of an approach based on ability to pay/affordability. At the same time, AID should support socio-economic studies to develop data on household incomes and expenditures and encourage modification of the staging plan to incorporate smaller and more frequent adjustments and a shift toward monthly billing.

AID should review its expectations on tariffs and covenants, and consider modifying the tariff provision in the MOU at the appropriate occasion. AID could either lengthen the expected time for achieving the targets, or set lower, more attainable targets for the near term.

The GOE should consider instituting an industrial waste surcharge/pollution tax to provide an incentive for industries to invest in pretreatment or process engineering modifications to their operations. Since the proposed wastewater surcharge assumes that all wastes are equal in strength, solids and toxicity, establishment of a much higher level of surcharge for industries discharging toxic wastes would be justified.

Finally, AID should assist the GOE in designing and financing a program aimed at upgrading revenue systems on a sector-wide basis. In this context, AID might wish to support the design and implementation of a central metering program under NOPWASD for procurement, testing, repair, warehousing and distribution of meters, and give priority within the proposed IHRD Project to the design of prototypical revenue systems for meter reading, billing and collecting, accounts receivable and control functions, with an aim of framing specific recommendations for wastewater surcharge.

Chapter 4

Physical Works: Design, Construction and Operation

This chapter deals principally with physical works; including planning, design, construction, operation and factors affecting the ability of the completed works to perform their intended functions.

A. Background.

1. Status of Existing Facilities.[1] Most of the existing facilities in the sector utilities visited during this review are in poor condition. Exceptions include elements of the Canal Cities water systems operated by the Suez Canal Authority and the Cairo water system. Wastewater treatment works and pump stations are in particularly poor shape; no wastewater treatment plant in the cities studied operates at even minimum levels of acceptability. Significant improvements of the pump stations in Cairo have recently been made or are proceeding under two AID assisted rehabilitation projects.

AID Strategy. In providing funds for the sector, AID has adopted a strategy of phased investments aimed at maximizing public health benefits by improving drinking water quality and reducing sewage flooding and removing wastewater from densely settled urban neighborhoods as a first priority. Treatment of wastewater follows as a second stage priority. To date, AID has made funds available for treatment plant rehabilitation in Cairo and Alexandria, but not for new works. Design of wastewater treatment facilities on the East Bank have been prepared by consultants (AMBRIC) under a project jointly funded by AID and ODA (British).

First Stage Facilities. Major new first stage works and rehabilitation and upgrading of existing facilities in the study sector cities have been designed and are either under construction or scheduled for construction in the relatively near future. With an aggregate construction cost of approximately LE 4,000 million, these works should result in a major increase in the ability of these utilities to meet the water supply and wastewater collection and disposal needs of their customers by about the year 1990.

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[1] For details on the status of the physical works in each of the cities studied see Annexes A through D.

Summary of New Works. Major new or rehabilitated works funded in part by AID are expected to be turned over to the various sector utilities within the next one to five years. A brief summary of the additional major facilities, by utility, follows:

Cairo Wastewater Works	Schedule Completion
Rehabilitation of 106 pump stations	1985-1986
Three major new East Bank pump stations	1988
New 250,000 m^3/day treatment plant	1989
Two new 600,000 m^3/day treatment plants	1990
Six major new West Bank pump stations	1988-1989
New 400,000 m^3/day treatment plant	1990
Rehabilitated 300,000 m^3/day WWTP	1989
20 Km. of main tunnels	1988
50 Km. of major culverts and collectors	1987-1989
Several hundred Km. of sewers & forcemains	1985-1990
Alexandria Wastewater Works	
Five major new pump station	1988
Upgraded 410,000 m^3/day treatment plant	1987
Upgraded 175,000 m^3/day treatment plant	1987
Two major new pump stations	1986
Over 100 Km of sewers and force mains	1985-1989
8 Km of tunnel collectors	1987-1988
Canal Cities Wastewater Works (Ismailia, Port Said, Suez)	
Gravity sewer projects	1985-1986
Forcemain project	1985-1986
Pump station projects	1985-1986
Canal Cities Water Works (Ismailia, Port Said, Suez)	
Upgrading of existing treatment plants	1985-1986
New finished water pump stations	1985-1986
Additional storage facilities	1985-1986
Distribution system extensions and improvements	1985-1986
Cairo Water Works	
Upgrading of Rod El Farag water treatment plant	1986
Distribution system extensions and improvements	1986

2. Delays in Progress.[2] The principal failure of progress to match expectations has been in the rate at which the proposed improvements are being implemented. The reasons for delay are many: governmental bureaucracy, funding procedural requirements, weaknesses in institutional and managerial structures and in some instances, local contracting practices. In addition, expectations were generally over optimistic and did not adequately consider the limitation of the resources available. Considering the size of the programs and the weakness in the institutional aspects of the sector however, progress should be considered reasonably satisfactory at this point.

The polarization of views in Alexandria on the marine disposal-vs-land reuse debate has created a five year delay. Further delays in resolving the dispute are anticipated. (If the 1978 master plan schedule had been followed the first stage works would have been completed in 1983.)

Current construction schedules for the Cairo wastewater program are about three years behind those presented in the 1981 Design Inception Report prepared as a result of the review of the previously prepared master plan. This is not untypical in the sector, and further slippage in today's schedules is probable.

3. Institutional Factors. The ability of the sector facilities to perform as intended is only partly dependent upon the quality of the design and construction of the works. Management, training and availability of operating funds are all critical to the ability of the existing and new physical facilities to be able to carry out their intended functions on a sustained basis. These factors are discussed in other chapters, but success in solving them is also vital to success of the construction and operation of the systems.

B. Discussion: Key Findings

1. Operational Status. The present state of disrepair of many of the existing sector facilities indicates that there are serious and wide-spread deficiencies in the current ability of the sector utilities to maintain existing facilities adequately, let alone take on additional responsibility for extensive and complex new works. Some of the principal causes of operational deficiencies include (1) poor management and direction, (2) inadequate funds, (3) difficulties in importing spare parts, (4) lack of skills in critical areas, (5) personnel policies which make it difficult to attract, motivate and retain qualified staff and (6) poor design that does not take into adequate consideration the need to have facilities that can be readily maintained.

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[2] See Annexes A through D for details.

Operational Skills: Deficiencies. To date, operational skills of the staff of sector utilities have been limited. Training has been uncoordinated. Failure to develop adequate capability of Egyptian personnel to operate the new works on a sustained and satisfactory basis will render most of the new works, with mechanical and electrical components ineffective within a few years of their completion.

Cost Implications: Estimates of operation and maintenance costs of the various first stage works were originally made in most of the master plans which preceded the design and construction of these works. Passage of time and changes in programs have rendered those cost data obsolete. There is an urgent need to prepare operation and maintenance costs for the facilities now under construction. To provide a complete picture, operation and maintenance estimates must also be made for the existing works.

Accurate and comprehensive estimates of future operation and maintenance costs are needed because:

- The proposed national tariff proposal is based on recovering 100 percent of operation and maintenance costs by 1991. The ultimate level of such tariffs will therefore be determined, in part, by the magnitude of the total operation and maintenance costs.

- Evaluation of the type of treatment alternatives can only be made on the basis of reliable estimates of the relative operation and maintenance costs.

- The GOE needs to have an estimate of the overall of operation and maintenance in order to prepare budgets for the sector.

Quantification of the likely increase in operation and maintenance costs once the first stage works are complete is difficult at this time. Taking into account the probability that existing operation and maintenance budgets are much lower than they should be, and the magnitude of the new works, it is certain that annual operation and maintenance costs should increase sharply over the next five years. C/GOSD, for example, has an annual recurrent budget of LE 28 million; the portion devoted to O&M is considerably less.[3] Assuming operation and maintenance costs of the new works

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[3] Of which 88 percent is for personnel costs, with many staff under utilized and poorly trained and supervised.

are in the order of one to two percent[4] of the capital cost, this would double or triple Cairo's operation and maintenance budget, even assuming that the present budget level is adequate.

2. Treatment and Disposal of Wastewater

Present Situation. The present lack of adequately functioning wastewater treatment plants in Cairo, Alexandria and the Canal Cities has resulted in the serious pollution with raw sewage of the following receiving waters:

- Cairo: Various agricultural drainage canals, East and West Banks; Nile River, at points where these canals discharge; and Lake Manzala
- Alexandria: Lake Mariut and the Mediterranean (beaches, harbors)
- Ismailia: Lake Timsah
- Port Said: Lake Manzala
- Suez: Gulf of Suez

Egyptian Law 48 of 1982 forbids the discharge of domestic wastewater into the Nile regardless of the degree of treatment. For discharge into fresh water bodies (supply canals, lakes) the law sets standards (BOD and SS less than 10 mg/l) which would require tertiary treatment. For discharge into brackish water bodies (irrigation drainage canals, marshes), the standards (60 mg/l BOD, 50 mg/l ss) require a high degree of secondary treatment. The law appears to be mute on discharge of wastewaters into Egypt's coastal seas. Permits to discharge wastewater into receiving waters are required. Waivers from the law are permissible and fairly common.

Athough the standards defined is in Law 48-82 are comprehensive and safe, they are unrealistic at present for both domestic and industrial wastewater. Even under optimum conditions, where all domestic and industrial establishments apply primary treatment to effluents, sophisticated secondary and sometimes tertiary treatments would be required to meet the standards of the law. Such treatment would require extremely sophisticated technology and enormous investments in equipment and training, as well as extended implementation times. The primary and secondary treatment or modification in industrial plants and processes that would be needed to meet the current legal standards is of questionable financially and economically viability for most if not all industries. Options to resolve these issues are being addressed by consultants working with GOFI under an AID assisted agreement.

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[4] Experience elsewhere indicates that operation and maintenance costs are not likely to be less than one percent and could be more than two percent of total capital costs.

Current Proposals. Plans, designs and proposed construction for wastewater treatment and disposal in the study cities are as follows:

- Cairo (First Stage) - Secondary treatment at five plants, total capacity of 2,180,000 m^3/day. Effluent to irrigation drainage canals

- Alexandria (First Stage) - Primary treatment at two plants, total capacity of 585,000 m^3/day. Effluent temporarily to Lake Mariut pending decision on final disposal. About 250,000 m^3/day of untreated wastewater will continue to be discharged directly to the Mediterranean through the soon to be extended overflows and the ineffective Kait Bey outfall.

- Ismailia - Secondary treatment by stabilization ponds, followed by infiltration basins and pumping for agricultural irrigation with the reclaimed wastewater. The updated projections for wastewater flows are an average flow of approximately 65,000 m^3/day increasing to approximately 140,000 m^3/day in the year 2000.

- Port Said - Interim program: New channel to conduct raw wastewater deeper into Lake Manzala [5] at a site for future treatment. Long term program: Conventional secondary treatment at a single plant with effluent to Lake Manzala. The updated projections for wastewater flows are an average flow of 137,000 m^3/day increasing to 237,000 m^3/day in 2000.

- Suez - Two treatment plants: One is for conventional secondary treatment followed by disposal to the Gulf of Suez through a marine outfall. Second is for secondary treatment by stabilization ponds and dipsosal to the land as for Ismailia. (Key people in the Governorate prefer 100 percent disposal to the land.) The updated projections for wastewater flows are 179,000 m^3/day in 1985 and 369,000 m^3/day in 2000.

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[5] Lake Manzala is a very large, shallow body of water which is open to the Mediterranean.

Alternatives. The proposals above involve expensive and relatively complex facilities for the treatment or reclamation and reuse of wastewater. These proposals represent such a quantum leap beyond current conditions and capabilities and raise questions about the need and wisdom of trying to bridge that distance in a single leap. A strong case should be made for considerating of alternative treatment technologies which would be less expensive to construct and to operate, at least on an interim basis. Possible alternatives, by project city, include:

- Cairo: Annex A suggests two alternatives, both of which would require waiver of current law to permit the use of primary treatment rather than secondary. Direct discharge to the Nile is a potential permanent and technically feasible alternative. It could, however, prove to be politically and culturally unacceptable despite the extensive cost savings and other benefits. Following the present proposals, but constructing only primary facilities at this time, would yield significant cost and operational. It is noted that there would be poorer quality of water in the drainage canals, however conditions would be improved when compared to the present situation.

- Alexandria: The situation in Alexandria is considered as a separate issue below.

- Ismailia: A potentially lower cost alternative for Ismailia is treatment by stabilization ponds followed by discharge by canal to Lake Timsah.

- Port Said: The location of Port Said on the shore of the Mediterranean Sea suggests the possible alternative of primary treatment followed by discharge directly to the Mediterranean through an outfall, rather than to the shallow and flow constricted Lake Manzala.

- Suez: Primary treatment or, if required, stabilization pond treatment, followed by outfall discharge to the Gulf of Suez is also a possible alternative.

3. Issues to be Addressed

Summary of Unresolved Issues. A comparison of the first stage works now funded and scheduled for construction, and those considered necessary for the proper functioning of the system as a whole raises a number of points that need to be resolved. The principal issues by project are set forth in Annexes A through D, and are summarized as follows:

Cairo Wastewater Facility	Issue	Consequence
1. East Bank branch tunnels	1. No funds yet identified	1. Unable to convey significant amounts of wastewater to WWTPs
2. Abu Rawash WWTP	2. Funds not yet certain	2. Unable to treat flow of 400,000 m^3/day
3. Berka and Shoubra WWTP's	3. Funds inadequate, questionable design and construction prohibiting adequate treatment performance	3. Unable to treat flow of 1,200,000 m^3/day
Alexandria Wastewater		
1. Marine outfall at Kait Bey	1. Tied up in internal debate	1. Continued pollution of Lake Maryout and Mediterranean Sea
2. Central Zone facilities	2. Eliminated from PP Stage 1	2. Continued pollution of beaches at old Kait Bey outfall
3. Industrial, toxic wastes	3. Lack of GOFI action and laws on excluded wastes	3. Pollution from untreated wastes; toxic wastes to sewer system

Cairo Water Facility	Issue	Consequence
Distribution system improvements	No designs, no funds	Unable to operate WTP at full capacity, needs unsatisfied
Canal Cities Water		
Port Said	Additional raw water delivery capacity required	Inability to meet future demands
Canal Cities Wastewater		
Ismailia		
Wastewater treatment facilities	No designs, no funds	Continued pollution of Lake Timsah

Port Said Wastewater treatment facilities	No designs, no funds	Continued pollution of Lake Manzala
Suez Wastewater treatment facilities	No designs, no funds	Continued pollution of Gulf of Suez

Unsewered Population: This subject is discussed in some detail in Chapter 5. Hard data on the percentage of the total population connected within a utility's service area are difficult to obtain. Evidence suggests that large and growing numbers of people, usually among the poorest, are not likely to benefit from the Stage 1 sector improvements without a significant additional effort.

4. Problems in Construction

Local Contractors vs Expatriate Contractors. Review of the work performed by local and expatriate contractors suggests that for a variety of reasons, including under-capitalization, lack of management experience, lack of experience on projects designed in the detail customary in the developed world, an over-extension in a period of booming construction in Egypt, and the lack of qualified construction managers and personnel, the performance of local contractors on projects designed by expatriates has been less than satisfactory, either in quality of work or in meeting time schedules.

At current rates of implementation, it seems certain that most of the local contractors will experience delays on the portions of the first stage works for which they have responsibility.

Contracting Practices. The contracting practices employed by the agencies of the Government of Egypt have a significant effect on the quality of the work performed, and the manner in which it is conducted.

While normal construction contracting calls for the "fixed price" approach, the GOE utilities use a "unit price" contracting procedure. If the work is not "assigned" to a public sector company, tenders submitted by qualified contractors are usually evaluated in committee and a contract is awarded to the lowest bidder.

Since most specifications for the work are developed on a historical basis, i.e., what has been proposed and utilized in the past, the bidders have no incentive to suggest innovative or less costly solutions to carrying out the work. In addition, since the bids are based on a fixed unit price, the proposals contain many caveats and are difficult to compare.

While the committee reviewing the bids wants to award the contract to the qualified contractor with the lowest unit price, the least number of conditional clauses and the shortest estimated project completion time, there are no formal, written procedures that specify how the committee should achieve these objectives.

The performance of local public sector contractors is less likely to be adequate than that of the private sector contractors. The public contractors are not responsive to the normal controls the client and his engineer have over the contractor through a firm contract agreement. The public contractors have no incentive since they are neither rewarded nor punished for the quality of work performance. Having no real financial responsibility, the tendering process is practically meaningless, and the threat of having to pay liquidated damages for delays has no force, since it becomes a transfer of funds from one government pocket to another.

Most of the first stage projects being constructed by Egyptian contractors are beng done by public sector firms.

Supervision of Construction. Experience in Alexandria, Cairo and the Canal Cities suggests the need for expatriate direction with full responsibility of the engineering supervision of construction on behalf of the client, if the works are to be properly constructed. Local operating authority construction supervision staff do not presently have the entire scope of skills or support to enforce proper enforce compliance with detailed plans and specifications. Such skills and support must be developed if Egypt is to sustain its work in this sector. In many instances the lack of support from higher authority in operating agencies has reversed recommendations made by resident field staff.

Contractor Problems. Expatriate contractors currently face many problems including (1) difficulty in importing equipment, materials and spare parts, (2) obtaining permits to interrup traffic, move equipment, obtain access to sites and other necessary approvls, and (3) delays in payment that result in further delays and added costs.

Contractors are also concerned about the impending problem of their possible inability to test their works fully under normal operating conditions because of the failure of other parts of the system to be completed in time. Such problems may result in disputes over the extension of performance bonds and guarantees, and to added costs and mutual frustration.

5. Alexandria Wastewater Options[6]

Present Situation. The two alternatives for the ultimate disposal of Alexandria wastewater are (1) discharge after primary treatment and disposal through a long outfall to the sea, and (2) reuse of wastewater (after appropriate treatment) for agricultural irrigation.

Studies show the present worth costs (for a 50 year project life) of the two systems to be about equal, and both alternatives are technically feasible. At this time, however, the land use scheme has an initial capital cost of about LE 1,000 million more than the sea disposal scheme.

The decision on which alternative to choose has been delayed because of the strong preference by key people in the Governorate of Alexandria for the land use scheme, while the GOE has adopted the view that Egypt cannot afford such a huge additional cost.

Consequences of Delay. The delay has two serious consequences: (1) the cost of construction of the disposal works is increasing because of inflation, and the differential cost between the two schemes is also increasing; and (2) the threat to the health of the people of Alexandria and the pollution in Lake Mariut and the sea to which Mariut's waters are pumped will remain. Additional studies are of little benefit toward resolving the dispute. Both schemes are known to be technically feasible. The difference in construction cost is so great that even a 30 percent reduction in the cost of the land use scheme, or increase in the cost of the outfall scheme, would not change the balance.

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6 For a discussion of reuse of wastewater for irrigation, see Annex A.

C. Conclusions

The following recommendations relate to the five issues presented in the previous section.

1. Factors Relating to the Operation of First Stage Works

Issue Summary. There is a need to address the magnitude and impact of the problems and costs of being able to operate and maintain the existing facilities and the first stage works now under construction, and to devise and implement a program to assure that these works will be operated properly on a sustained basis.

Recommendations. Responsibility for preparation of a coordinated program should be assigned to consultants with experience in the operation and maintenance of major water and wastewater facilities.

AID should finance these services under existing projects or the new IHRD Project.

This program should include an assessment of needs, consideration of alternative methods of satisfying those needs, and specific recommendations for operations for each of the operating utilities. Alernatives to be considered include:

- Provision of operations services on a contract basis by an expatriate firm, with a requirement that the necessary operation and maintenance skills be transferred to assigned local staff within a given period of time.

- Consideration that the local staff be employees of the operating utility or employees of a private sector Egyptian firm. The latter would be associated with the expatriate firm, who would develop within Egypt local private sector capability for contract operations.

- Expatriate contract operations with parallel training program, run by others, to train utility staff to take over the works as the expatriate contract services are phased out.

The program should establish basic criteria and typical terms of reference for the provision of contract services or such other alternatives as may be adopted. The role of the utilities' existing consultants, either in performing the services or monitoring them (but not both), should not be excluded.

2. Degree of Treatment and Disposal of Wastewater

Issue Summary. There is a need to reevaluate the present recommendations for high level of treatment and disposal, and to determine what is the most appropriate degree of treatment for and ultimate disposal of Egypt's wastewaters.

Recommendations. An independent review should be made of the subject of wastewater treatment and disposal in Cairo, Alexandria and the Canal Cities.

GOE should finance this review considering the use of donor funds and expatriate contractors.

In the interim, the GOE should be encouraged to (1) proceed as proposed in Alexandria, (2) construct only the primary treatment portions of proposed WWTPs in Cairo, (3) construct temporary, anaerobic, earth-dike stabilization ponds in Ismailia to meet its emergency needs, (4) continue the interim program in Port Said of discharging untreated wastewater further out in Lake Manzala, and (5) defer action in Suez until further studies have been completed.

3. Unresolved Issues in First Stage Programs

Issue Summary. There is a need to establish priorities in the various first stage programs which are most critical to the success of the programs, and to allocate resources as required to ensure that the most critical issues are resolved.

Recommendations. The agreements with the various consultants serving the sector utilities should be amended to request them to review the issues noted in this report, or others that they may determine. The consultants also should be requested to submit their findings and recommendations concerning:

- establishing priorities
- the cost of resolving the issues
- the consequences if corrective steps are not taken.

- These reports from the various consultants should be reviewed independently. Recommendations on priorities for the entire sector among the cities involved should be established to guide the GOE in the expenditure of its limited funds.

4. Problems in the Construction of Sector Facilities

Issue Summary. There is a need to ensure that first stage works are constructed and supervised in a manner that ensures timely completion and quality work of the facilities.

Recommendations. US contractors should be selected as prime contractors on all US-funded projects. They also should be required to associate with local private sector contractors on such projects and to such an extent as AID deems advisable.

The GOE should be encouraged to discontinue the use of public sector contractors for work in the sector on other non-AID funded projects until such time as procedures can be developed and adopted to ensure that public contractors either perform adequately or face termination of their contracts.

US construction supervision specialists should be selected and assigned principal responsibility for that task, and not merely as advisors. Scopes of work for such services should be developed which will ensure that construction supervision skills are transferred from the US specialists to local staff assigned for that purpose, and under the direction of the US specialists.

A study should be made of the problems facing US contractors in regard to problems related to importing goods, obtaining necessary permits, and other problems which result in delays and added costs. The study should present recommendations to the GOE for the establishment of policies, and procedures to alleviate these problems on a national level since the cost of dealing with these difficulties, is inevitably passed along to the GOE in the form of higher tender prices.

A study should be made on the problem of inability to test works because of the failure of other parts of the system to be completed in time. Such problems result in disputes over the extension of performance bonds and guarantees, and to added costs and mutual frustration. The study should recommend procedures for dealing fairly with such situations.

5. Alexandria Wastewater Disposal Alternatives

Issue Summary. There is a need to resolve promptly the dispute over land use versus sea outfall as the means of final disposal of Alexandria wastewater.

Recommendations. The results of the independent review of the most appropriate degree of treatment for and the ultimate disposal of wastewater, referred to in Recommendation 2, should be made available to all parties interested in the Alexandria disposal discussions.

AID should be guided by the review recommendations in considering possible additional funding of Alexandria domestic wastewater treatment or disposal facilities.

Until these recommendations are available, AID should expend no additional funds in Alexandria for domestic wastewater treatment or disposal facilities beyond its present commitments.

Chapter 5
Estimating Beneficiaries Served, Assessing Ability to Pay and Systems Impact

A. Background

Within Egypt this is the first time in a water and wastewater assessment that an effort has been made to determine the nature of the relationship between AID-financed systems and urban populations targeted for service. In general, the populations are not easy to quantify nor readily identifiable. The designs of the systems are complex, necessity of redesign has been frequent in some cases, and vastly different estimating and mapping methodologies have been used to delineate the populations.

In addition, it is difficult to design and implement urban water and wastewater systems to reach only a specific group of beneficiaries. The systems in place or planned are primarily designed according to engineering and demographic principles, not social objectives.

Furthermore, since the urban systems already in place and operating have generally required urgent rehabilitation or major corrective maintenance to maintain a given level of service to current beneficiaries, it has been found necessary to correct problems before attempting to reach the unserved population. The core of water and wastewater systems must be operating and capable of carrying the maximum loads before this system can serve all the potential beneficiaries.

By necessity, therefore, actions to rehabilitate and expand the capacity of the existing system have been initiated. Programs to provide services to ameliorate conditions in existing and emerging informal settlements remain to be developed. Since the study on informal housing and other related studies have confirmed that between 40 percent and 60 percent of all new urban housing in Egypt is being built on informally subdivided land without services, the current systems must be expanded considerably in order to maintain even the existing percentage of coverage.

While noting factors that influence project design and the fact that many of the urban poor will not be served by the current projects, it is important to mention that in Egypt that AID is financing components of systems which touch beneficiaries indirectly. The largest portion of project funds are for system

designs and the construction of main wastewater collectors and water distribution networks. With the exception of Cairo Wastewater II, the AID-financed components of most projects do not have budgets for laterals and household hook-ups. In general, project components that touch beneficiaries directly are financed by the GOE or the beneficiaries themselves, e.g., hook-ups.

1. Estimating Design Populations. Projecting service levels for water and wastewater requires demographic and land use projections to a specified horizon. The average rates of water consumption by the different categories of users, e.g., domestic, commercial, tourist, industrial, public, as well as production records and projected per capita demands are reviewed and serve as the basis to estimate the future flow quantities required or to be handled.

The review of the water and wastewater master plans suggests that different methodologies were utilized to estimate the populations to be served at the specified planning horizon. Table 5.1 presents in summary form the techniques used to estimate the future populations in cities with AID water and wastewater projects. (See Appendix 5.1)

Table 5.1
Methods Used to Estimate the Population

Method	Cairo	Alex.	Suez	Ismailia	Port Said	Minia	B.Suef	Fayoum
Ratio	X	X				X	X	X
Evaluation		X						
Linear Projection	X					X	X	X
Power Curve Projection	X							
S-Curve	X					X	X	X
Urban Master Plan Data	X		X	X	X			
N.U.P.S						X	X	X
Other	X	X	X	X	X			

In general, the master plans for the projects differ significantly in the degree to which the projected population are explicity defined, or tied to a recognized census tract. The master plans for water and wastewater systems are, therefore, in large part unrelated to plans used by the Bureau of the Census (CAPMAS) or the General Organization for Physical Planning (GOPP). This fact makes it difficult to define the characteristics of a population to be served.

2. Determining Standards of Service. The master plans for Cairo and Alexandria used different basic assumptions for per capita consumption of water when projecting the required capacities for the water and wastewater systems. However, it is known that the per capita consumption of water across the cities varies dramatically.

Table 5.2 records the assumptions for water demand, in liters/capita/day, at the AID-financed project sites at the horizon year 2000. The planning assumptions summarized in the table are however, not always explicity stated in the master plans. The dramatic discrepancies in domestic demand between Cairo and the other cities are difficult to explain.

Table 5.2
Average Water Demand (Projected)
(l/c/d for the year 2000)

Project	Domestic Includes Commercial	Total All Users
Cairo		
Water Master Plan	390	520
Wastewater Master Plan	330	415
Alexandria		
Water	155	307
Wastewater	158	303
Canal Cities		
Suez	180	417
Ismailia	167	339
Port Said	175	382
Provincial Cities		
Minia	NA	210
Beni Suef	NA	195
Fayoum	NA	200

Source: Master Plan reports for each city. Cairo data from the GOPP Cairo Region Scheme, 1981.

To some extent, the differences in domestic demand for water can be explained by the different methodologies used to estimate demand. Since the metering data on consumption and production are not available, several different assumptions were developed on average water consumption and the amount of unaccounted for water in the systems.

3. Beneficiaries Served by Current AID-Financed Projects. The existing water and wastewater systems do not adequately serve the lowest 25th income percentile of the Egyptian population, the most frequent target for assistance under AID projects. Indeed, it is suspected that few, if any, beneficiaries of the existing networks are within the lowest income percentile.

However, given the poor conditions of the systems at the time the AID-assistance began, rehabilitation had to precede expansion. Flooding from sewers may present a more serious public health hazard than conditions in the informal and unsewered areas where a great proportion of the low income population resides. Therefore, the current AID strategy of rehabilitating and upgrading conveyance networks that benefit populations who are not in the lowest income groups appears warranted.

The master plans do not identify the number and characteristics of the beneficiaries to be served. It is, therefore, difficult to analyze the socio-economic profile of the populations with water and wastewater services. The master plans only estimate the percentage of the total population to be served by the existing and planned networks at specified target years. (See Table 5.3)

Table 5.3
Populations Served by Wastewater Systems (Estimated)
(Population in 000)

City	Existing	1985	1990	1995	2000
Cairo					
Total Pop.	7,700 (b)	8,850	10,500	NA*	13,700
% Served	75%	81%	90%	NA	95%
Alexandria					
Total Pop.	3,100 (b)	NA	4,000	NA	5,300
% Served	84%	NA	71%	NA	60%

* NA = Not Available

Port Said					
Total Pop.	305 (b)	390	490	590	680
% Served		N O T A V A I L A B A L E			
Ismailia					
Total Pop.	270 (b)	310	380	NA*	560
% Served	54%	71%	79%	NA	98%
Suez					
Total Pop.	300 (b)	480	700	850	990
% Served	94 %	100% (c)	100% (c)	100% (c)	100%(c)
Minia					
Total Pop.	180 (a)	195	220	250	280
% Served	60%	70%	80%	85%	88%
Beni Suef					
Total Pop.		N O T A V A I L A B L E			
Fayoum					
Total Pop.	210 (a)	225	260	290	330
% Served	38 %	38 %	58 %	79 %	100 %

* NA = Not Available

(a) 1983 figures; (b) 1980 figures; (c) updated by design reports

Note: Project boundaries do not always conform to established administrative boundaries and census tract areas. Discrepancies have been noted between the projected populations and the existing urban master plans. Furthermore, wastewater and water project areas are not always congruent. For example, the Cairo wastewater master plan boundaries differ from the water master plan project area, and both project areas differ from the present urban master plan. The General Organization for Physical Planning (GOPP) has recommended that the Cairo W/WW master plans take into account the presently committed program of construction.

B. Discussion

1. Ability to pay for water and wastewater services. The master plans and project documents suggest that the tariffs for water and wastewater systems should be based more closely on the true costs of the services. The cost recovery strategies defined in the AID project planning documents argue that amounts sufficient to cover the cost of operations and maintenance, as well as a certain percentage of the capital cost, should be collected. The master plans and project documents, however, do not assess the ability of the current and projected beneficiaries to pay amounts sufficient to achieve revenue goals.

Water Tariffs. Current water tariffs vary from city to city and do not raise revenues sufficient to cover operations and maintenance, much less a percentage of the capital cost. In Cairo the average rate is 12.5 mellims per cubic meter. A progressive tariff is in place in Alexandria. The charge is 10 millims per cubic meter for the first ten cubic meters; 15.2 millims is charged for each additional cubic meter. The water tariff is 18 millims per cubic meter in the Canal Cities. In most low income urban areas without house connections water is provided free of charge through public water fountains. (See Table 3.2, Chapter 3: Financing Project Completion and Sustainability, for a comparison of tariffs.)

Wastewater Charges. There is no current charge for sewerage in the serviced areas. In the unsewered areas, households pay a relatively large amount for this service. For example, evacuating a typical cesspit of 2-3 cubic meters costs 7 L.E. on average. The frequency of evacuation depends on the concentration of cesspits ground water infiltration and whether the house is connected to the water distribution network. In general, as settlement density increases, the amounts paid annually for cesspit evacuation increase. The percentage of household income used to defray the costs of evacuating cesspits in the unsewered areas of Cairo, for example, has ranged from approximately 0.5 percent to 4 percent.

Table 5.4 reflects the average amounts paid for water and wastewater services by different income groups in Egypt.

Table 5.4
Amounts Paid (L.E.) as a Percent of Income

Item	Income Level (Monthly) Low	Middle	High
Income Ranges			
Low Estimate	65 - 92	130 - 197	Above 300
High Estimate	136 - 167	227 - 278	Above 400
Water			
Consumption l/c/d	60 - 150	150 - 250	250 - 550
Max. Cost L.E./M/HH	0.26	0.43	0.95
Cesspit Service			
Cost L.E./M/HH	0.39 - 6.42	0.00	0.00
Total Cost L.E./HH	0.65 - 6.68	0.43	0.95
% Income (Water)	0.16%- 0.1%	0.15%-0.3%	0.2%-0.3%
% Income (Wastewater)	0.6%- 3.84%	0.00	0.00
% Income (W/WW)	1%- 4%	0.15%-0.3%	0.2 %-0.3%

The table clearly indicates that the low income unsewered population is currently spending a larger percentage of their income on water and wastewater services than beneficiaries in the middle and upper income brackets. At the same time, those in the upper income range have a tendency to use more water and pay less, as a percentage of income, than those in the lowest income group.

2. Hookup Practices. In all the cities and project areas building owners pay the costs of connecting to the water and sewer systems. This cost is then passed on to the tenants in the form of increased rents or through requests for lump sum payments.

In general, the procedure for making the connections does not vary greatly from city to city. (See Appendix 5.2) Building owners request and obtain permits from the relevant local authority with payment of fees. In addition to paying the connection charge, the building owner may also have to pay the cost of restoring the road surface.

The connection is carried out by the staff of the authority or by the building owner under the supervision of the authority. The effectiveness and coverage of the supervision by the authority involved requires extensive improvement. Water meters are installed when the connection is made, if such meters are available. Sewer connections are made from an inspection chamber at the building to the nearest manhole. All work is carried out at the building owners' expense.

In some of the unsewered neighbourhoods, lateral collectors have been installed to adjacent sewer lines. Such installations have been made by private contractors without the technical assistance of the relevant authorities. Where this has been done, the cost of both the lateral and the hookups has been borne by the building owner.

The fact that households within the service areas, and even some of those outside, willingly pay the cost of connecting the building to the water and wastewater networks indicates that the service is highly desired and that the cost of the hookup is not a barrier to acquiring the services.

It has been reported by those in the water and wastewater authorities that a distinction must be made between the beneficiaries "ability to pay" and their "willingness to pay". While few question the beneficiaries desire for services and their ability to pay the capital costs associated with connecting to the water and sewer lines, most doubt the beneficiaries willingness to pay the charges associated with receiving services on an on-going basis. Reports from managers in the water and wastewater authorities suggest that beneficiaries will not pay for consumption until the quality of service, generally regarded as very poor, is improved. The argument that payment should be made in order to ensure that service will be upgraded has not been endorsed by managers, although no one has attempted to promote this approach among the beneficiaries.

3. Health impacts of the current and proposed systems. Although good health is ensured through a safe and adequate supply of good water, no direct and immediate health benefits can be readily observed as a result of the installation of water and wastewater systems in large urban areas. Eliminating incidents of wastewater flooding is certainly one positive step toward improving overall health status. Still, this step alone is not likely to lead to significant changes in mortality and morbibity when other environmental health hazards exist.

Multiple interventions are required to achieve positive health impacts. In addition to the installation and proper operation of water and wastewater systems, solid waste collection and disposal programs and public awareness campaigns that lead to substantive changes in the behavior of the beneficiaries of the systems are required.

Indeed, if the full complement of interventions is not in place, systems can be misused and have an adverse effect on the health status of populations. For example, when clean water is stored in unclean jars, as has been documented in case studies in Alexandria, or in contaminated storage tanks on building rooftops, as in Cairo and other cities, there may be no health benefits or even enhanced hazards.

C. Conclusions and Recommendations

Master plans and AID project documents do not clearly identify the beneficiaries of the water and wastewater systems. Different methodologies have been employed to estimate the size of the populations to be served. None analyzes in detail the socio-economic characteristics of the urban populations in the serviced or project areas, and there is little correspondence between the plans developed for the water and wastewater systems and the GOE's established census tracts. Furthermore, there is a wide disparity among the estimates of the average daily rates of per capita water consumption.

While it is difficult to target water and wastewater systems to specific beneficiary groups, the GOE should require that the same standard methodologies be applied to all urban centers when estimating the populations and designing the systems. It might be appropriate to use census tracts as the unit of analysis. This approach would facilitate the up-dating of master plans whenever new census data become available, and provide more complete socio-economic data on the population served.

The GOE also needs to collect more specific information on the average rates of per capita consumption for water. Once defined, these rates should be used to estimate the volumes of the systems and the designs required to carry the flows. At the moment, some of the rates appear to be too high. Using high rates produces designs that are in excess of the requirements of the population as projected to the horizon year, and places an excessive demand on the resources available for system's construction and expansion. The need to obtain more accurate estimates of demand suggests that metering is essential.

While it is not possible to state definitively who is benefiting from the current levels of water and wastewater service, it appears that middle and upper income groups benefit more than lower income populations who frequently reside in unsewered areas. The tariff currently in effect is regressive. The poor pay more as a percentage of household income for water and wastewater than others who have more resources. Implementing the newly proposed national tariff (See Chapter 3) and collecting the charges assessed, should contribute to increasing efficiency in the systems' operations and should not have the adverse consequences associated with increasing prices for other basic services (e.g., transportation) and commodities (e.g, bread). Since one of the objectives of the projects underway and proposed is to raise revenue sufficient to cover operations and maintenance costs at a minimum, the GOE should survey a sample of current beneficiaries, as well as those unserved, to obtain more information on "ability" and "willingness" to pay for services. Such a survey is likely to show that significant tariff increases are warranted and can be implemented without political risk.

Finally, it is extremely demanding and expensive to relate improvements in the operations of the current water and wastewater systems -- measured as an increased quantity and improved quality of water or the reduction of wastewater flooding -- and health status. The epidemiologic linkage is very difficult to establish. If the GOE is interested in documenting some aspects of the relationship between water and health, compaigns to educate the public on proper practices in the collection, transport and storage of water, and use of the wastewater system, should be implemented. Such activities might be carried out in connection with the AID-financed National Control of Diarrheal Diseases Project (263-0137).

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Appendix 5.1

Methodologies for Projecting Populations in Project Cities

The different demographic methods used to estimate the total populations in the AID project cities at the year 2000 are discussed below. Estimates are presented in Table 5.3 of Chapter 5.

Alexandria. Since Alexandria is the major Egyptian summer resort, and the water network supplies areas along Mersa Matruh railroad, Ameria and Maryut, special attention has been given to estimating the rate of population growth.

Two methods are adopted to estimate the population in Alexandria at the year 2000. The estimates were averaged to obtain the most likely figure. The two methods are the ratio technique and the rational evaluation technique.

The Ratio Method. A statistical relationship between Alexandria's population and Egypt's total population was established. The linear functional form estimation ($Y = 4.61 + 0.0532X$, where the independent variable is Alexandria's share of Egypt's total population and X is the number of year after 1930) gave an expected value of 7.74 percent. The log linear functional form ($Y = 2.0556 + 1.0917 \ln X$) gave an expected value of 6.9 percent in the year 2000. The study favored the log linear results (i.e. Alexandria's share of Egypt's total population will rise from 6.4 percent in 1976 to 7 percent in 2000). This increase was distributed overtime and applied to CAPMAS forecasts of total Egyptian population at the target year.

The Rational Evaluation Method. This method divides the growth rate of Alexandria's population into two components: the rate of natural increase and the net migration rate.

The rate of natural annual increase was estimated to be 2.25 percent. The rate of net migration was calculated by estimating the annual compound population growth rates for the intercensal years (1947-1960, 1960-1966, and 1966-1976) and subtracting the rate of natural increase for the same intercensal years. The rate of

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natural increase is estimated to be stable at 2.2 percent over the next 2 decades. The rate of net migration will decline to 0.8 percent per annum in the years 1985-1990, and to 0.7 percent in the years 1990-2000.[1]

Provincial Cities (Minia, Beni Suef, Fayoum)
The NUPS estimate of the total population projection to the year 2000 was used. In addition, it was assumed that the ratio of governorate population to total population would change according to historic trends. UN demographic methodologies were used to estimate urban and rural populations for the years 1985 and 2000. The urban population was projected through the utilization of logistic curve characteristics. Populations projected through the period 2000-2020 was based on the annual rate of growth projected for the period 1990 to 2000, assumed to be 3 percent per annum.

Ismailia. Two sources were used to determine the 1978 population of the Ismailia project areas; three sources were used to estimate future population.

Source for the existing population were the planning department of the Ismailia Governorate estimates of the Ismailia Master Plan, (March 1976), the Ismailia Demonstration Project (Feb. 1978) and the Ministry of Housing and Reconstruction were used to estimate future population.

The 1975 population estimates were adjusted to reflect information obtained from the 1976 census. The 1976 estimate of the population of the project area was arrived at by adjusting the 1976 CAPMAS figures to include areas which were not in the census but are within the project area, and to exclude areas which were included in the census but do not form a part of the project area. Field surveys were used to confirm estimates in particular areas.

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1 · To estimate the size of seasonal variations, the monthly and daily water use records made available by AWGA were utilized. Accordingly, it was possible to estimate that on an average day during the peak summer months of July and August, the additional non-permanent residents are around 350,000. This number is expected to grow to be around 600,000 in the year 2000. The estimation of population in other areas was facilited by labour/cultivated land ratio, since agriculture is the predominant economic activity.

Suez. Population projections for Suez were adjusted to reflect information from the 1976 census, planning studies of industrial development, and the Suez Canal Regional Industrial Plan. The population forecast of the Suez Master Plan was adopted without major modifications. Two areas were excluded because they are outside the project boundaries.

Port Said. Population estimates for Port Said were adjusted by the 1976 census and the Port Said Demonstration Project 1977. The population was established using the 1976 census, the 1977 surveys, and information on new housing starts. Future population projections were adopted in the Port Said Master Plan.

Cairo. The Cairo projections were carried out using linear, power curve, s-curve, and ratio methods.

An acceptable range of population projections for Egypt was estimated to the planning horizon. The most probable trajectory was selected. The percentage of Greater Cairo's population in the total population of Egypt, and the development of a reasonable range in share projections, was determined.

This work was based on census data (1976), information on spatial distribution of the population and earlier demographic work done for the Wastewater Master Plan (1977).

Appendix 5.2

Hookup Practices

1. Introduction

The following presentation summarizes the installation practices for water and sewerage connections for selected cities in Egypt. The cities selected have either water and/or wastewater projects that have been funded in part by AID. In general, the procedures for making the connections do not vary greatly from city to city. Building owners request and obtain permits from the relevant local authority with payment of fees. In addition to paying the connection charge, the building owner may also have to pay the cost of restoring the road surface.

2. Sewerage Connections (Building to manhole)

Provincial Cities

The application and authorization for sewer connection is processed through the city council of the respective city. The staff of the city council prepares a bill for the connection (connection fee) which varies with the size and type of installation. The fee usually ranges from L.E. 150 to L.E. 200 and covers the actual cost of connection plus a percentage markup for technical and administrative services. Upon payment of the fee in advance by the owner, the work proceeds.

The work is either carried out by the staff of the sewerage division or by a private contractor under the supervision of the municipality. The standard method of hookup includes an inspection chamber (junction box) which is constructed at the owner's expense, and is made of brick and cement mortar having inside dimensions of 60 cm and 60 cm and fitted with a cast iron or concrete cover. The sewer service line connecting the inspection chamber to the nearest manhole is made with six inch diameter vitrified clay sewer pipe, supported by concrete where required.

Canal Cities

The authorization for hookup is processed through both the sewerage department and the road department of the city. Upon payment by the owner of the appropriate fee, the connection is carried out by the sewerage department or by the building owner under the supervision of the municipal engineers. The road department charges the owner for the cost of road restoration, if required.

Depending on the building capacity, intended usage and occupancy, connections are made using 4 to 6 inch PVC pipe. The fee paid covers the actual cost of the connection plus a set percentage for the technical and administrative services involved. This is exclusive of the inspection chamber whch is a direct owner cost.

The building owner can also make the connection at his own direct cost by using a private contractor. In this case, the owner obtains prior approval from the sewerage department and proceeds upon payment of a modest fee.

Alexandria

The request/authority for hook up is processed through A/GOSD. In addition, a permit for excavation must be obtained from the traffic authorities. The hook up (connection) is made by the owner of the building under the supervision of the staff of A/GOSD. The owner is charged 15 percent of the administrative services in addition to the cost of pavement restoration. The payment is made in advance to A/GOSD. The method of hookup is the same as described above.

Cairo

Very limited control regarding hookups is provided by GOSSD. Installations are made by building owners through private contractors at their expenses and without supervision from GOSSD. The method of installation is similar to the standard practice previously described.

3. Water Connections (Building to Watermain)

Provincial Cities

Water connections in the provincial cities follow the same pattern as for sewer connection. The application for connection is made to the city council. The building owner pays in advance a connection fee to cover the actual cost of the connection from the water main to the house, a valve and a meter, plus a set percentage for technical and administrative services. The connection is made by the staff of the water department. Meters are installed at the time of connection. The connections are made by wet tape with the installation of a corporation cock. Various kind of pipes are used including galvanized iron, lead, copper and P.V.C. Upon installation the maintenance of the meters becomes the responsibility of the water utility.

Canal Cities

The request for connection is made to the local water department of the Suez Canal Authority (SCA). The building owner pays in advance to the SCA the connection fee which is determined annually. The fee covers the actual cost of the connection from the water main to the house, a meter, plus a certain percentage for technical and administrative services. The connection is made by the staff of SCA.

The connections are made by wet tap with the installation of a corporation cock. Meters are installed at the time of connection. Upon installation, the maintenance of the meters becomes the responsibility of SCA.

Alexandria and Cairo

The request for connection is made to the water authority. The building owner pays in advance the connection fee which covers the actual cost of the connection from the water main to the house, a valve, a meter, plus certain percentage for technical and administrative services. The connection is made by the staff of the water authority and the meter is installed at the same time, if available. The connection is made by wet tap for small diameter mains and dry tap for large diameter mains. Various kinds of pipes are used including galvanized iron, lead, and P.V.C. Upon installation, maintenance of the meters becomes the responsibility of the water authority.

Appendix 5.3

Public Water Facility Rehabilitation
Cairo Water Fountains
Grant No. 263-0111

Project Description

The Public Water Facility Rehabilitation project began in 1978, was completed in 1980 and cost 1.3 million L.E. It was part of an accelerated program implemented by GOGCWS to improve and expand water supply services, especially in unserved low income areas. The project's objective was to improve public access to potable water. Funds were provided for the rehabilitation of Cairo's 600 public potable water fountains, serving nearly 1.5 million residents. Adequate drainage facilities were to be provided by means of connection to the sewer system, canals or septic tanks. This component was inadequately completed, significantly reducing the benefits envisaged under the project. (Approximately 445 of the 600 fountains drained into a formal sewer system.)

The GOGCWS was responsible for operating and maintaining the public water fountains; Cairo Governorate agreed to pay water use charges to GOGCWS.

Before the project, a large number of water fountains were in poor condition. Water was lost and wasted due to faulty and non-functioning faucets or valves. The project reduced costs significantly by reducing water wastage. Water wastage was reduced by installing flush valves that provide a pre-determined volume of water when activated rather than the more commonly used switch-on faucets.

Findings:

1. Beneficiaries: The urban poor who relied mainly on often inadequate public water taps for their potable water requirements were the primary target group. At the time the project was designed, an estimated 25 percent of Greater Cairo's population had access only to public water taps. Consumption from Cairo's 600 fountains was approximately 2 percent of the total potable water produced.

The rehabilitated fountains were located in 18 districts of Greater Cairo, incorporating Cairo, Maadi, Helwan and Giza. The project's direct beneficiaries, i.e., those having direct access to potable water, were estimated at over one million (1978 figures), including an additional 375,000 as a direct result of replacing or restoring non-functioning or defective fountains (15 percent of the total number of fountains).

The average population density of the targeted areas was 800 to 1500/km^2. The average daily consumption per person using the fountain was 80 litres. The approximate number of users per fountain was 500 to 2000, depending on the area served. The total consumption per day for each fountain ranged according to area density and proximity of the fountain, from 40 cu/m to 160 cu/m.

2. Socio-Economic Impact: The average monthly income per household in the selected areas ranged from 30 to 50 L.E. Prior to the rehabilitation of the fountains, the costs of informal provision of water, mainly by water vendors (who obtained water from a distant working fountain or from a neighbour), averaged 2-3 L.E. per month. People who were able to dispense with the services of a water vendor after the project's intervention thus realized a monthly saving of up to 3 L.E.

In the unsewered areas, the cost of informal wastewater collection (mostly by privately owned and operated dump trucks) was as high as 7 L.E. per month. The introduction, or improvement in service of water fountains without concomitant drainage facilities in these areas thus exacerbated the problem of sewage collection. During site visits, people complained of the inadequate sewage facilities and resultant health hazards.

3. Practices: Though the fountains were metered, Cairo Governorate did not charge user fees, but paid water use charges to GOGCWS out of its own budget. The users did not officially share in paying the maintenance or repair costs, but were arbitrarily called upon to pitch in 20-25 PT for small repair works. People contributed to the repair of the taps to ensure a regular and reliable level of service.

Public water fountain users frequently wash clothes by the tap. When drainage facilities are not satisfactory, this practice often creates stagnant pools of water around the tap, and increases health hazards.

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4. Assessment of health conditions: Tangible and directly attributable health benefits emanating from this project cannot be measured with any accuracy. Improved access to potable water can have a positive health impact on women and children who are primary fetchers and carriers of water.

Inadequate drainage, identified as a serious problem during site visits, resulted in stagnant pools of wastewater. The problem was further compounded by non-functioning or broken faucets, in turn increasing the undrained wastewater near the site.

Since many taps are no longer in service because households have been connected to the formal water and drainage networks, some of the fountains have become garbage dumps for solid waste.

Domestic storage practices also have implications for health. Water delivered from the fountains can be of good quality but can become contaminated when carried or stored in an unclean container. Since the mandate of USAID's intervention in this project was only to improve access to potable water, concomitant public health campaigns on diverse but related issues such as water storage practices, proper usage of the system and so forth might have enhanced the benefits associated with an improved water source. .

Issues

(1) Operation and maintenance. The taps still functioning 5 years after the project completion date are enclosed by walls (4 meters high) or have a "protective" construction surrounding them. Future AID-financed taps should be enclosed. While a special covenant in this project emphasized GOGCWS's need to develop a maintenance and spare parts inventory for the upkeep of the fountains, most of the taps inspected on a recent site visit had faulty or non-funtioning faucets. Reports differed from site to site on the expediency of repair work by local authorities.

(2) Technology. The type of faucet (flush valves) did not present problems in water delivery. Most users interviewed during site visits had no complaints against the valves (other than the fact that they were not working, in certain fountains). However, it has to be technically determined whether flush valves are more prone to became damaged through misuse or heavy usage than other types of faucets.

(3) Implementation. The absence of satisfactory drainage limited use and created potential health hazards.

Conclusions and Recommendations:

1. To reach and serve the lowest income groups, projects or interventions have to be specially tailored. Projects such as the Cairo Water Fountains, or the metered water service connections program, (part of Cairo Water Supply Project but never implemented), are examples of bringing piped potable water and drainage services to the "poor majority". USAID's current investment in the rehabilitation of formal water supply and wastewater collection systems does not reach these groups exclusively since relatively few are served, or connected to the formal systems. AID's approach in this sector has been to concentrate first on the rehabilitation of the major infrastructure or skeleton, including treatment plants, and then to improve and connect services to the unserved population. Since all of USAID's water and wastewater projects are still under construction, many potential beneficiaries connected or unconnected, have not benefited from an improved system.

2. Even with specially tailored interventions to provide a more reliable water supply system, the importance of adequate drainage services cannot be minimized. In the Cairo Water Fountains Project, drainage in a number of sites was far from adequate. This constrainted delivery as well as increased health hazards.

3. Specific, "one shot" interventions (as well as large-scale, long term projects) such as the Cairo Water Fountains project, should be accompanied, preferably simultaneously, by public awareness campaigns ranging from public health and personal hygiene to storage practices and water conservation. Moreover, solid waste collection/management is vital, especially in unserved low-income areas.

4. The design of this project did not consider alternative and acceptable solutions to washing by the tap. The setting up of public wash basins might have freed the area around the taps and eliminated a portion of the flooding. Future designs should recognize the need to initiate campaigns to change behaviors when introducing technologies. Campaigns to design the project and implement and maintain the system might be most effective if initiated and carried out on a local level, emphasizing direct and active community participation.

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Annex A

Project Review: Cairo Wastewater Project

1. Status of Physical Works

a. Existing Facilities

(1) Description of the System. The existing wastewater facilities operate as a combined system for the collection of wastewater and surface water. The sewered area is served by six principal pump stations (Ein Shams, Ameria, Souk El Samak, Gamaa, Giza and El Ahram) which deliver wastewater to four treatment plant sites (Gabal El Asfar*, Kossous*, Nahya* and Zenein): a fifth site, Abu Rawash, is used only for the treatment of sludge at present. Wastewater is delivered to the principal pump stations through a system of gravity collectors which receive constributions from a large number of drainage areas. The flows from individual areas either gravitate directly to the collectors or to subsidiary pump stations from which the wastewater is conveyed to a collector, often via one or more intermediate stations.

The basic layout of the existing system is shown on Fig A-1. For details of the existing system refer to AMBRIC Special Report No. 2, Inventory of Major Facilities, September 1980.

(2) Wastewater Flow and Population Served. At the present time the existing Cairo Wastewater System is estimated to serve about seven million people, or about 75 percent of the current estimated total population in the Cairo wastewater service area.[1] Total average flow of wastewater carried by the system is on the order of 1,700,000 m^3/day. In terms of strength (relative amount of solids and organic material per cubic meter), Cairo Wastewater is from 50 to 100 percent stronger than typical US wastewaters.

Of the total wastewater flow, about 30 percent is generated from the West Bank and 70 percent from the East Bank of the Nile.

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* These three facilities are small, in very poor condition, and currently provide effectively no treatment. They are scheduled for abandonment.

[1] These estimates are from the AMBRIC Design Inception Report (DIR) of June 1981. There is great difficulty in determining the total population of Cairo, but it is now believed to be significantly higher than the 1981 DIR estimates. Percentage served is more likely to be in the order of two thirds of the total population.

(3) Conditions in the Existing System. Virtually all parts of the existing collection and conveyance system are grossly overloaded, or, at best, working to full capacity. In consequence, the system has no available spare capacity to meet the sudden demands imposed by mechanical or electrical failure. As a result, intermittent flooding with wastewater occurs in many areas.

The existing facilities inlcude well over 100 pump and ejector stations, many of which are equipped with machinery more than 50 years old. In many cases, pumping capacity is barely sufficient for present flows and stand-by pumping capacity is inadequate. Spares for the older equipment are difficult to obtain, and the arrangement of the stations and types of equipment installed do not facilitate easy maintenance.

The existing wastewater treatment plants are wholly inadequate to treat present flows to an acceptable standard. All plants are in poor condition and overloaded and, in consequence, their purification effect is minimal. The capability of all treatment plants is further impaired by the inoperable condition of essential mechanical and electrical plant. As a result, less than one fourth of the wastewater collected is given any treatment and the remainder is discharged to the irrigation drainage canals without treatment.

b. Proposed Facilities

(1) Overview of Proposed Improvements. The facilities needed to meet the needs of collection, treatment and disposal of wastewater from Greater Cairo into the early part of the 21st century are set forth in detail in the AMBRIC Design Inception Report, dated June 1981. Emphasis is given to the first stage works, expected to meet the needs of Cairo into the early 1990's.

First stage works include rehabilitation of about 100 pump stations and the existing Zenein treatment works; new culverts, sewers, pump stations and a new treatment plant on the West Bank; and new tunnels, culverts, sewers, pump stations and three new treatment plants on the East Bank.

(2) Status of Proposed First Stage Facilities. The first stage works proposed for design and construction are listed and described in Table A-1, together with a very rough estimate of their cost, the source of the needed funds, and the status of these works as of February 1985. The major first stage works are shown on Figures A-2 (East Bank) and A-3 (West Bank), and the estimated construction schedule is shown on Fig. A-4. For details of the proposed first stage facilities refer to the AMBRIC Design Inception Report (Main Report), June 1981.

(3) Wastewater Flow and Population Served. By the year 1990, when most of the first stage works are proposed to be completed, the estimated sewered population will increase to about 9 million.[2] Average total wastewater flow in 1990 is estimated at about 2,500,000 m^3/day.

c. Perceived Gaps in Physical Facilities

(1) Gaps Related to Funding Shortfalls. At the present time, several critical groups of facilities which have been proposed for construction in the first stage are unfunded, nor have potential sources of funds for some of these works yet been identified.

The various spine and branch tunnels listed in AMBRIC contracts 5, 13, 14 and 15, with a total estimated cost of L.E. 700 million, have no potential funds at this time. While unable to quantify the extent of the problem, AMBRIC admits that the other East Bank facilities now under construction or scheduled for tendering will be significantly under-utilized until these branch tunnels are completed.

Funding for the critical Abu Rawash WWTP on the West Bank is also uncertain. While the foreign exchange portion of the plant costs may be made available (discussion are curently in progress), no allocation of the local currency requirements (about half of the total or about LE 65 million) has yet been made by the GOE. Presently approved capital budgets of C/GOSD would be totally inadequate to meet this additional burden.

The Berka and Shoubra El Kheima WWTP's on the East Bank are also critical to the effectiveness of the first stage system since they will be called upon to provide about 80 percent of the total East Bank treatment capability. These works have been designed and are to be constructed entirely with local resources. The estimated cost to complete them is about LE 200 million. Construction is presently proceeding at a very reduced pace because funding for them must come out of a total annual C/GOSD capital budget of LE 60 million per year, from which C/GOSD must also fund needed new lateral sewers, house connections, sewer flooding improvements and other capital works programs.

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[2] Which probably would be in the order of 70 percent of the total population.

Finally, all of the major facilities cannot be properly utilized unless the program of constructing house connections and lateral sewers keeps pace. AID is providing funds for this purpose on the West Bank but C/GOSD's funds for such works appear to be very restricted. There is some question as to the adequacy of the overall pace of building new connections and small sewers and the matter warrants attention.

(2) Gaps Related to Quality. The four member firms of AMBRIC (BVI and CDM of the US, Taylor and Binnie of the UK) are all large, experienced, competent consultants, with wide international experience in the water and wastewater field. They are responsible for the studies, designs and supervision of construction of most of the stage one works and have performed these services in a competent manner which should ensure that the works for which they are responsible will be completed to a satisfactory level of quality.

The 400,000 m^3/day Abu Rawash WWTP is being designed by a Japanese firm (TEC) with support from CDM, one of the US member firms of AMBRIC. TEC is an experienced water and wastewater consultant and the plant is being designed on the basis of criteria established earlier by AMBRIC. When completed, the plant should be able to meet its intended function at a satisfactory level of quality.

The two 600,000 m^3/day East Bank WWTP's at Berka and Shoubra El Kheima have been designed by local consultants and are being constructed by local public sector contractors. (Concerns about construction are discussed in Section 3, Key Issues.) These are extremely large plants, and relatively few secondary wastewater treatment plants of that capacity have been constructed anywhere. The largest plants built previously in Egypt are the Zenein works (330,000 m^3/day) in Cairo, and the East and West works in Alexandria (both under 80,000 m^3/day). These three plants were all locally designed and built. Their design and performance fall considerably short of adequacy. In view of the critical role of these two plants, which will be expected to provide about 80 percent of the first stage treatment on the East Bank, it would be prudent for CWO and C/GOSD to take the necessary steps to ensure that these works can satisfactorily perform their intended function. This situation is cause for serious concern, and while the matter is very sensitive it must be addressed.

(3) Other Possible Gaps. At the present time, the drainage canals proposed for receiving the effluent from the Abu Rawash WWTP are inadequate for that purpose. The GOE, AMBRIC and TEC are well aware of this problem, and AMBRIC is currently carrying out a study to determine the necessary improvements. The study is to be completed in June 1985. These drains are under the control of the Ministry of Irrigation, and permits to discharge wastewater to the drains must have the approval of both the Irrigation and Health Ministries. Considering the probable length of time for designs, construction and permits, together with the fact that no funding has yet been identified for such improvements, potential delay in completing this link in the first stage program of improvements gives rise to concern.

To date, recommendations for disposal of the huge quantities of sewage sludge expected to be generated by the first stage WWTP's are based on using sludge lagoons and sludge drying beds as temporary measures. AMBRIC and CWO are discussing a study which would lead to recommendations for a final solution of the sludge disposal problem. The temporary sludge disposal methods, however, will not adversely affect the overall performance of the first stage system.

Matching the capacity of the proposed new wastewater treatment plants to meet the expected future is another area of potential concern.

First stage works currently proposed include:

Name of WWTP	Capacity	Planned Completion Date
	m^3/day	
Abu Rawash, Stage I	400,000	Jan. 1990[3]
Zenein, Rehabilitated	330,000	Feb. 1988
Gabal El Asfar, Stage I	250,000	Jan. 1989
Berka	600,000	Jan. 1989[4]
Shoubra El Kheima	600,000	Jan. 1989[4]
Total	2,180,000	

[3] Assuming funds are made available
[4] C/GOSD estimates, but current availability of funds makes these completion dates optimistic.

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Given the past history of optimistic completion date targets, it seems reasonable to assume that, except for Zenein, some of these works will be completed no earlier than 1990. By that year, AMBRIC estimated in it's 1981 report that the average daily wastewater flow from a sewered population of 9.3 million would be 2,490,000 m^3/day. Further, in the ten year period 1990 to 2000, AMBRIC estimated an average annual increase in flow of about 210,000 m^3/day.

These calculations are based on a combination of assumptions about population and the rate at which connections, collection works and conveyance facilities can be constructed. With the program now about three years behind schedule, it is possible that the facilities needed to collect the 2,500,000 m^3/day may not be in place until well after 1990.

Given the long lead time for design, construction and financing, however, the conclusion seems to be that future stages for Abu Rawash and Gabal El Asfar should be initiated in the very near future to ensure that treatment capacity is adequate for collected wastewater flow.

Another gap of concern is the relatively slow progress in overcoming the problems in those unsewered areas where the provision of conventional collection by means of lateral sewers and house connections is either not economical or practical, or both. AMBRIC has just started an 18 month, $1.5 million demonstration project to make field tests of 12 different methods of disposing of wastewaters from "informal" housing in unsewered areas. AID provided both foreign and local currency needs for this project because CWO felt it was outside its jurisdiction.

2. Progress vs. Expectations

a. Expectations

The expectations of AID relative to its support of the Cairo Wastewater Project can be found in general terms in the Project Papers used to justify AID's funding, and more specifically in the Scope of Work of the agreements and amendments of the consulting engineers whose services are being funded by AID.

In terms of the Engineering Component, these expectations may be broadly summarized as follows:

(1) Procure equipment, train staff and provide hands-on direction of work related to the cleaning of debris from some of Cairo's larger sewers.

(2) Review the 1978 Binnie-Taylor Cairo Wastewater Master Plan prior to expenditure of AID funds on financing facilities proposed by the Master Plan.

(3) Prepare a detailed program of facilities proposed to meet the demands of the collection, treatment and disposal of wastewater from Cairo, both for the immediate future (Stage I, about 1990) and for the "planning horizon" (some time in the early 2000's).

(4) Study, design and supervise the construction of facilities for the rehabilitation of selected works; mostly pump stations, force mains and some relief sewers.

(5) Identify those areas in Cairo subject to periodic wastewater flooding, present recommendations for improvements, and design needed improvements for one of these areas as a pilot program.

(6) Prepare detailed designs for the first stage facilities proposed for the West Bank, with the exception of the Abu Rawash WWTP.

(7) Prepare detailed designs for other collection facilities on the West Bank, as jointly agreed by AID and the GOE.

(8) Provide construction supervision services for the AID-financed West Bank facilities, and participation in general construction management for the entire first stage Cairo wastewater program.

(9) Prepare studies and designs for the rehabilitation of the Zenein WWTP.

(10) Conduct such additional studies and designs as directed by AID and GOE, including those related to final solutions for sludge disposal and needed improvements to West Bank drainage canals proposed as receiving waters for treated wastewater.

b. Progress

(1) The sewer cleaning program was funded under a $500,000 AID grant in 1978. Necessary equipment was purchased, about ten C/GOSD sewer cleaning crews were trained and then supervised for a period of about one year during which extensive cleaning took place. C/GOSD cleaning crews are working now on a continuous basis, and the AID-funded equipment is still in service.

(2) The review was carried out in 1979 and 1980 and resulted in an agreement between the US and UK members of AMBRIC on some changes to and general agreement with the Binnie-Taylor 1978 Master Plan.

(3) AMBRIC prepared a "Design Inception Report" dated June 1981 which was approved by the GOE and AID as the basis for work to be designed and constructed.

(4) The rehabilitation studies and designs were completed on schedule, the program is now under construction, and some works have been completed, with obvious and satisfactory results.

(5) The flooding studies were completed as well as the pilot area design. The pilot area was later constructed (by a local contractor) with excellent results. Local engineers and contractors have continued the program and in several of these areas flooding has been eliminated.

(6) Designs for the AID-funded West Bank first stage facilities have been recently completed and are now being packaged to put out for tender. At AID's request, contracts are being repackaged and some construction will be stretched out.

(7) AMBRIC is in the process of preparing recommendations for AID's consideration for the design of pump stations, lateral sewers and house connections, with a total value of $190 million, for the Northwest and Pyramids area. Following agreement on the program, AMBRIC will start work on the designs.

(8) West Bank facilities have been designed and tenders are currently being received. No construction supervision services have yet been required however, these services will be provided by AMBRIC. Services related to the overall management of construction are ongoing but limited, since construction on the East Bank is only recently underway.

(9) A design report on the "Rehabilitation of Zenein Wastewater Treatment Plant" was prepared and submitted in January 1981. Design of these improvements is underway and is expected to be completed by mid 1985.

(10) AMBRIC is now studying the question of drainage canal improvements and will recommend solutions to these problems by mid-1985. Work related to the study of the ultimate means of sludge disposal is to be financed as a separate work order (No. 7) by AID and ODA.

c. Comparison and Comment

At this point progress has essentially been up to expectations. Items (1) through (5) above were all part of earlier AID efforts. (1) through (3) are completed and the results have been satisfactory. Items (4) and (5) are now in the later stages of construction and give every indication of being completed in general accordance with expectations, with the usual exception of delays in getting construction underway.

Of the remaining items, the design stage is essentailly complete and the results are satisfactory. The current first stage construction program is estimated to extend to the end of 1989 and periodic review will have to be made to evaluate progress. Original Design Inception Report schedules, prepared in 1981, had estimated completion of the first stage by the end of 1986.

3. Key Issues

a. General

Such issues as management, operation and maintenance, and availability of operating funds are all critical to the ability of the existing and new physical facilities to be able to carry out their intended functions on a sustained basis. These issues are discussed in other sections of this report, but success in solving them is so vital that they should be considered collectively as the priority issue of the Engineering Component as well.

Some of the issues, particulary those related to the policy aspects of treatment and construction, have much in common with other sector projects, but are discussed in depth in the Cairo Wastewater Project Assessment.

b. Degree of Treatment of Wastewater

(1) Introduction. Treatment and disposal of wastewater is a dilemna in Cairo. Experienced consultants have thoroughly studied all possible feasible alternatives and have concluded that secondary treatment with discharge of the effluent to irrigation drainage canals is the recommended solution, if Egyptian law is to be satisfied. Yet, secondary treatment is expensive to construct and it is both expensive and difficult to operate. Further, the poor experience to date of the operation of existing wastewater treatment plants in Egypt, whether primary or secondary, raises serious concerns about the future quality of operation of the proposed major new treatment works. Finally, the consultant's recommendation has been, in effect, forced by strict Egyptian law rather than arrived at on the basis of engineering principles.

(2) The Nile. The world's largest cities are almost always located on the ocean, a river or a large lake. Among their other benefits, such large bodies of water can be utilized in an evnironmentally effective manner as receiving waters for the wastewater generated by the cities. The degree of treatment needed prior to such disposal is determined largely by the following factors: the amount and strength of the wastewater discharged, and the size and quality of the receiving waters.

Cairo is currently prevented from obtaining similar benefits from the Nile by Egyptian law, rooted in customs based on the extemely high regard in which the Nile is held by all Egyptians. Such decisions are the right of the Egyptian people alone to make, but when the consequences are as signficant as they appear to be in this case, the decision should be an informed one.

Given the size of flow of the Nile, and the ability, now with the Aswan High Dam, to regulate this flow, it is possible that Cairo could discharge its wastewaters to the Nile without any adverse consequences after primary rather than secondary treatment. The savings in capital and operating costs, and the fact that primary plants are much easier to operate then secondary plants, would amount to enormous savings to Egypt. These savings could be redirected to an intensified program of extending the benefits of connection to the sewerage system to many more people.

Egyptians should also be frank in recognizing that the present law is not being upheld because of breakdowns in the existing system. Further, even with the completion of the currently proposed new system, domestic wastewater will still be discharged to the Nile indirectly from the irrigation drainage canals.

Before finally committing itself to such a law, unique in the world, Egypt should at least be aware of the consequences of that decision.

(3) Possibility of Staging. Given the fact that less than one fourth of Cairo's wastewater now receives any treatment, and that what treatment is provided is at a level of poor primary treatment at best, it would seem logical to suggest that the proposed new treatment facilities be staged so as to provide only primary treatment initially. This would have the benefits of (a) deferring large capital and operating costs, (b) allowing sufficient time for Egypt to develop good skills in plant operation and maintenance, and (c) still result in significant improvements over existing conditions.

At the present time, unless a waiver is obtained, Egyptian law prevents such a course of action. Law 48/1982 requires that wastewater being discharged to irrigation drainage canals must be treated to a level such that the plant effluent contains not more than 60 mg/l of BOD and 50 mg/l of suspended solids. Only a high degree of secondary treatment (85 to 90 percent) can achieve these results.

It is true that wastewater receiving only primary treatment would cause greater pollution to the receiving canals than that receiving secondary treatment. On the other hand, many of these receiving canals are already seriously polluted and their condition would be improved once adequate primary treatment is provided. The advantages of staging should be weighed against the delays in further improvements to drainage canal water quality.

(4) Reuse for Irrigation. Reuse of wastewater for irrigation as a disposal alternative is frequently an emotional recommendation rather than a logical one. Such reuse is technically feasible, but rarely is it economically feasible. The factors in the decision to make use of wastewater for the irrigation of arid lands include (a) the availability of alternative sources of water, (b) the availability and cost of preparation of the land, (c) the cost of treatment and transmission of the wastewater to the land, (d) the cost of alternative methods of wastewater disposal, and (e) the net value of the crops that can be raised on the irrigated lands.

Until such time as the Nile becomes insufficient for all of Egypt's needs[5] it will always be preferable to the use of reclaimed wastewater for irrigation. Wastewater cannot be used for irrigation without secondary treatment, both by local law and scientific principles (the suspended solids would otherwise be too high for the soil to sustain over an extended period). As a consequence, while reuse of wastewater for irrigation may become economically viable and desirable in the long term, that is not the case now nor in the forseeable future. This is not a key issue for Cairo, but the situation in Alexandria and the Canal Cities indicates the need for more education among Egyptian decision makers to allow them to view this issue dispassionately.

c. Gaps in the System

(1) Introduction. The perceived gaps in the system of physical facilities are discussed in detail in Section 1-c, above. These gaps represent one of the key issues of the engineering component, and are summarized below.

(2) Gaps Related to Funding Shortfalls. The following important facilities, essential to the proper functioning of the first stage works by 1990, are presently unfunded, or are inadequately funded:

East Bank branch tunnels
Abu Rawash WWTP
Berka WWTP
Shoubra El Kheima WWTP
Lateral sewers and house connections

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[5] Total muncipal and industrial use of water in Egypt represents a very small percentage of the Nile River flow. Far greater amounts of water could be made available for irrigation by substantial conversion from flood irrigation practices to the use of sprinkler or drip irrigation. The cost to do so would be much less than the costs associated with reclamation and reuse of wastewater.

(3) Gaps Related to Quality. There are serious doubts about the ability of the Berka and Shoubra El Kheima WWTP's to function adequately, even if funding is found to complete them in time.

(4) Other Possible Gaps. Two other possible gaps are (a) necessary improvements to the irrigation drainage canals on the West Bank designated to receive the effluent from the Abu Rawash WWTP, and (b) possible shortfall in treatment plant capacity in comparison to future wastewater flows. Both of these issues are principally matters of assuring that the necessary steps are taken in time.

While not a part of the first stage program, progress on resolving the problems of wastewater disposal from the unsewered areas is sufficiently slow and resolution sufficiently important that this gap should also be considered a key issue.

d. Construction

(1) Local Contractors vs Expatriate Contractors. By this time there have been sufficient examples of the use of both local and expatriate contractors on water and wastewater projects to draw some conclusions. For a variety of reasons, including under-capitalization, lack of management experience, lack of experience on projects designed in the detail customary in the developed world, and over-extension in a period of booming construction in Egypt, the performance of local contractors on projects designed by expatriates has not been satisfactory, either in quality of work or in meeting time schedules.

(2) Local Private Sector vs Local Public Sector Contractors. The performance of local public sector contractors in less likely to be adequate than that of the private sector contractors. The "Publics" are not responsive to the normal controls a client and his engineer has over the contractor through the contract agreement. The Publics have no incentive since they are neither rewarded nor punished for doing good or bad quality work. Having no real financial responsibility, the tendering process is practically meaningless, and the threat of having to pay liquidated damages for delays has no force, since it becomes a transfer of funds from one government pocket to another.

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(3) Supervision of Construction. Experience on the Top Priority Projects in Alexandria indicates the need for expatriate direction (full responsibility) of the engineering supervision of construction on behalf of the client, if the works are to be properly constructed. Local operating authority construction supervision staff do not presently have the skills or support to properly enforce detailed plans and specifications. Such skills and support must be developed if Egypt is to sustain its work in this sector, but they do not exist at this time.

e. Other Issues

(1) Liaison Among C/GOSD, CWO and AMBRIC. C/GOSD will ultimately take over all of the works now being designed and constructed under the direction of the CWO. There is some question as to whether C/GOSD is being adequately involved in the decision making process about facilities for which it will have to accept responsibility. This problem, unless resolved, may tend to become increasingly severe now that the same person is no longer chairman of both C/GOSD and CWO.

(2) Land Acquisition. Acquisition of land for the permanent site of new facilities and obtaining temporary construction rights-of-way is frequently a slow and difficult process. In some cases the problems have been so great that facilities have been redesigned for other available sites because of probable extensive delays relating to the preferred sites.

4. Recommendations

a. General

The following recommendations relate to the Key Issues described in Section 3:

b. Degree of Treatment of Wastewater

(1) Issue: Use of the Nile as a receiving water for treated Cairo wastewater.

(1) Recommendation: (a) That a study be made to determine the technical feasibility of discharging wastewater directly to the Nile, and that a comparison of the costs and consequences be made of disposal to the Nile vs. disposal to the drainage canals. (b) That the results of this study be presented to the GOE with AID's comments, for their consideration.

(2) Issue: Staging of treatment by deferring the construction of secondary treatment facilities

(2) Recommendation: (a) That, concurrently with the study recommended above, a separate study be made of a comparison of the cost and consequences of the initial use of primary treatment only vs. secondary treatment. (b) That the results of this study be presented to the GOE with AID's comments, for their consideration.

c. Gaps in the System

(3) Issue: Need for additionaly funds for critical components of the first stage program.

(3) Recommendation: (a) That the possibility of savings through the deferral of secondary treatment, as described in Issues (1) and (2), be fully explored as a means of providing some of the needed additional funds. (b) That USAID consider providing the needed local currency of the primary treatment portion of the Abu Rawash WWTP to complement the expected Japanese loan for the foreign exchange costs, on the basis that this facility is critical to the investment commitment already made by AID on the West Bank. (c) That AMBRIC be requested to conduct a study to determine the order of priority, based on "best estimates" of wastewater volume contributed per unit of estimated construction cost, for the unfunded spine and branch tunnels. (d) That construction of these branch tunnels be accorded a high priority, and that alternative (to UK) sources of funds be sought for their construction on the basis that the tunnels could be constructed by contractors from the nation providing the funds. (Minor modification of the specifications should permit this.) As funds become available they should be applied to the tunnel contracts on the basis of the priorities determined by AMBRIC. (e) That needed additional funds for the Berka and Shoubra El Kheima WWTPs be sought only after completion of the work described in Recommendation 4. (f) That needed additional funds for lateral sewers and house connections be sought in accordance with a schedule which recognizes that such works will create additional burdens on the presently overloaded system if they are constructed before significant improvements in the collector and transport system are made.

(4) Issue: Need for assurance that the design and construction of the Berka and Shoubra El Kheima WWTPs are adequate to result in works which will effectively perform their expected function in the first stage program.

(4) Recommendation: (a) That discussions be held among AID, ODA, CWO and C/GOSD to discuss the problem and agree on a course of action. (b) That, with the concurrence of the above parties, AMBRIC be requested to review the designs of these plants, evaluate their current status, and present recommendations for possible changes, similar to the report conducted on the Zenein WWTP in Jan. 1981. (c) That, after review by the above parties of the AMBRIC study report, action be taken to implement its recommendations.

(5) Issue: Need for timely completion of improvements to the irrigation drainage canals to be used as receiving waters on the West Bank.

(5) Recommendation: That as part of the a study now being conducted by AMBRIC, a schedule be prepared to show how the necessary designs, permits and construction is to take place in order to assure that the proposed improvements are completed in time to receive the effluent from the Abu Rawash WWTP.

(6) Issue: Need to assure that treatment plant capacity will be adequate for tributary wastewater flow.

(6) Recommendation: That AMBRIC be requested to review the current situation and prepare a schedule showing when additional capacity, beyond that currently proposed for the first stage, must be brought on-line to meet expected flows. This schedule should show when design work should be started in order to provide necessary lead time.

(7) Issue: Need to accelerate the program for providing effective and appropriate means of wastewater disposal in those "informal housing" areas where conventional piped sewerage may not be feasible.

(7) Recommendation: (a) That, since potential solutions to this problem do not depend directly on the Cairo Wastewater System, and since progress to date has been limited, consideration be given to assigning responsibility for this matter to the Joint Housing Project Agency (JHPA) rather than to C/GOSD or CWO, on the basis that the JHPA is more likely to be sympathetic to the problems. (The JHPA has responsibility for upgrading conditions in "informal housing" areas. Like C/GOSD, JHPA is responsible to the Ministry of Housing and Public Utilities, so coordination problems should be resolvable.) (b) That the current AMBRIC demonstration project for work in unsewered areas be coordinated with JHPA so they may be kept informed of pgoress. (c) That AID consider funding advisors to the JHPA, together with funds for their implementation, for possible future programs arising out of the AMBRIC demonstration project.

d. Construction

(8) Issue: Need to ensure that AID-funded projects are properly constructed while also developing enhanced capability of local construction contractors.

(8) Recommendation: (a) That US contractors be selected as prime contractors for all US-funded projects. (b) That US contractors be required to associate with local private sector contractors who will serve as sub-contractors to the US Firm(s) for a minimum percentage of the contract to be specified by AID.

(9) Issue: Need to ensure that the construction of AID-funded projects is properly supervised while also developing such capability locally.

(9) Recommendation: (a) That US construction supervision or management specialists be selected and assigned full responsibility for that task, and not merely serve as advisors. (b) That scopes of work for such services be developed which will ensure the transfer of construction supervision or management skills, from the US specialists to local staff assigned for that purpose.

e. Other

(10) I ed to ensure that C/GOSD, which will
e be called upon to assume responsibility for
t ion of the facilities being developed by CWO
w C assistance, has an effective voice in and
i lly informed about all aspects of the
p

(10) R tion: That AID, with ODA support, encourage
a e meetings among C/GOSD, CWO and AMBRIC to
e t satisfactory procedures are developed to
a this ojective. AID should periodically
r situation to ensure continuation of this
p

(11) I ed to ensure that land and rights-of-way are
o n a timely basis so as not to result in
u y of the construction of the first stage
p

(11) R tion: (a) That AID request that the US
c s working on AID funded projects share their
e s on this subject and jointly draft a paper
s sent problems and presenting proposed
t tions. (b) That AID review these
r tions and encourage the Ministry of Housing
t Utilities to assist in bringing about GOE
t of a policy on land acquisition and
r -way which would bring about improvements of
dures for all public works projects
Egypt.

BEST AVAILABLE COPY

TABLE A-1 STATUS OF FIRST STAGE CAIRO WASTEWATER IMPROVEMENTS

REHABILITATION (AMBRIC Design)

Contract No.	Description	Estimated (1) Cost (Millions)	(2) Status	Funding (3) Source
007	Rehabilitation of 100 Subsidiary P.S.	$50	UC	AID
010	Rehabilitation of 5 Major P.S.	15	UC	AID
-	Rehabilitation of Zenein WWTP; 330,000 CMD	35	UD	AID
-	Rehabilitation of 3 P.S.; Roda Island	10	UD	AID
	Sub-Total	$110		

EAST BANK (AMBRIC Design)

1	Ameria P.S., Civil Works: High Lift Sta: 45 m diameter by 32 m deep; Low Lift Sta. 26 X 40 m by 10 m deep	*	UC	UK
2	Ameria P.S., Mech. & Elec: High Lift- 8 Pumps at 3,600 l/s; Low Lift - 4 Pumps at 2,200 l/s	*	UC	UK
3	Main Tunnels-Ameria to Souk El Samak 6.0 km, 1.2 to 5.0 m diameter	*	UC	UK
4	Main Tunnels - Souk El Samak to Abdeen 5.0 km, 2.5 to 5.0 m diameter		PC	UK
5	Boulac Spine Tunnels - Boulac to Main Tunnel 6.9 km, 1.2 to 2.5 m diameter	*	D	(4)

(1) Cost estimates are in US$ for AID projects, otherwise are in LE. These estimates are very approximate and are intended only as a general guide to relative magnitude.

(2) As of Feb. 1985: D = Designed; UD = Under Design; UC = Under Construction; PC: Designed and Proposed for Construction and Funds Available

(3) Funds available except as otherwise noted.

(4) Currently unfunded

* See page 29

Contract No.	Description	Estimated Cost (Millions)	Status	Funding Source
6	Culverts - Ameria P.S. to Urban Boundary/Matareya Branch 2.9 km, 2 boxes at 3m X 4m each 0.9 km, 1 box at 3m X 2.75m	*	UC	UK
7	Culvert - Urban Boundary to Kossous P.S. 3.2 km, 3 boxes at 3.0 m X 3.5 m each	*	PC	UK
8	Culverts - Kossous P.S. to G. El Asfar WWTP A: Kossous P.S.; B: Khalag - Gabal El Asfer A. 5.5 km, 2 boxes at 3m X 3m each B. 2.3 km, 2 boxes at 3m X 3m each	*	 PC PC	 UK UK
9	Kossous and Khalag P.S. Kossous: 12 Screw Pumps + 5 Centrifugals Khalag: 10 Screw Pumps (3m dia)	*	PC	UK (1)
10	Gabal El Asfar WWTP - Civil Works Secondary Treatment, 250,000 CMD	*	PC	UK (1)
11	Gabal El Asfar WWTP - Mech & Elec Secondary Treatment, 250,000 CMD	*	PC	UK (1)
12	Main Tunnels - Abdeen to Ein El Siera 3.3 km, 4 m dia; o.8 km, 1.2 m diameter	*	PC	UK
13	Main Tunnel - Ein El Siera to Maadi Branch Tunnel to Dar El Salaam 3.2 km, 4 m dia; 1.1 km, 2 m diameter	*	D	(2)

(1) Probbable UK loan to fund this project now under discussion

(2) No funding presently available

* See page 29

Contract No.	Description	Estimated Cost (Millions)	Status	Funding Source
14	Branch Tunnels to Boulac Spine 9 Tunnels: 10.4 km, 1.2 m diameter	*	D	(1)
15	Branch Tunnels to Main Tunnel 6 Tunnels: 12.4 km, 1.2 to 1.8 m diameter	*	D	(1)
16-19	Gabal El Asfar WWTP Expansion Stages II through V for a total additional capacity of 750,000 CMD	*	(2)	(1)
	Sub-Total: Funded Portions	LE 825		
	Sub-Total: Unfunded Portions	LE 1,200		
EAST BANK (Local Designs)				
-	Berka Wastewater Treatment Plant 600,000 CMD, Secondary Treatment	LE 100	UC	GOE (3)
-	Shoubra El Kheima WWTP 600,000 CMD, Secondary Treatment	LE 100	UC	GOE (3)
-	Lateral Sewers, House Connections Ongoing annual program, as funds permit	(3)	UC	GOE (3)
	Sub-Total	LE 200		

(1) No funding presently available

(2) Modular design available from Stage I. Future Stages could be prepared for tendering relatively quickly.

(3) Being funded from C/GOSD annual capital budgets of LE 60 million/year for all capital projects, under current five year plan.

* Total estimated cost of funded contracts = LE 825 million (Contracts 1-4, 6-12)
Total estimated cost of unfunded contracts: LE 1,200 million (Contracts 5, 13-19)
(Source of Cost Information: AMBRIC, Feb. 1985)

WEST BANK (AMBRIC Design)(1)

Contract No.	Description	Estimated Cost (Millions)	Status	Funding Source
20	Sewers and Collectors - Embaba, Agouza Boulac El Dakrour	$150	PC	AID
21	Culvert-Boulac El Dakrour to Abu Rawash WWTP	$ 80	PC	AID
22	Pump Stations: Embaba, Boulac, South Muheit and Junction at Abu Rawash	$100	PC	AID
23	Giza Relief System	$ 40	PC	AID
24	Collectors - Dokki Area	$ 40	PC	AID
25	Culvert - Pyramids Area to Northwest Culvert	$ 80	PC	AID
26	Pyramids Pump Station	$ 20	PC	AID
27	Collectors - Pyramids Area	$ 60	(2)	AID
28	Lateral Sewers, House Connections-Northwest	$ 75	(2)	AID
29	Lateral Sewers, House Connections - Pyramids	$ 55	(2)	AID
	Sub-Total (AID)	$700		

(1) Contracts in process of being re-packaged; ultimate contracts may not have same numbers or contents.
(2) Under discussion between AID and AMBRIC, Funds available but works not yet designed

Contract No.	Description	Estimated Cost (Millions)	Status	Funding Source
WEST BANK (Other Designs)				
-	Abu Rawash Wastewater Treatment Plant Secondary treatment; 400,000 CMD	LE 130	UD(1)	Japan (2)
-	Lateral Sewers, House Connections Ongoing C/GOSD capital works program	(4)	UC	GOE (3)
	Relief of Local Wastewater Flooding	LE 4	Completed	GOE (1)
	Pilot program for Abu El Saud, Designed by AMBRIC, Constructed by Egyptian public sector contractor.			
	Relief of Local Wastewater Flooding	LE 35	Various:	GOE (4)
	Some 30 to 40 areas being designed and constructed by local firms		some completed some UD	
	Roda Island Collection System Pump Sta. and 2.6 km of 0.4 to 0.7 m dia sewer collectors, designed by AMBRIC	$ 5	UD	AID
	Demonstration Program for Unsewered Areas 18 mos program to try 12 methods for wastewater disposal in unsewered Areas	$ 1.5	(5)	AID

(1) Designs by Japanese Consultant (TEC) to be completed about mid 1986

(2) Japanese funds for foreign exchange under consideration, L.E. funds not allocated

(3) C/GOSD has LE 60 million per year for all of its capital works programs.

(4) From C/GOSD annual capital projects budget of LE 60 million per year.

(5) Program just starting

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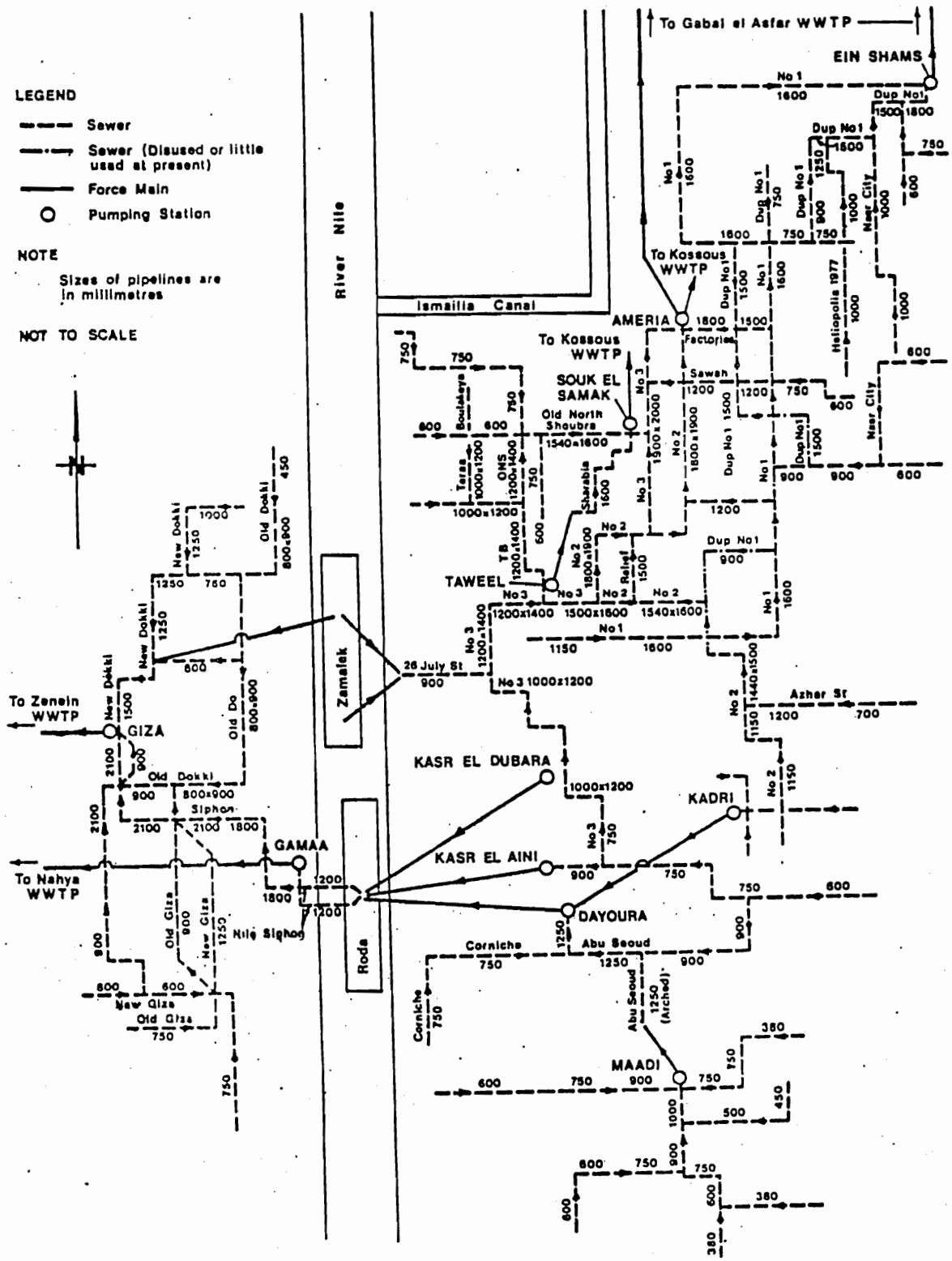
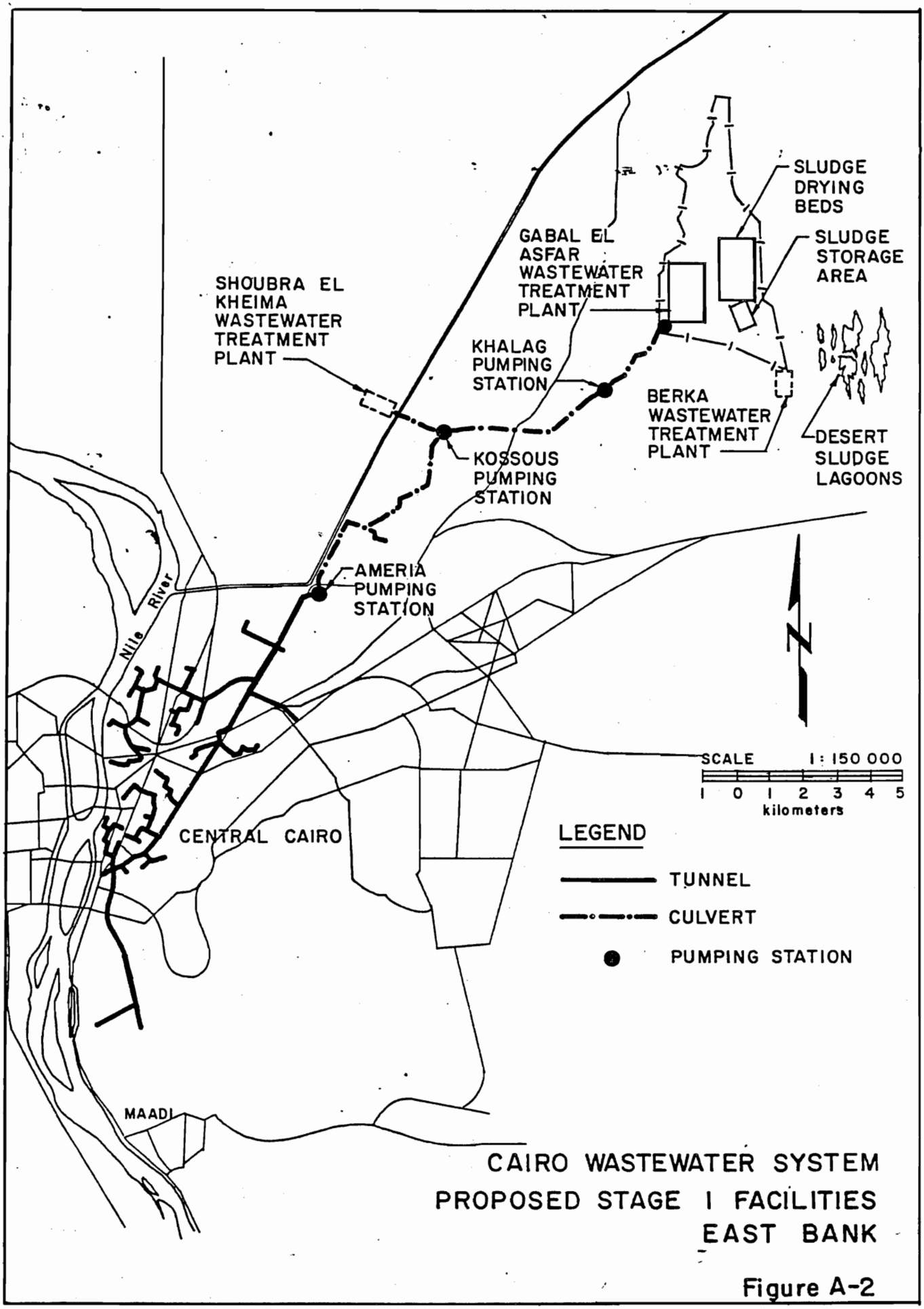


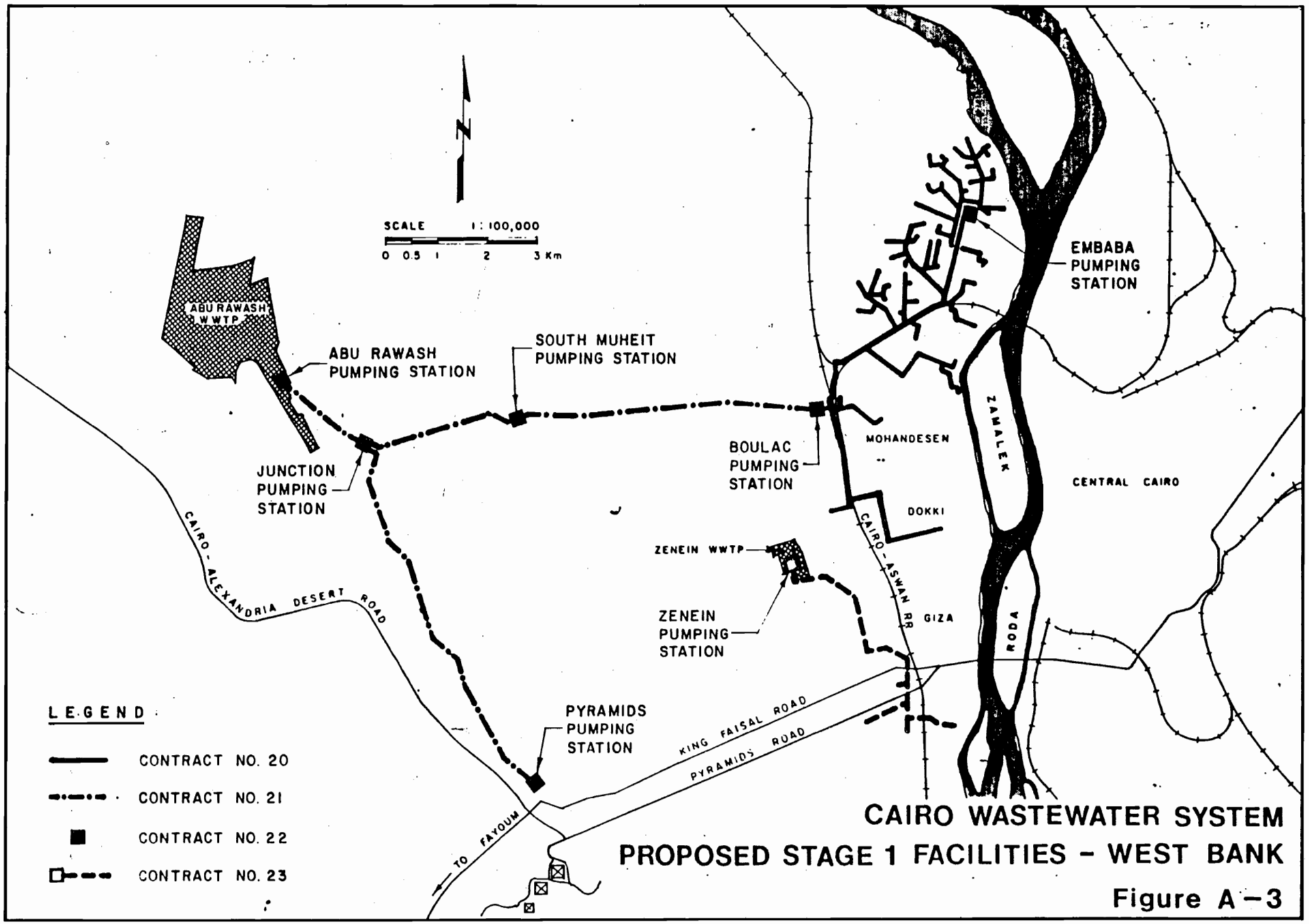
CAIRO WASTEWATER SYSTEM
EXISTING FACILITIES

Figure A – 1



CAIRO WASTEWATER SYSTEM
PROPOSED STAGE I FACILITIES
EAST BANK

Figure A-2



CAIRO WASTEWATER SYSTEM
PROPOSED STAGE 1 FACILITIES - WEST BANK
Figure A-3

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Figure A-4

FEB. 1985

CAIRO WASTEWATER PROJECT
ESTIMATED CONSTRUCTION SCHEDULE – STAGE I

	1984	1985	1986	1987	1988	1989
EAST BANK (UK FUNDS)						
1. Ameria Pump Station – Civil						
2. Ameria Pump Station – M & E						
3. Main Tunnel – Ameria to Souk El Samak						
4. Main Tunnel – Souk El Samak to Abdeen						
5. Boulac Spine Tunnels (Unfunded)						
6. Culvert – Ameria to Urban Boundary						
7. Culvert – Urban Boundary to Kossous						
8. Culvert – Kossous to Gabal El Asfar						
9. Pump Stations at Kossous & Khalag; F.M. to Shoubra El Kheima						
10. Gabal El Asfar WWTP, Stage I; 250,000 CMD; Civil & Sludge Beds						
11. Gabal El Asfar WWTP, Stage I; 250,000 CMD; M&E & Sludge Beds						
12. Main Tunnel – Abdeen to Ein El Siera						
13.-15. Tunnels, Various (Unfunded)						
16.-19. Gabal El Asfar WWTP, Stage II-V; 750,000 CMD (Unfunded)						

Figure A-4

CAIRO WASTEWATER PROJECT
ESTIMATED CONSTRUCTION SCHEDULE – STAGE I

FEB. 1985

	1984	1985	1986.	1987	1988	1989
WEST BANK (AID FUNDS)						
20. Sewers & Collectors: Embaba, Agouza, & Boulac el Da Krour						
21. Culvert : Boulac el DaKrour to Abu Rawash WWTP						
22. Pump Stations : Embaba, Baulac, South Muheit, Jct. at Abu Rawash.						
23. Giza Relief System : Collectors & Pump Station at Zenein WWTP						
24. Collectors in Dokki Area						
25. Culvert : Pyramids Area to Northwest Culvert						
26. Pump Station : Pyramids						
27. Collectors in Pyramids Area						
WEST BANK (JAPANESE FUNDS)						
Abu Rawash Wastewater Treatment Plant; 400,000 CMD						
REHABILITATION (AID FUNDS)						
IFB 007 Subsidiary Pump Stations						
IFB 010 Major Pump Stations						
— Roda Island Collection Works						
— Zenein WWTP Rehabilitation						

Annex B
Project Review: Cairo Water Supply

The responsibility for operating and maintaining Cairo's potable and non-potable water systems rests with the General Organization for Greater Cairo Water Supply (GOGCWS). GOGCWS has also the responsibility of designing and implementing the water supply projects in the area of Greater Cairo. The population of Greater Cairo has grown steadily during the past 16 years going from 4.8 million in 1960 to 8.0 million in 1976. Estimation of the current population range from 10 to 14 million. This growth has created a tremandeous strain on Cairo's water system.

1. Status of Physical Works
a. Existing Facilities

The Cairo water system currently produces about 2.8 million cubic meters of water per day (m^3/day). The current production comes from eight filtration plants using only surface water, four filtration plants with surface water and well fields, and four separate well fields. Ten of the twelve treatment plants are along the Nile while two of the plants are located adjacent to the Ismailia Sweetwater Canal. More than 80 percent of the current production comes from the Nile (surface) while the remainder comes from groundwater (wells).

(1) Filtration Plants. Twelve filtration plants have been built and expanded over the last 80 years. Tebin, South Giza, and Mostorad were constructed in the last fifteen years and Embaba Phase I was put into operation early 1984. Plant production varies from 7,000 m^3/d at Tura to the highs of 300,000 to 450,000 m^3/d at the Tebin, Rod El Farag, North Cairo, and Mostorod plants.

The filtration plants have raw water intakes, raw water pump stations, flocculators-clarifiers, rapid sand filters, chemical buildings, clearwell storage, and finished water pumps for the distribution system.

Throughout the older existing filtration plants, several common problems are evident in each element of the treatment process. Raw water intakes and pump stations, as a result of multiple expansions, are poorly arranged, lack standardization of unit, have little or no standby capacity or emergency power.

The clarification processes generally do not have precisely controlled feed of alum and polymers. Monitoring of feed rates is almost absent. Mixing of coagulants with the raw water is inadequate resulting in substandard flocculation and exit velocities are too high causing floc carry over. Filters have a variety of shortcomings. The entrance velocities are often of a speed and direction that disturbs the bed causing disruptions in the media and increased turbidity of the water above the bed. Lack of effective back wash results in the accummulation of mud over the media and unrelieved clogging.

Clear wells have inadequate capacities and commonly hold less than two hours of storage at average production rates.

Main effluent pumps often suffer from the same problems found in the raw water pump stations. Complicated piping causes large headlosses. Control panels, meters, and pumps have high risks of breakdowns, and standby power equipment is commonly not available or is inadequate to maintain average production. Safety precautions in chlorinators and mechanical areas are virtualy non-existent. Pipeline identification, general housekeeping and storage organization in the older plants need significant improvement.

(2) Well Fields. The GOGCWS operates eight well fields within the service area, of which four are within filtration plants. About 200 wells are being operated in the eight well fields. Total well field production is about 500,000 m^3/d with most wells rated at 5,000 m^3/d. In general, the existing wells and well fields do not meet their rated production capacities. Every well field has a similar set of problems of inadequate design, construction, and maintenance which leads to poor performances and water quality.

Well screens are constructed from galvanized steel which corrodes rapidly and allow sand to accumulate within the wells and escape to the distribution system. Also wells are too closely spaced causing drawdown from one well to increase the depression of water levels in adjacent wells and thus reducing the production capacity of the well fields. Most well fields need a more reliable power supply and back-up diesel generators on site. Each well set or group should have the flow metered and recorded daily. Major modifications of well design and field layouts are necessary to optimize well field output.

Table B-1 presents the average 1984 production from the treatment plants and wells.

TABLE B-1

CAIRO WATER PRODUCTION FACILITIES

Name	Plant	Existing - m^3/d Design Capacity	*Flow
Mostorod	Plant	450,000	560,000
	wells	170,000	75,000
North Cairo (Ameriya)	Plant	400,000	325,000
	Wells	140,000	95,000
Rod El Farg	Plant	325,000	415,000
Roda	Plant	110,000	140,000
El Marg	Wells	40,000	40,000
Shoubra El Kheima	Wells	50,000	90,000
Maadi	Plant	75,000	95,000
	Wells	10,000	5,000
Giza	Plant	120,000	145,000
South Giza	Plant	200,000	225,000
Warrek El Arab	Wells	50,000	50,000
El Ahram	Wells	40,000	30,000
Embaba	Plant	300,000	300,000
	Wells	5,000	5,000
Tebin	Plant	100,000	75,000
Kafr El Elwy	Plant	75,000	85,000
North Helwan	Plant	170,000	120,000
Tura	Plant	7,000	10,000
Fostat	New plant under construction		
	TOTAL	2,837,000	2,885,000

* Average of 1984 production

(3) Transmission and Distribution System. The water produced at the 16 different sites is distributed to seven service areas in several pressure zones. The transmission and distribution system contains 3200 kilometers of pipelines, of which about 50 percent are street distribution mains of 100 to 150 mm diameter pipe. Less than 10 percent of the pipes are 600 mm to 1200 mm diameter mains. Sixty percent of the pipe was installed before 1971 and about 12 percent is more than 40 years old. Within the distribution system, reservoirs have a total of 210,000 m^3/day capacity.

The distribution systems are troubled by many problems. The distribution system from Rod El Farag is operated purposely at pressures below required levels. The lower operating pressures are used to avoid ruptures and major leakage in many older or weakened pipelines. The actual operating pressures often fall to less than one-third of design pressure levels during the summer peak demand periods. Because of this, the reservoirs do not fill and water is not adequately supplied.

Leakage and wastage surveys within the distribution system showed that a large percentage of all water produced is not beneficially consumed. It is either leaked from the distribution system or wasted by users. Surveys of user demand and wastages analyses show that the total wastage is approximately from 40 to 50 percent of production.

b. Cairo Waterworks Improvement Plan

Early in 1979 the Cairo Waterworks master plan was completed. The Master Plan recommended an improvement plant consists of two parts. Part I, immediate phase, covers the period from 1978 through 1982. Part II, staged development program, covers the period 1982 to the year 2000. The major objective of the immediate phase plan was to provide engineering, planning, and financing information for the use of the ministry to meet the projected demand and improve the reliability of the water service to the consumers in the Greater Cairo area without reduction, even temporarily, in the level and quality of service currently offered. In part II, staged development, the objective is to determine the optimum number and capacity of sources to satisfy the projected demand and to define the associated plant concept designs, the primary distribution system capacities and arrangement, and the storage reservoirs capacity and locations.

2. Recommended Immediate Program (Part I)

The recommended improvement consists of additions, modifications and upgrading of the filtration plants, well fields, distribution system and storage facilities.

Filtration Plants:
Improvements have been recommended for the following facilities. Estimated capital costs (1985) prices are also shown.

Plant	Capital Cost (thousands of $ U.S.)
Tebin	2,800
Kafr El Elwy	12,000
North Helwan	3,000
Maadi	4,500
South Giza	9,500
Roda	4,000
Giza	2,800
Rod El Farag (North Part)	6,500
North Cairo (under construction)	8,400
Mostored	4,000
TOTALS	57,000

Well Fields

The part I program recommendations for the well fields includes the enlargement of the field at El Marg and several miscellaneous improvements to the other existing fields. The cost of the improvements is as follows:

Well Fields	Capital Costs (thousands of $ U.S.)
El Marg	11,880
Maadi	160
El Ahram	240
Embaba	100
Warrak El Arab	200
Zeitoun	800
Shoubra El Khima	50
Rod El Farag	120
Cairo North	400
Mostorad	50
TOTALS	14,000

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Distribution System

The distribution system improvements consists of additional pipelines and appurtenances to relieve overloaded mains, constructions to meet the near future anticipated demands, and also replacement of old mains. The total length of the required pipelines are 300 km with a total estimated cost of $50 million.

Storage

To meet the 1982-1985 storage requirements, 365,000 cu m/d of storage is recommended. The estimated cost of the additional storage is $60.0 million.

In addition to the above system improvements, supplemented improvements needed to operate an efficient water works system (operation and maintenances and water conservation) are also recommended.

3. Recommended Staged Development Program (Part II)

The staged development program was planned to cover the period from 1983 (after the completion of part I) through the year 2000. The capital cost of the program (1985) prices is estimated at US $1.35 billion allocated as shown below:

Component	Capital Costs (Thousand of U.S.$)
Treatment plants	540,000
Distribution	610,000
Storage and Booster Stations	175,000
Supplementary Improvements	25,000
TOTAL COST	1,350,000

Description of the Recommended Program
Filtration Plants

The filtration plants to be expanded or constructed are the facilities at Tebin, Embaba, South Giza, Shoubra El Kheima and Boulac El Dakrour. The recommended production capacities for these facilities are shown in Table C-2.

TABLE 2
WATER PRODUCTION CAPACITIES IN
THE RECOMMENDED DEVELOPMENT PROGFRAM
(THOUSANDS OF CU M/D

Facility	Year 1983	1990	2000
Tebin	340	530	930
Embaba	300	600	600
South Giza	200	400	400
Shoubra El Khema	0	564	2664
Boulac El Dakrour	0	0	383

Distribution System

An addition of 605 km of pipelines to the primary distribution system is proposed to be constructed in three stages.

Stage I	(240 km)	1983-1987
Stage II	(240 km)	1988-1992
Stage III	(125 km)	1993-1998

Also major improvements and additions are recommended for the secondary distribution system.

Storage Reservoirs and Booster Pumping Station

A three stage program are also recommended for the additional storage capacity. The additional capacity for each stage is as follows:

		Capacity - m^3/day
Stage I	1983-1987	245,000
Stage II	1988-1992	205,000
Stage III	1993-1998	405,000
	TOTAL	855,000

There are 21 new booster pump stations and two existing booster stations which require major expansion.

4. On-going GOGCWS Improvement Projects

Even before the completion of the master plan Study GOGCWS solicited funds for its improvement projects. One of the early identified projects during the preparation of the Master Plan study was the expansion of the south portion of the Rod El Farag water treatment plant to increase its production capacity from 150,000 to 600,000 cubic meter per day. The project (Cairo Water Supply, $91.4 million) is financed by AID. Construction work of the plant is being performed by Howard-Harbert-Jones, a joint venture of three American construction contractors. Work was begun in January 1983 with a completion date February 24, 1986. Stage I facilities were completed and put in operation in October 1984. The overall project is now 55 percent complete and three months behind schedule. However, the contractor has made plans to intensify his work activities to get back on schedule. In addition to the expansion of Rod El Farag plant, which is the major project activity, the project is also providing six kilometers of ductile iron pipe and necessary valves, US engineering design and construction supervisory services, and the services of management consulting firm to assist GOGCWS in upgrading its services. Also, AID is in the process of reviewing possible financing of the upgrading of the distribution system in the area served by Rod El Farag plant (Cairo Water Supply II, $100.0) to accommodate the expected increased pressures and flow from the new plant.

The Arab Fund Cooperation has provided the foreign exchange (Kuwait Dinar 9.6 million) for the construction of the new Fostat water treatment plant which is currently under construction. The plant will have a capacity of 600,000 m^3/day. It was planned that the plant be completed in 1983, but the anticipated completion date is now December 1988. The project also includes 45 km of 800 to 1400 mm ductile iron pipe.

The Embaba plant which, now almost in operation with a capacity of 300,000 cu.m/day, is financed by the West German Financial Cooperaion (Deutsche Mark 60 million). The project also provides 35 km of 600-1600 mm ductile iron pipe.

The French Fund Cooperation has provided (F.F 65 million) for the expansion of Mostorod water treatment plant from 450,000 to 650,000 m^3/day and (FF 70 million) for Phase I of the Shoubra El Khima water treatment plant (200,000 m^3/d).

A Japanese funded project provides 215 kms of pipe lines, seven storage reservoirs with a total capacity of 120,000 m^3/day and a number of pump stations.

GOGCWS is financing the LE cost of the above projects, the upgrading of the existing water treatment plant and well fields and the reinforcement of the secondary distribution system. The above projects will add to the Cairo water system an additional treatment capacity of 1,750,000 m^3/day, 300 km of pipe lines and additional storage capacity of 130,000 m^3/day. This essentially provides for the recommended Part I program but most of Part II recommendations have not started yet. This is due to the shortage of funds and the current condition of the Cairo sewerage system which cannot cope with the discharges corresponding to the planned increases in water supply.

Annex C

Project Review: Alexandria Wastewater Project

1. Status of Physical Works

a. Existing Facilities

(1) Description of the System. The existing system includes about 150 km of main interceptor sewers, 1500 km of secondary collectors and street sewers, 30 km of force mains and 34 pump stations of varying capacities. There are, in addition, some privately operated pump stations force mains, and sewers. The system also includes the East Treatment Plant (65,000 m^3day capacity) which was placed in operation in 1974 but has not been in operation for the past seven years, and the West Treatment Plant (design capacity 85,000 m^3day) whose construction has been stopped for several years, far short of completion. All collected wastewaters of the area currently are discharged untreated to local water bodies. Major discharges occur into Abu Kir Bay through the Tabia Pump Station, into the Mediterranean Sea through the existing Kait bey outfall, into the Western Harbor through local drains, and into Lake Mariut through a number of sewer outfalls and drains. Wastewater dischares into Lake Mariut are transferred after a short detention time into the Western Harbor through the Mex pump station. There are, in addition, many local points of discharge to the Mediterranean Sea through shoreline overflows and local drains. These 48 separate discharges are primarily wastewater except during wet weather when sewage is partially diluted with storm runoff, since it acts essentially as a combined system which collects both wastewater and surface water from rainfall. The existing sewerage system is divided into three zones; the Central, West, and East. The principal features of the existing system are shown in Figure C -1.

(2) Wastewater Flows and Population Served. The current total population of the Alexandria Governorate is about 3.5 million, including an estimated 470,000 summer inhabitants. Of this total, an estimated 3.0 million live within the sewered area. How many of these people are actually connected to the piped sewerage system is not clear from the master plan but it may be in the order of two thirds of the total.

Total average daily dry-weather flow of wastewater carried by the system during the summer season is estimated at about 500,000 m^3/day. This includes about 40 percent of the total industrial wastes. An estimated additional 300,000 m^3/day of industrial wastes never enters the collection system but is now being discharged directly to drains, canals or other nearby bodies of water.

(3) Conditions in the Existing System. The existing collection system is often overloaded during times of wet weather. Extensive portions of the sewerage system are operated in surcharged condition much of the time even during dry weather. Overflows exist at many locations in the city, discharging either to the sea or to nearby surface drains.

The existing system is plagued by many operational problems. Large quantities of such materials as garbage, trash, mazout residue and other oils, toxic industrial wastes, cow manure and septage from holding tanks, are illegally dumped into the system which results in reduction in flow capacity and ultimate blockage of the sewers, as well as difficult biological treatment conditions, health and fire hazards, and increased pollution loads on the receiving waters.

The lack of any operational treatment facilities results in the discharge of an estimated volume of 800,000 m^3/day raw sewage and untreated industrial wastes to Lake Maryut and the shoreline of the city's Mediterranean beaches. This creates serious health problems, causes extensive pollution of the receiving waters, and results in considerable nuisance and noxious odors throughout Alexandria. Sewage from the Central zone is either pumped to the sea through a badly corroded and leaking outfall at Kait Bey or overlfows directly into the Eastern and Western Harbors. East Zone flows are conveyed by sewer or open drain to either the East Plant bypass or is discharged as raw sewage to the Smouha Drain. Wastewaters from the Eastern area, after passing through several kilometers of open drains, enter Lake Maryut and are subsequently discharged to the Western harbor, with the exception that the wet weather overflows occur at shoreline discharge points along the Mediterranean from Sisila to Montazah. In the West Zone, raw sewage from areas north of the main ridge flows directly into the Western Harbor, while to the South, the sewage drains to lake Maryut via sewers and open channels.

b. Proposed Facilities

(1) Overview of Proposed Facilites. The first modern study of Alexandria's wastewater problems was made by the US firm Camp Dresser & McKee (CDM) with AID financial assistance. The report, dated May 1978, recommended collection improvements and discharge of the collected wastewaters to the sea through two long outfalls (8 and 10 km) after only preliminary treatment.

A subsequent environmental assessment hearing held in the US led to an AID decision that the treatment be upgraded to the level of primary treatment. This in turn led to questions about whether the alternative of reuse of wastewater for irrigation might not now be a more feasible alternative.

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To response to such questions, AID and the GOE agreed to restudy these alternatives. Another consultant group, Wastewater Consultants Group (WWCG) consisting of Metcalf and Eddy, CH_2 M Hill in association with local consultants, conducted this study and concluded in May 1982 that their comparison of the two alternatives was "inconclusive". As a consequence, they proposed a "Phased Implementation Plan" (PIP) which would concentrate on needed collection and treatment works in the first phase, while postponing a decision on the final disposal of Alexandria wastewater until more data could be obtained on both alternatives.

AID approved the PIP with the understanding that the plan consists of the following:

"Phase I: Design and construction of the collector system will continue. Design changes in the East and West treatment plants will be implemented to convert these facilities to primary treatment plants. The effluent from these plants would discharge into lake Maryout. These plants will handle most discharges from the West and East Zones. Central Zone will continue to discharge at Kait Bey.

Phase II: Design and construction of a new 8 km sea outfall will be implemented at Kait Bey and the primary treatment facilities at the West Plant will be expanded. Upon completion, all discharges from Central Zone and West Zone will receive primary treatment at the upgraded West Treatment Plant and be discharged through the new Kait Bey outfall.

Phase III AGOSD has deferred decision on permanent disposal alternatives for discharges from the East Zone. In the interim, these flows will be treated and discharged to lake Maryut. AGOSD will continue to study, design and implement improvements to the quality of the water in Lake Maryiut."[1]

(2) Status of Proposed First Stage Facilities. Table 3 of the PIP listed the components intended for construction in the first stage, which was proposed to be completed by about the end of 1987. The current monthly report of WWCG indicates that while most of the East Zone improvements recommended in the PIP are being implemented, major portions of the Central and West Zone works are not:

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(1) Letter from USAID to AGOSD, 23 Feb. 1982

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PIP Stage 1 Works Not Now Being Implemented

Central Zone

1. Western Harbor and Collector General (Eastern Harbor) relief sewers
2. Western Harbor pump station
3. Rehabilitation of Kait Bey pump station

West Zone

4. Rehabilitation of pump stations 2 and 3
5. Rehabilitation of Industries pump station
6. West Plant influent pump station
7. Lake Mariut improvements

East Zone

8. East Zone pump station
9. Sludge disposal for East and West treatment plants

The first stage works currently proposed for design and construction are listed and described in Table C-1, together with a very rough estimate of their cost, the source of the needed funds, and the status of these works as of February 1985. The major first stage works are shown in Figure C-2 and the estimated construction schedule of these works is shown in Fig. C-3.

(3) Temporary Works. As a temporary measure, the GOE has directed the Petroleum Projects and Investment Company to Construct short, coated steel outfalls at several locations. A 1.5 m diameter pipeline of 750 m length is to replace the existing broken and corroded Kait Bey outfall. Several 750 m extensions of 700 mm dia are also planned for other existing overflows along the beaches, at a rate of about two per year. These works are being designed, constructed and funded by the GOE.

(4) Wastewater Flow and Population Served. The first stage works are proposed to serve the needs of Alexandria by about the year 1990. At that time the population in the sewered area will have increased to 4.1 million. Again, the master plan is not clear how many of these people are expected to be connected to the system by 1990. Total wastewater generated in 1990 from the AGOSD service area is estimated to be 1,120,000 m^3/day, which represents 100 percent of all estimated flows of domestic and industrial wastewaters. Industrial wastes are expected to account for 50 percent of this total.

The present works under construction, or soon to be constructed, are designed to collect and provide primary treatment for the West Zone, the East Zone and the Outer East Zone, which includes

Abu Qir and Maamoura. Total 1990 domestic wastewater from these areas is estimated to be about 420,000 m^3/day. About 350,000 m^3/day of industrial wastes, or almost 65 percent of the total, will also be generated from these areas.

The sewerage system will also pick up about 150,000 m^3/day of domestic sewage in the Central Zone but this will be discharged untreated at Kait Bey. The remaining 35 percent of the industrial wastes, 200,000 m^3/day from the Central Zone, Ameria and Mex Dekheila, will not be treated, and only the 30,000 m^3/day from the central zone will be generaged in the sewered area.

Total wastewater flow of 770,000 m^3/day is expected to be generated by 1990 within the first stage area tributary to the East and West treatment plants, with a combined first stage capacity of 585,000 m^3/day. It is unlikely that the system will collect all of the 770,000 m^3/day generated in these areas. The proposed treatment capacity of 585,000 m^3/day would be adequate fro about 75 percent of this total flow. An additional 350,000 m^3/day of wastewater flow will receive no treatment, most of which will end/up in the Mediterranean.

Of the total estimates 1990 wastewater flow generated in the "inner areas", about 21 percent will come from the West Zone, 22 percent from the Central Zone and 57 percent from the Eastern Zone.

c. Perceived Gaps in Physical Facilities

(1) Changes in Proposed Stage 1 Improvements. The deletion of almost all the Central Zone facilities, and some of those from the West Zone, from the original PIP Phase I program will result in the continuation of problems in those areas from overloaded sewers and the direct discharge of wastewater to the Mediterranean. Since these two Zones account for 43 percent of the estimated 1990 flows, this could be a serious problem, but quantifying it is difficult.

(2) Industrial Waste Considerations. Progress has been very slow in bringing about needed pretreatment of those industrial wastes which are now or are proposed to be discharged into the AGOSD sewerage system. AID is funding a program for the pretreatment of wastewater from 15 industries out of the approximately 112 which have been identified. There is not much indication of cooperation between AGOSD and GOFI (General Organization for Industries) on this problem and it seems doubtful that needed pretreatment works will be constructed for the estimated 350,000 m^3/day of industrial wastes in the first stage collection area by the time the treatment works are proposed for completion in late 1987.

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(3) Excluded Wastes. While not a physical facility, the necessry legal, administrative and technical steps to ensure that harmful wastes (identified as such in the original CDM master plan of 1978) are excluded from the sewerage system have not yet been taken. Until they are, these wastes will continue to contribute to the deterioration of the system and increase the threat to the health of the people of Alexandria.

(4) Problems Related to Interim Treatment. There should be no illusions that the proposal to discharge wastewater to Lake Maryout after primary treatment is anything but a temporary measure. The only rationale for this procedure is (a) that it's an improvement over the present condition in which raw, untreated wastewater is now going to Lake Maryout, and (b) that it buys some time before a method of final disposal is chosen. That time is very limited, however, because studies have shown that Lake Maryout cannot recover from its polluted condition even if secondary treatment is provided.

(5) Sludge Disposal Facilities. Construction of sludge disposal facilities, even on temporary basis, is not now a part of the Stage 1 program. An immediate start should be made to remedy this deficiency before the treatment works are scheduled to come on line by the latter part of 1987.

(6) House Connections. There are substantial areas in Alexandria which are either presently unsewered, or for which piped sewerage is not a feasible solution. Progress is being made in both areas but there is a concern that such efforts do not enjoy the level of priority they deserve.

2. Progress vs. Expectations

a. Background

The Alexandria wastewater project has undergone such significant changes in direction in the past seven years that an assessment of this sort is best made only in broad terms.

b. Expectations

The scope of work for the original master plan, completed in 1978, was established by the GOE without input from AID. The financing of the master plan by AID was offered just before the agreement was signed between the GOE and the consultant.

The essential charge to the consultant was to study the problems of wastewater collection and disposal in Alexandria and present the most technically and economically feasible solution to these problems.

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c. Complications

With AID funding came a requirement to fulfill AID policies and procedures. One of those was the need for an environmental assessment, complete with public hearings in the USA. The result of these hearings was the decision by AID to upgrade, from preliminary to primary, the degree of treatment prior to marine disposal of the wastewater.

This decision reopened the question of the feasibility of land disposal for irrigation as an alternative to marine disposal. AID agreed to restudy the matter. The Review and Update of the master plan, presented in 1981, concluded that while the cost of the two alternatives was about the same on a present worth basis, the initial cost of marine disposal would be LE 4 billion less.

The dispute over ultimate disposal of Alexandria wastewater is unresolved to date, and this situation has resulted in a continued increase in costs, a lack of progress in reducing pollution to Lake Mariut and the Mediterranean, and a serious threat to the health of the people who live and visit Alexandria. The first stage works are already five years behind the schedule of the original 1978 master plan. Moreover, the current first stage works will not provide an adequate solution to the problem of wastewater disposal. Even if a decision were taken now, the solution would not be achieved for another three or four years.

Table C-1 Status of First Stage Alexandria Wastewater Improvements

OUTER EAST ZONE Contract	Project	Estimated Cost (1) (Million LE)	(2) Status	Funding(3) Source
17	Abu Qir/Mamoura Force Main	2	UC	GOE
08A	Abu Qir/Mamoura Collectors	6	UC	AID
08B	Abu Qir/Mamoura Lateral Sewers	7	UC	AID
01	Abu Qir Pump Station	6(4)	CA	AID
01	Mamoura Pump Station	6(4)	CA	AID
East Zone (WWCG Design)				
01	Sidi Bishr Pump Station	6(4)	CA	AID
45	Sidi Bishr Collectors	6	UC	AID
55	Sidi Bishr Conveyance System	?	UC	?
02	Siouf Keblia Tun. Collec. (A&B)	15	PC	AID
09A	Siouf Keblia Hagr/Nawatiya Col.	3	PC	AID
01	Siouf Keblia Pump Station	6(4)	CA	AID
31	Siouf Keblia Canal Crossing,	NA	CC	NA
31	PS 11 FM	NA	NA	NA

(1) Very approximate; intended only as a guide to relative magnitude. Costs rounded to nearest million.

(2) As of Feb. 1985: D = Designed; UD = Under Design; CC = Construction Completed; UC = Under Construction; PC - Designed, Proposed for Construction and Funds Available; CA = Contract Awarded

(3) Funds available unless otherwise noted

(4) All five pump stations in Contract 01 tendered as a single contract. Cost indicated is arbitrarity taken as 20 percent of total contract price.

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East Zone (WWCG Design) (Cont'd)

34	Smouha Comined Collectors	14	UC	AID
01	Smouha Pump Station	6	CA	AID
02	Smouha Drain Tunnel	NA	PC	NA
07A	Smouha Lateral Sewers	NA	UC	AID
08C	Smouha Force Main & Drains	NA	PC	NA
06	Smouha&East Zone Hyd. Drain	NA	PC	NA
07B	Smouha&East Zone Under Cros.	NA	PC	NA
41	East Zone Force Main; PS's 6, 7 & 8 NA	UC	NA	
03	East WWTP Upgrade (410,000 CMD)	25	PC	AID
09B	East Zone Force Main			
22	WWTP Fill and Surcharge	NA	UC	NA

EAST AND CENTRAL ZONES (CDM Design)

-	Ras El Soda Pump Station FM and Collectors (East (TPP)	($12)	UC	AID

CENTRAL ZONE

(None except CDM Design of Ras El Soda PS)

WEST ZONE

02	West Zone Collector Tunnel	9	PC	AID
02	West Zone Nousha Tunnel	NA	PC	NA
03	West WWTP Upgrade (175,000 CMD)	12	PC	AID

MISCELLANEOUS

Contract	Project	Estimated Cost (1) (Million LE)	(2) Status	Funding(3) Source
1	Ras El Soda Lateral Sewers*	3	UC (93%)	AID (TPP)
2&3	Ras El Soda Lateral Sewers	12	UC (40%)	AID (TPP)
4	Ras El Soda Lateral Sewers	8	UC (28%)	AID (TPP)
39	East WWTP Blowers**			

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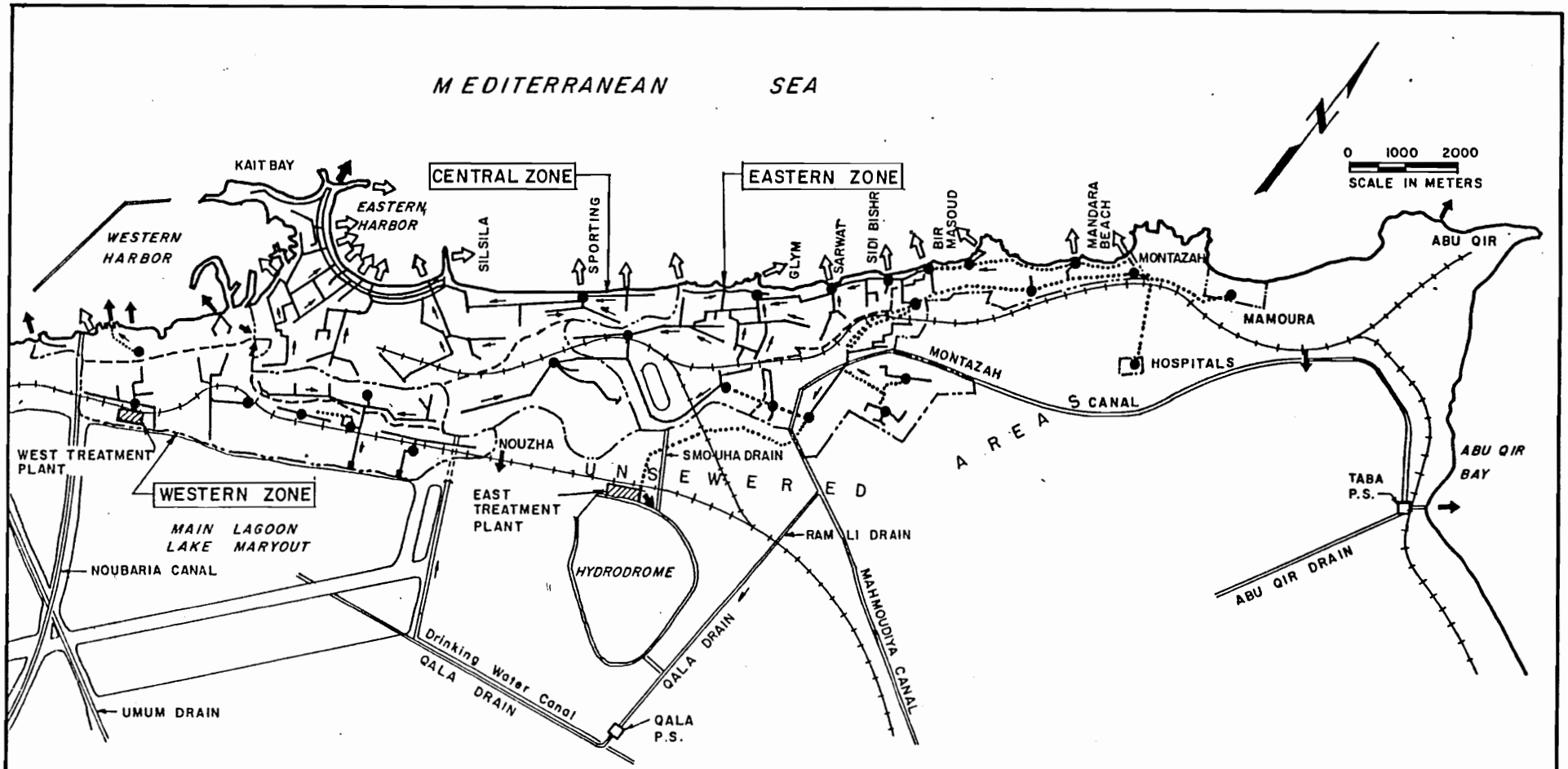
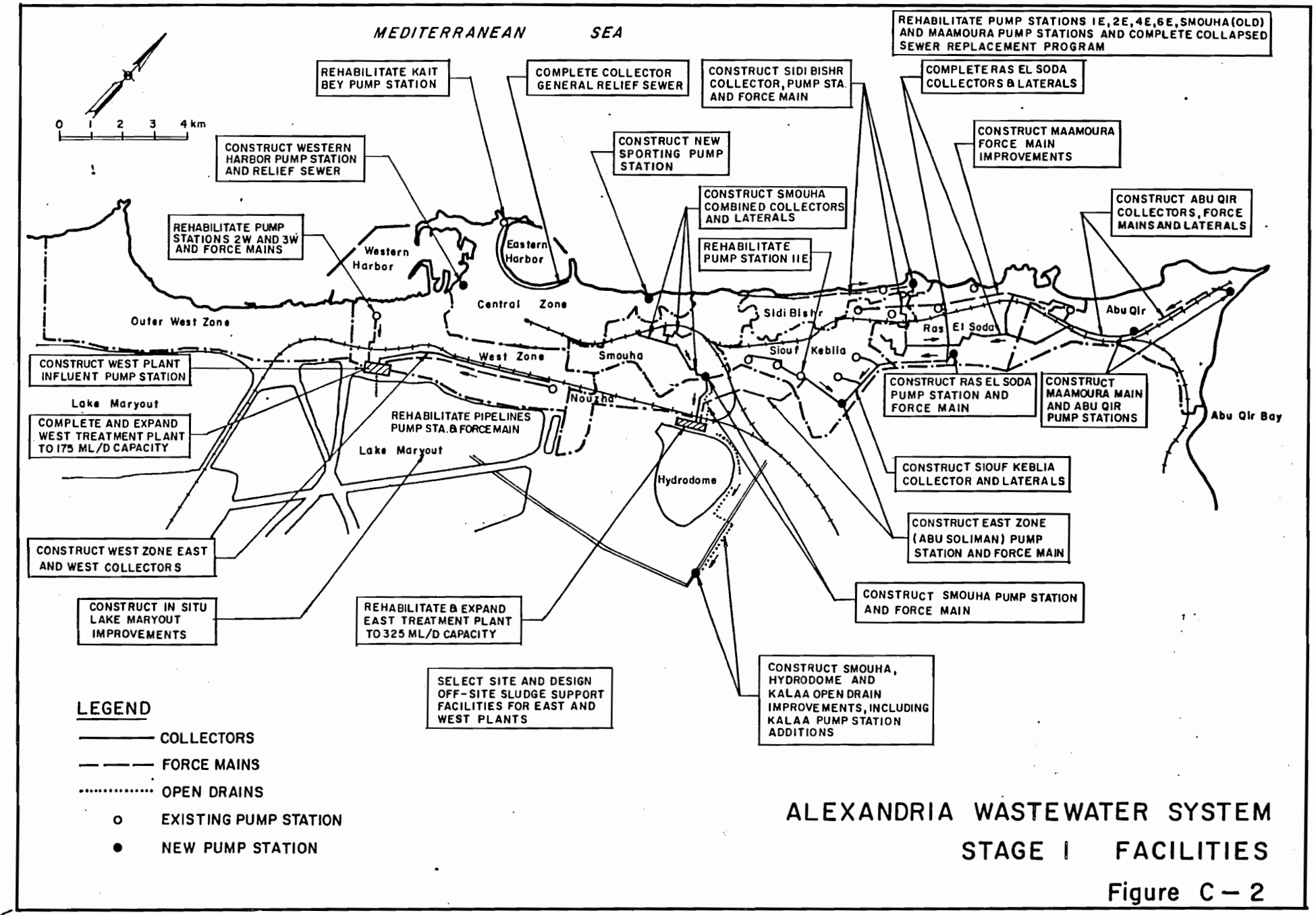
* Designed by CDM; under construction by local contractors, construction supervision by AGOSD

** Designed locally, WWCG monitoring installation.



ALEXANDRIA WASTEWATER SYSTEM
EXISTING FACILITIES

Figure C – 1



ALEXANDRIA WASTEWATER SYSTEM
STAGE I FACILITIES

Figure C – 2

Figure C-3

ALEXANDRIA WASTEWATER PROJECT

ESTIMATED CONSTRUCTION SCHEDULE

FEB. 1985

		1984	1985	1986	1987	1988	1989
OUTER EAST ZONE (WWCG Design)							
17	Abu Qir / Maamoura Force Main						
08A	Abu Qir / Maamoura Collectors						
08B	Abu Qir / Maamoura Lateral Sewers						
01	Abu Qir Pump Station						
01	Maamoura Pump Station						
EAST ZONE (WWCG)							
01	Sidi Bishr Pump Station						
45	Sidi Bishr Collector						
55	Sidi Bishr Conveyance System						
02	Siouf Keblia Tunnel Collectors (A & B)						
09A	Siouf Keblia Nawatiya Collector (C)						
01	Siouf Keblia Pump Station						
31	Siouf Keblia Canal Crossing for PS 11 Force Main	Completed Dec. 1983					
39	Smouha Combined Collectors						
01	Smouha Pump Station						
02	Smouha Drain Tunnel						

Figure C-3
ALEXANDRIA WASTEWATER PROJECT
ESTIMATED CONSTRUCTION SCHEDULE

FEB. 1985

	1984	1985	1986	1987	1988	1989
EAST ZONE (WWCG Design) (cont'd).						
07 A Smouha Lateral Sewers						
08 C Smouha Force Main and Drain						
06 Smouha and East Zone Conveyance & Hydrome Drain						
07 B Smouha and East Zone Undercrossings						
41 East Zone Force Mains for PS's 6, 7 & 8						
03 East Wastewater Treatment Plant Upgrade						
09 B East Zone Force Main						
22 WWTP Fill and Surcharge						
EAST & CENTRAL ZONES (CDM Design)						
East: Ras El Soda Pump Station, Force Main & Collectors						
Central: Sporting Pump Station, Force Main & Collectors						

Figure C-3

ALEXANDRIA WASTEWATER PROJECT
ESTIMATED CONSTRUCTION SCHEDULE

FEB. 1985

	1984	1985	1986	1987	1988	1989
WEST ZONE (WWCG Design)						
02 West Zone Tunnel Collector						
02 West Zone Nouza Tunnel						
03 West Wastewater Treatment Plant Upgrade						
MISCELLANEOUS						
– Ras El Soda Lateral Sewers(I-4) (CDM Design; Local Const.)						
39 East WWTP Blowers (AGOSD Design; WWCG Support)						

Annex D

Project Review: Canal Cities Water and Wastewater Projects

1. Status of Physical Works-Ismailia Wasteworks (See Fig. D-1)

a. Existing Facilities

(1) Source. The Sweetwater Canal conveys water of an acceptable quality from the Nile River to Ismailia.

(2) Treatment Facilities. The following table identifies the existing treatment plants.

Year Completed	Type	Design Capacity (m^3/day)
1948 - 1952 (Two stages)	Semi- Rapid Sand Filtration	25,000
1967	Rapid Sand Filtration	50,000
1980	New Rapid Sand Filtration	80,000

(3) Treated Water Storage. The capacity of underground storage reservoirs located at the treatment plant site is 13,700 m^3.

(4) Distribution System. The Ismailia water distribution system consists of two finished water pump stations located at the WTP, 223 km of water mains and five elevated distribution storage. Two of the tanks are not in operation due to war damage. The two pump stations contain nine pumps each with a rated capacity of 540 m^3/hr, one pump at 450 m^3/hr and three 450 m^3/hr diesel engine-driven pumps. The 223 km of installed mains range from 60 to 600 mm in size. All mains istalled prior to 1974 are unlined cast-iron, while newer pipes installed by SCA are asbestos-cement (400 mm or smaller) or steel (600 mm). Three out of the five elevated tanks are in operation, two of them of 500 m^3 capacity each in Abu Rakham area and the third elevated tank is of SCA Hospital and its capacity is 200 m^3. The total capacity of elevated distribution storage tanks is 1200 m^3.

b. Water Project Under Construction

Contracts I-CP-1 and 2 Water Treatment Plant

- New yard piping and flow metering
- New 144,000 m^3/day finished water pump station
- New 15,000 m^3 finished water storage

- New chlorination building
- New administration and chemical feed building
- Upgrade old rapid sand plant pump station
- Upgrade old rapid sand plant raw water intake
- Upgrade old rapid sand plant filter building

Contracts I-CP-3 - Elevated Storage Tanks

- 96,120 meters of pipe in sizes from 150 to 1200 mm in diameter.

2. Ststus of Physucal Works - Ismailia Wastewater (See Fig D-1)

a. Existing Facilities

(1) Pump Stations and Forcemains. The following table includes information on existing pumping facilities.

No.	Pump Station & WWTP	Discharge To	Force Mains Size(mm)	Force Mains Length (m)
1	Mustafa Kamel	Main P.S. No. 5	350	2,600
2	Matafy	Main P.S. No. 5	350	3,200
3	Port Said	Matafy	200	965
4	Abu Rakham	Mustafa Kamel	200	1,200
5	Main P.S. No. 5	Abu Atwa WWTP	500	2,200
6	Sheikh Zayed	Abu Atwa WWTP	500/450	1,500+5,750
7	Abu Atwa	Abu Atwa WWTP	200	200
8	Abu Atwa WWTP	Lake Timsah	Open Channel	
	Total length of Force Mains			17,615

The pump stations are of the standard circular design of NOPWASD. The stations have a flat bottom wet well with the inlet-sewer entering the wet well through a sluice gate approximately 1.3 m above the floor. The pumps draw wastewater through a 45 degree flared elbow and discharge through a check valve to the station discharge header. Pumping capacity varies from 2,600 m^3/day to 26,000 m^3/day.

(2) Sewers - Ismailia has approximately 72 km of sewers ranging in size from 7 to 24 inches.

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(3) Treatment Facilities - The Ismailia treatment plant is designed to provide a secondary treatment through the high rate trickling filter process. It has a design capacity of 12,000 m^3/day and a peak flow capacity of 18,000 m^3/day. The plant discharges effluent to El Mahsama drain which flows into Lake Timsah. Sludge is dried on drying beds, prior to being sold to local farmers for use as fertilizer.

The plant consists of two grit and screen chambers, four primary settling tanks, four trickling filters, two final settling tanks, a recirculation pump station, and 160 sludge drying beds. The plant now is virtually inoperative due to a lack of maintenance. The influent flow is bypassed around the main treatment units.

b. Ismailia Wastewater Projects Under Construction (See Fig. D-2)

Gravity Sewers

Pipe Size (mm) D.I.P.	Length (m) U Contract	E Contract	Total
54 Inch	3006	-	3006
1200	870	1379	2,249
1000	827	-	827
900	-	1763	1,763
800	582	-	582
300	261	-	261
V.C.P.			
175 thru 300	-	Abu Atwa Area	
175 thru 1000	-	El Hekr Area	

Pump Stations

Station	Type	Contract	Firm Capacity m^3/day	Discharge To
Abu Atwa	New	U	168,000	Abu Atwa STP
Port Said	New	U	62,672	Junction Box
Abu Rakham	New	U	60,545	Junction Box
Matafy	Rehab.	E	23,328	Junction Box
Moustaf Kamel	Rehab.	E	23,328	Junction Box
El Hekr	New	E	15,552	Sewer Manhole

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Force Mains

From	To	Contract	Pipe Size(mm)	Pipe Length(m)
Abu Atwa P.S.	Abu Atwa STP	U	900	1064
Port Said P.S.	Junction Box	U	700	2186
Abu Rakham P.S.	Junction Box	U	700	1292
El Hekr	Sewer MH	E	300	622

c. Planned Facilities

With the completion of the works under construction, the need for effective wastewater treatment and disposal facilities will become exceedingly critical if gross pollution of receiving waters is to be avoided. In addition, several areas are developing more rapidly than expected, and the need for sewerage facilities in these areas will soon become urgent.

The population and sewage flow projections for Ismailia have been updated since completion of the master plan in 1979. The most recent projections are presented below:

Year	Projected Population	Flow (m^3/day) Average	Flow (m^3/day) Peak
1985	217,250	64,481	115,305
1990	317,500	98,459	178,686
1995	434,000	119,758	220,319
2000	550,600	141,056	261,952

Based on the existing conditions it is clear that ongoing rehabilitation work at the Abu Atwa treatment plant (AATP) must be expedited and that efforts be increased to improve operating efficiency of the exisiting units. However, under the most favorable conditions, the AATP will be capable of providing primary treatment to only 24,000 m^3/day. It has therefore been recommended that detailed design work should be initiated at once on the proposed new South Land treatment plant (SLTP). In particular, it is important that the required tracts of land be acquired without delay so that survey work, geotechnical studies, on-site pilot studies and final design can be begun at the earliest possible

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date. Preliminary pilot studies have been conducted by Canal Cities Consultants as recommended. The results of the subsoil infiltration tests were generally favorable. The recommended plan consists of primary treatment followed by rapid infiltration through intermittently charged basins.

Approximately 21 percent of the total flow (24,000 - 115,305 m^3/d) is receive primary treatment through AATP, hence the majority of the flow must be discharged, untreated, to the Mahsama drain.

Policy decisions need to be made regarding jurisdiction over the operation and maintenance of the SLTP. Consultations should be begun soon and should include the Governorate, the Ministry of Agriculture, NOPWASD, and other concerned agencies.

3. Status of Physical Works-Port Said Water Works (See Fig. D-3)
   a. Existing Facilities
   (1) Source. Nile River water is conveyed through the Ismailia and Port Said canals to Port Said.

   (2) Treatment Facilities. The following table includes information on existing treatment plants.

Type Of Plant	Design Capacity (m^3/day)	
CTE rapid sand riltration		80,000
Old bamag rapid sand filtration	35,000	
New bamag rapid sand filtration	70,000	
CTE slow sand filtration		26,000
Total capacity of WTP		211,000

(3) Treated Water Storage. The total underground storage capacity is 17,000 m^3 plus 1,000 m^3 stored in one elevated tank. All facilities located at the El Raswa WTP.

(4) Distribution System. The water distribution system consists of four separate pump stations for both raw water and finished water located at El Raswa WTP, 81 km primary mains, smaller laterals and house services. The four pump stations contain eleven raw water pumps and eleven finished water pumps. These pumps range in

capacity from 400 to 1,080 m^3/hr. All are electric motor driven, 22 to 190 hp, with separate switchgear and starters. The 81 km of primary mains deliver water from El Raswa to Port Said and to Port Fouad across the Suez Canal. The diameter of these mains varies from 200 to 800 mm and the material is cast iron, steel and asbestos-cement pipe.

b. Water Projects under construction (See Fig. D-4)

Contracts P-CP-1 and 2 Water Treatment Plant

- New yard piping and flow metering
- New 192,000 m^3/day finished water pump station
- New chlorination facility (in pump station)
- New chemical building
- New raw water intake facilities
- Upgrade old bamag pump station
- Upgrade CTE Clariflocculators

Contracts P-CP-3 and 4-Water Distribution System
- 17,700 meters of pipe in sizes from 150 to 1070 mm in diameter.

c. Key Issue.

Because of physical constraints related to the Suez Canal and the railroad, the Sweetwater canal cannot be enlarged nor deepended. This situation exists from Qanntara which is located between Ismailia and Port Said - to Port Said. It has been proposed to construct two pipe lines of 1200 mm each with a length of approximately 46 km from Qanntara to Port Said. The pump station would be constructed at Qanntara for pumping the raw water to the El Raswa water treatment plant in Port Said.

By constructing this project the future requirements of Port Said which will be 325,000 m^3/d can be met. The Sweetwater canal now provides only 120,000 m^3/d and any improvements to this canal will not enable it to discharge more than 175,000 m^3/d.

The estimated costs for furnishing SCA with all the materials needed for that project, engineering design and construction supervision will be about $25 million, and the construction costs will be funded by GOE which will be about LE 10 million.

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4. Status of Physical Works Port Said Wastewater (See Fig. D-3)
   a. Existing Facilities.
   (1) Pump Stations and Forcemains. The following table includes information on existing pumping facilities

No	Pump Stations & WWTP	Discharge To	Force Main Size mm	Force Main Length m
1	P.S. No. 1	P.S. No. 3	200	825
2	P.S. No. 2	P.S. No. 8	200/300	510 + 1,250
3	P.S. No. 3	P.S. No. 8	300/300	600 + 600
4	P.S. No. 4	P.S. No. 7	200	650
5	P.S. No. 5	P.S. No. 8	250/300	200 + 1,250
6	P.S. No. 6	P.S. No. 8	200/300	685 + 660
7	P.S. No. 7	P.S. No. 8	250/300	115 + 550
8	P.S. No. 8	Mazrah WWTP	500/600	400 + 2,400
9	P.S. No. 10	P.S. R_2	150	1,200
10	P.S. No. 11	Interior Canal	120/200	200 + 410
11	P.S. No. 12	P.S. No. 8	300/350	465 + 550
12	P.S. R_1	Mazrah WWTP	400	2,600
13	P.S. R_2	Mazrah WWTP	400	1,800
14	P.S. R_3	Mazrah WWTP	350	3,600
15	P.S. R_4	Junction Canal	300	3,600
16	P.S. R_5	Manzala Canal		
17	P.S. R_6	Interior Canal	300	1,800
18	Port Fouad P.S.	Harbor	150	50
19	Mazrah WWTP	Lake Manzala	Open Channel	

Total length of force mains 26,970

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The pump stations No.1 to No. 12 except No. 8 are listed under what is called the "Japanese Project". All stations are of similar design. Each consists of a circular concrete caisson five meters in diameter and approximately four meters deep. A concrete dividing wall, offset from the caisson's centerline, separates the wet and dry wells. The floor levels of the wet and dry wells are the same. The pump station wet well fills regularly with solids, requiring periodic cleaning.

The dry well of each station contains two vertical centrifugal, two-speed pumps, rated at 144 m^3/hr and 250 m^3/hr at the two speeds. The pump suction pipe inverts in the wet well are located about 20 cm off the floor, with the influent sewer invert about 1 m above the floor.

The Main Pump Station No.8 and pump stations R-1 and R-6 have substructures similar to, but larger than the other pump stations. Each of these pump stations has a superstructure which houses above-ground pump motor drives and other equipment. Capacities range from 2,400 m^3/day to 21,600 m^3/day.

(2) Sewers. Gravity sewers are constructed of virtified clay pipe with morter joints, 1.5 $\pm$ m pipe sections length. Installation of sewer pipes less than 450 mm in diameter has included encasement in concrete. Larger pipes are encased only to the center line of the pipe.

Approximately 105 km of sewers ranging in diameter form 150 to 600 mm serve Port Said and Port Fouad.

(3) Treatment Facilities. The Mazrah treatment plant provided treatment for most of Port Said until the 1967 war. Since then raw wastewater has been bypassed the plant and been discharged into Lake Manzalah. About one third of the wastewater in Port Fouad is treated and disposed of through individual on-site system, while the remaining flows are collected and discharged without treatment.

The facilities at Mazrah consist of three liquid treatment systems plus sludge drying beds.

System 1 includes a grit chamber, primary sedimentation basins rated at 17,000 m^3/day, and trickling filters nominally rated at 3,000 m^3/day but actually of less capacity because of clogged media, clogged underdrains, or both.

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System 2 consists of screening and grit removal equipment (2,400 m^3/d), primary clarifiers (14,200 m^3/d), aeration basins and final clarifiers (7,400 m^3/d).

System 3 includes primary sedimentation basins presently rated at 12,000 m^3/d.

Sludge drying beds, of unknown capacity are flooded six months of the year presumably because of poor drainage through sand and/or undrain system. The Mazrah WWTP is currently using system 1 to provide primary treatment for a small portion of the wastewater influent.

b. Wastewater Projects Under Construction (See Fig D-4)

Gravity Sewers

Pipe Size (mm) D.I.P.	Length (m) "U" Contract	"E" Contract	Total
1200	-	359	359
1000	474	243	717
900	455	1262	1,717
800	435	1674	2,109
700	497	-	497
600	953	829	1,782
500	2,371	2,326	4,697
400	110	911	1,021
300	16	175	191

Pump Stations

Station	Type	Contract	Firm Capacity	Discharge To
4 D	New	U	54,000 m^3/day	Mazrah
8 D	New	U	54,000	Mazrah
1 S	New	U	20,218	8/3S
10 S	New	E	59,616	Outfall
11 S	New	E	33,700	Marah/Outfall
R1/6S	Rehab.	E	35,500	Mazrah
R2/5D	Rehab.	E	11,230	Mazrah
8/3S	Rehab.	E	41,000	Mazrah

Force Mains

From	To	Contract	Pipe Size (mm)	Pipe Length (m)
1 S	8/3S	U	400	1,266
R1/6S	Mazrah Chamber	U	400	2,775
R2/5D	Mazrah Chamber	U	400	1,886
4 D	Mazrah Chamber	U	700	3,250
8 D	Mazrah Chamber	U	700	3,795
Mazrah Chamber	Mazrah STP	U	1000	235
			800	312
			600	100
11S	Mazrah Chamber	E	700	1,523
Mazrah Chamber	Outfall	E	1200	121
10 S	Outfall	E	900	1,260

c. Planned Facilities

The communities of Port Said and Port Fouad are to be handled separately, with independent collection, pumping, treatment and disposal facilities. The projected populations and sewage flows from the two communities are presented below:

	Port Said			Port Fouad		
Year	Projected Population	Flow (m^3/d) Average	Flow (m^3/d) Peak	Projected Population	Flow (m^3/d) Average	Flow (m^3/d) Peak
1985	414,333	106,665	247,732	29,500	13,500	34,128
1990	507,889	132,541	303,045	38,000	22,135	55,900
1995	609,945	165,642	377,189	38,000	23,300	58,840
2000	712,000	198,684	451,181	38,000	24,523	61,933

The total firm pumping capacity for the new or rehabilitated pump stations now are under construction will be 230,330 m^3/day, and if the exisiting WWTP has a design capacity of 61,700 m^3/day, only 27 percent of the total flow can be handled by this plant. The remainder must be bypassed around the plant and discharged, untreated, directly to Lake Manzala. The effluent is discharged to Lake Manzala.

5. Status of Physical Works - Suez Waterworks (See Fig. D-5)

a. Existing Facilities

(1) Source. Raw water for most potable, industrial and irrigation for Suez presently is drawn from the Sweetwater canal and the Maghrabi canal which branches from the Sweetwater canal. These canals are a part of the system of canals that branch from the Nile River.

(2) Treatment Facilities. The following table identifies the existing treatment plants.

Type of Plant	Design Capacity (m^3/day)
CTE semi-rapid sand filtration	60,000
CTE slow sand filtration	16,000
Old bamag filtration	55,000
New bamag filtration	108,000
Total capacity of WTP	239,000

The above mentioned plants are located on SCA property located at the present northern edge of the city adjacent to the junction of the Sweetwater and Maghrabi Canals.

(3) Treated Water Storage. The total storage volume inside the WTP is 26,000 m^3, where 21,000 m^3 is available for equalization, fire flow and emergency reserve purposes and the remaining 5,000 m^3 for in-plant uses.

(4) Distribution System. The Suez distribution system consists of four finished water pump stations located at the WTP and 188 km of water mains. The four pump stations contain 17 pumps of which eight are diesel-driven with rated capacities ranging from 450 m^3/hr to 600 m^3/hr at heads of 30 m and 35 m. Three are electrically-driven each with a rated capacity of 450 m^3/hr at a head of 45 m. One electrically-driven pump is temporary. There are five electrically-driven pumps each with a rated capacity of 972 m^3/hr at a head of 50 m. The 188 km of water mains range from 60 to 700 mm of cast iron, asbestos-cement and steel pipe.

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b. Water Project Under Construction

Contracts S-CP-1 and 2 Water Treatment Plant

- New 144,000 m^3/day finished water pump station
- New chlorination building
- New yard piping and flow metering
- Upgrade CTE clariflocculators
- Upgrade maghrabi raw water pump station
- 80,641 meters of pipe 150 mm to 1200 mm in diameter

6. Status of Physical Works - Suez Wastewater (See Fig. D-5)

a. Existing Facilities

(1) Pump Stations and Forcemains. The following table include information on existing pumping facilities.

No.	Pump Stations & WWTP	Discharge To	Force Mains Size mm	Length m
1	Sawahel P.S.	Zarb P. S.	200	1,450
2	Zarb P.S.	WWTP	450	4,450
3	Arbien P.S.	Zarb P.S.	300/300	1,375+3,000
4	Qalzam P.S.	WWTP	400	5,000
5	Selim El Hay P.S.	Qalzam P.S.	200	2,000
6	Faisal P.S.	WWTP	300	1,600
7	Sabah P.S.	WWTP	300	2,300
8	Port Tewfik P.S. (No.8)	Qalzam P.S.	250/300	300+3,500
9	Port Tewfik P.S. (No.9)	Qalzam P.S.	250/300	270+3,500
10	WWTP	Suez Bay	Open Channel	
	Total length of Force Mains			25,245

All of the exisiting pump stations installed for the nine districts, except District No.7 which has a temporary station, are of the standard NOPWASD design. These consist of a circular substructure segmented by a partition wall to provide a wet well and a dry well, each provided with vertical access. The wet well has screens which are manually cleaned, and the dry well is equipped with vertical centrifugal pumps and shafting, a sump pump, and all attendant piping. A superstructure houses the sewage pump motors, the seal water system, ventilating equipment and electrical switchgear.

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Capacity for the pump stations varies from 108 m^3/hr to 504 m^3/hr.

(2) Sewers. The system consist of over 90 km of pipe, ranging in diameter from175 to 450 mm, of vitrified clay with jute and cement mortar joints. Almost 4,000 manholes provide for access to the sewers, and are located at changes in sewer direction, size and gradiant, and also at house leader connections.

(3) Treatment facilities. The existing wastewater treatment facility is located on a 45 hectare site about 3 kilometers west of the present urban area. The facility consists of two primary sedimentation trains. Drying beds were provided for disposal of solids removed in the sedimentation process. Since 1974, plans were implemented to construct two additional primary tank units, one on either side of the exisitng tanks, and to install two 600 mm diameter asbestos-cement gravity lines to convey the primary effluent to Suez Bay. The status now is that the old primary sedimentation tanks are working and one of the new additional primary tanks is under test but irrigation is not formally practiced and the effluent goes to Suez Bay by way of an adjacent surface drainage canal. It should be noted that the primary units are not properly aperated, and that the quality of construction for the new units is extremely poor.

b. Wastewater Projects under construction (See Fig. D-6)

Gravity Sewers Pipe Size (mm) D.I.P.	Length (m) "U" Contract	"E" Contract	Total
1200	261	-	261
1000	544	-	544
800	3384	-	3384
600	366	-	366
500	1366	-	1366
V.C.P.			
175 thru 450	---	Areas I through VIII	
175 thru 450	---	Area X	

Pump Stations

Stations	Type	Contract	Firm Capacity	Discharge To
Zarb P.S.	New	U	37,145 m^3/d	WWTP
Zarier P.S.	New	U	43,200	WWTP
Qalzam P.S	Rehab.	E	20,736	WWTP
Sawahel P.S.	Rehab.	E	16,762	Zarb P.S.
P.S.VIII	New	E	12,960	Sewer MH
P.S. X	New	E	25,920	Sewer MH

Force Mains

From	To	Contract	Pipe Size (mm)	Pipe Length (m)
Zarier P.S.	WWTP	U	800	2376
P.S. VIII	Sewer MH	E	200	355
P.S. X	Sewer MH	E	1370	300

c. Planned Facilities

The latest projections for population and sewage flow for Suez are as follows:

Year	Projected Population	Flow (m^3/day) Average	Flow (m^3/day) Peak
1985	473,000	179,405	333,772
1990	692,000	264,200	477,568
1995	841,000	315,515	559,109
2000	990,000	369,385	643,276

Based on existing conditions only about 70 percent of the average daily flows will be discharged to the treatment plant. The remainder will be discharged untreated to the receiving waters. The treatment capacity of the WWTP is 48,000 m^3/day if all three treatment trains could be placed into operation. Upon completion of Phase 1 projects this facility would be able to treat only about 38 percent of the flow pumped to it. The remainder, or almost 79,000 m^3/day on the average would be discharged untreated to the surface

drain which empties into Suez Bay. It is vital therefore, that adequate treatment facilities are provided. It has been recommended that two new treatment facilities be constructed, the Southerly treatment plant and the Northly treatment plant. The Southerly Plant would serve the exisiting developed and developing areas and would receive higher priority. The treated effluent will be discharged through a marine outfall to Suez Bay. The Northerly plant would serve the areas developing in the future to the north of the city. The treated effluent of this plant will be discharged either to the Suez Canal or to a land irrigation site.

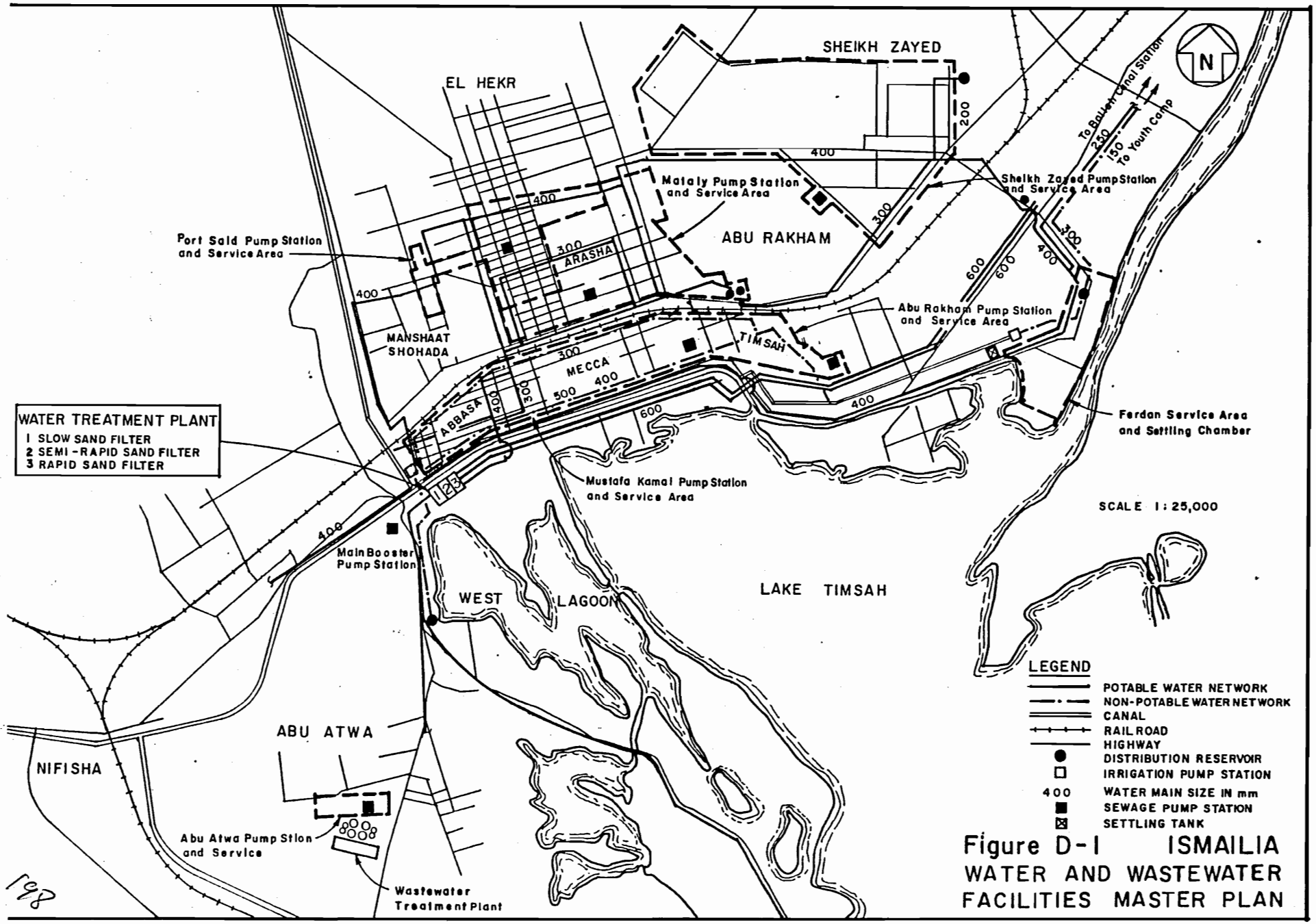

Figure D-1 ISMAILIA WATER AND WASTEWATER FACILITIES MASTER PLAN

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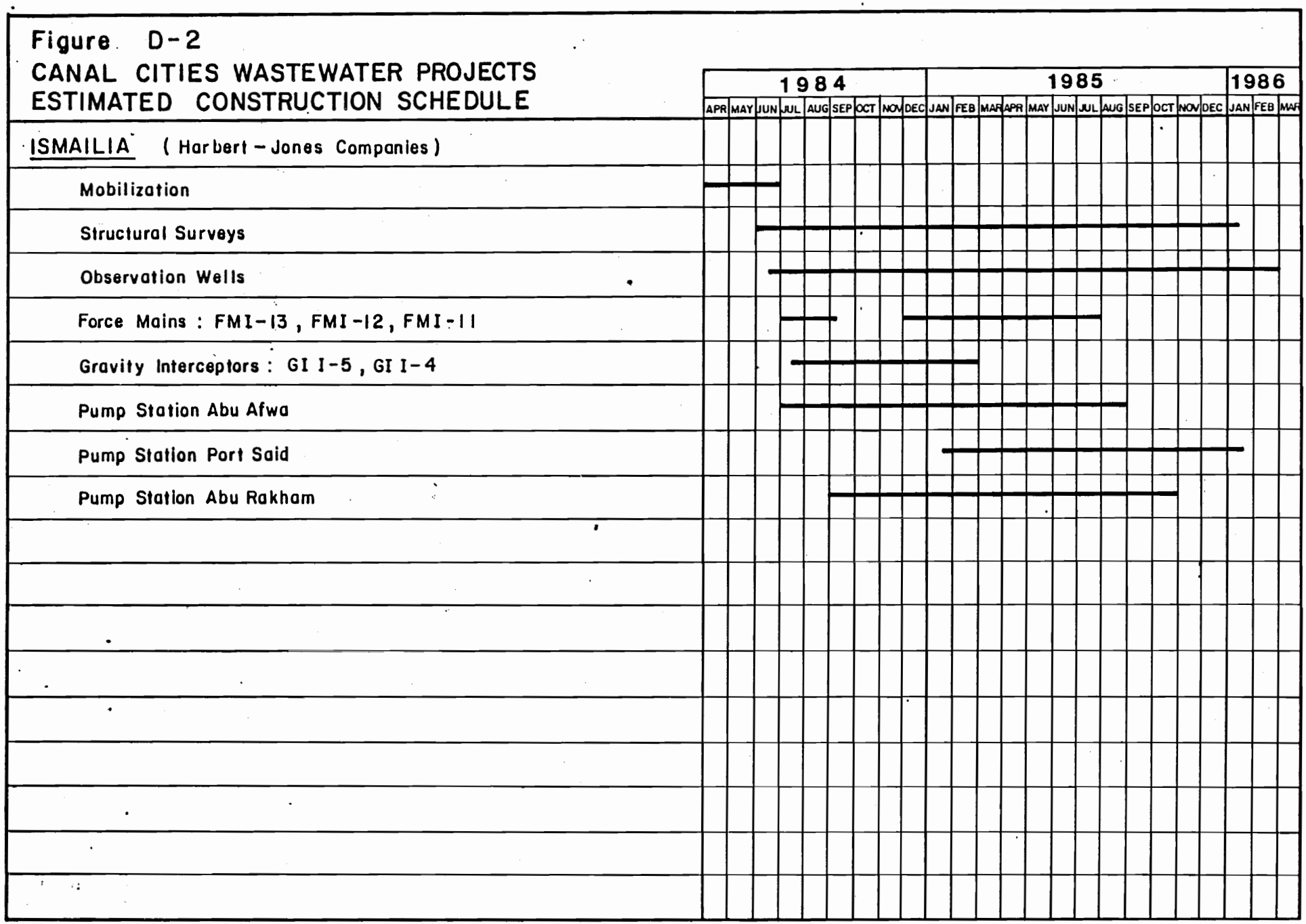
Figure D-2

CANAL CITIES WASTEWATER PROJECTS
ESTIMATED CONSTRUCTION SCHEDULE



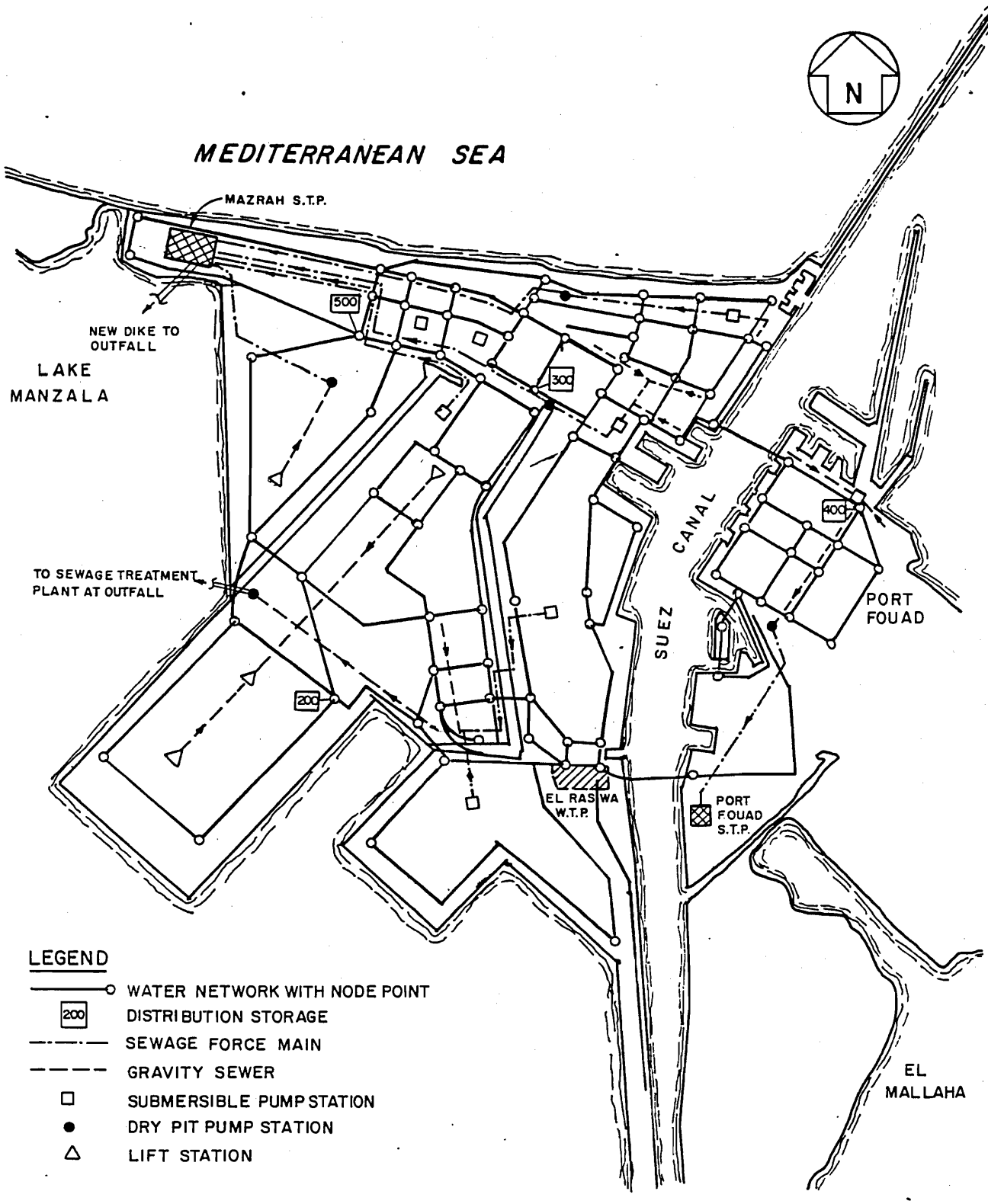
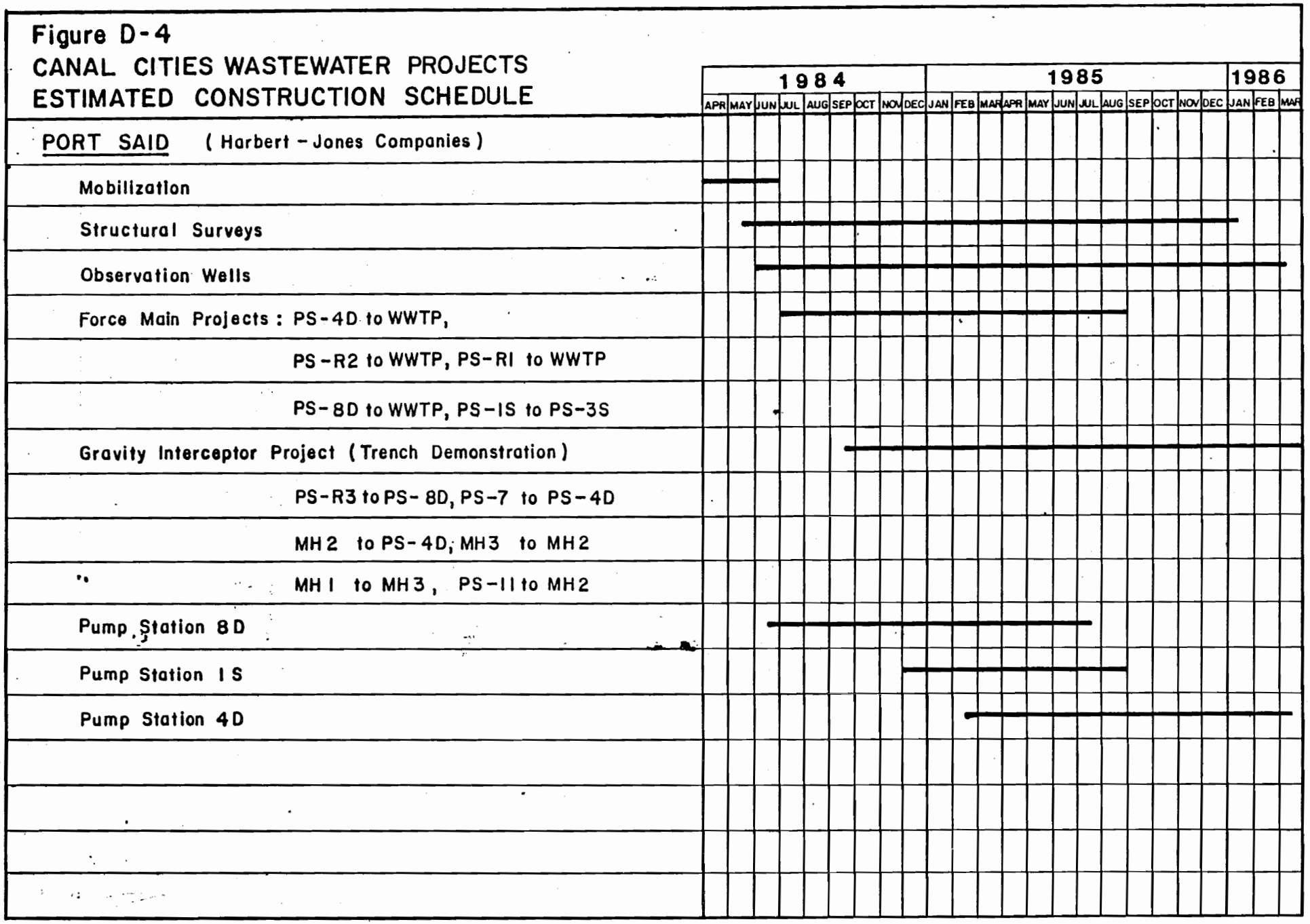


Figure D-3 PORT SAID WATER AND WASTEWATER FACILITIES MASTER PLAN

Figure D-4
CANAL CITIES WASTEWATER PROJECTS
ESTIMATED CONSTRUCTION SCHEDULE



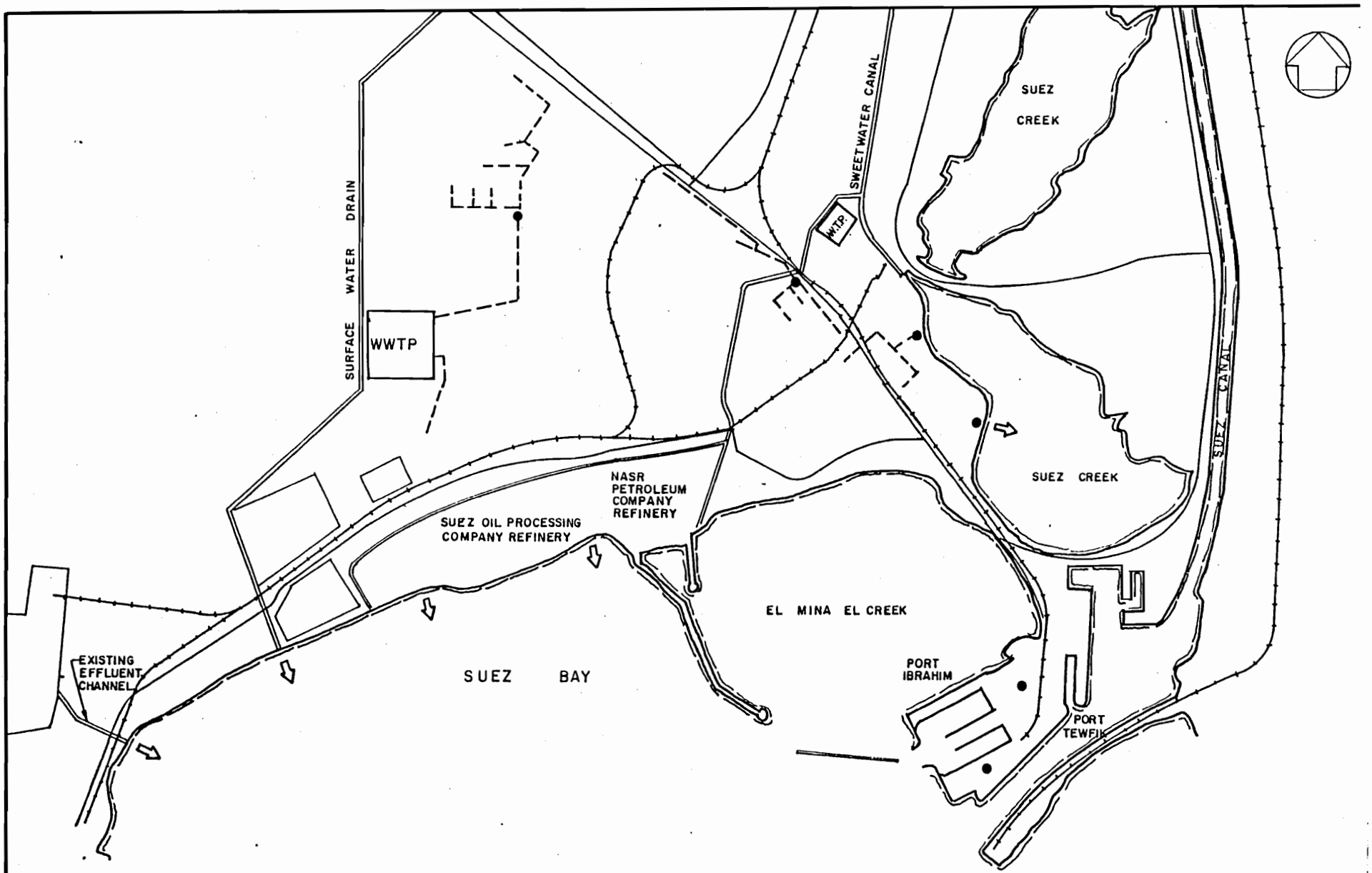
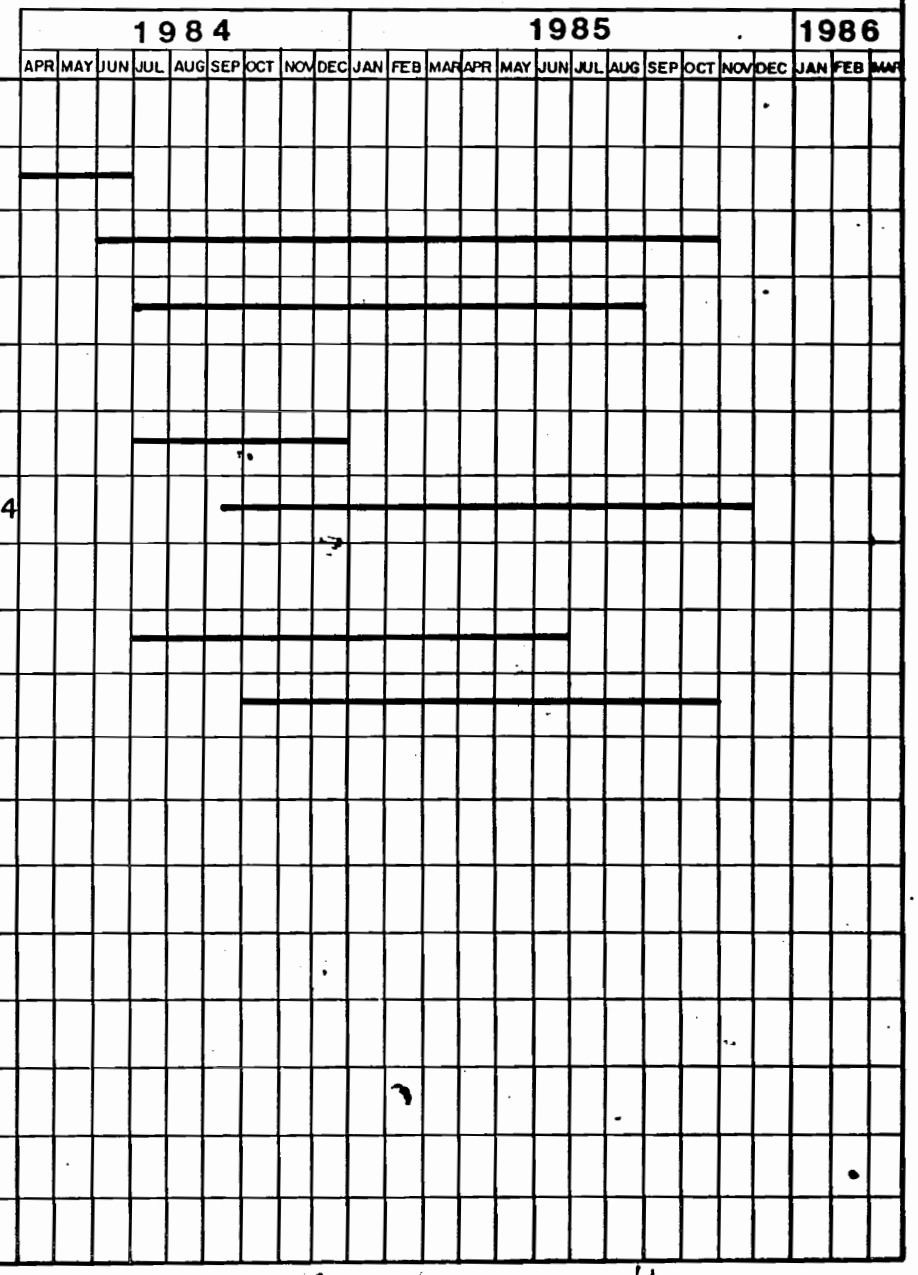


Figure D-5 SUEZ
WATER AND WASTEWATER
FACILITIES MASTER PLAN

Figure D-6

CANAL CITIES WASTEWATER PROJECTS
ESTIMATED CONSTRUCTION SCHEDULE



SUEZ (Harbert - Jones Companies)

Mobilization

Structural Surveys

Observation Wells

Force Main FM S-19

Gravity Interceptors : GI S-11, GI S-15, GI S-13, GI S-12, GI S-14

Pump Station Zarier

Pump Station Zarb