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GAZA WASTEWATER PROJECT
PHASE 1 FINAL REPORT

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List of Acronyms

A&E	Architectural and Engineering
ANERA	American Near East Refugee Aid
BZU	Berzeit University
CFED	Center for Financial Engineering and Development
C/M	Corrective Maintenance
CMMS	Computerized Maintenance Management System
CIDA	Canadian International Development Agency
CIVAD	Israeli Civil Administration
CP	Community Participation
DANIDA	Danish International Development Agency
EHP	USAID's Environmental Health Project
EU	European Union
FIPD	Foundation International for Planning and Development
GWWP	Gaza Wastewater Project
Km	Kilometers
LACC	Local Aid Coordination Committee
LOP	Life-of-Project
MOPIC	Ministry of Planning and International Cooperation
NGO	Non-governmental organization
ODA	Overseas Development Agency (British)
OJT	On-the-Job Training (program)
O&M	Operation and Maintenance
PA	Palestinian Authority
PA	Public Awareness
PEA	Palestinian Energy Authority
PECDAR	Palestinian Economic Council for Development and Reconstruction
PPDI	Project Planning, Design, and Implementation Department of the SHEP
P/M	Preventive Maintenance
PS	Pumping Station
PVO	Private Voluntary Organization
PWA	Palestinian Water Authority
QA/QC	Quality assurance/quality control
SHEP	UNRWA's Special Environmental Health Programme
SIDA	Swedish International Development Agency
SCF	Save the Children (a US PVO)
SOP	Standard Operating Procedure
SWG	Sector working Group (of the LACC)

TA	Technical Assistance
TOR	Terms of Reference
UN	United Nations
UNDP	United Nations Development Program
UNRWA	United Nations Relief and Works Agency for Palestine Refugees in the Near East
UNSCO	United Nations Special Coordinator in the Occupied Territories
USAID	United States Agency for International Development
USG	United States Government
WB	World Bank
WWCG	Water and Wastewater Company of Gaza

EXECUTIVE SUMMARY

This report provides an overview and detailed description of the USAID funded, UNRWA managed Phase 1, Gaza Wastewater Project. Project background, development, purpose and scope are discussed. A description of project activities and the project accomplishments are presented in some detail.

When this project began in July 1995 it was common for sewage to flow in the streets of Gaza in the summer, as well as during winter rain storms, due to overflows from surcharged manholes. Storm water drains were clogged and during heavy rains storm water filled some streets with rivers of runoff several feet deep. Because both sanitary sewers and stormwater sewers were full of "sludge and sand" essentially Gaza had no operational drainage collection systems. Further, the sewage and stormwaters accumulated in pools and in two low lying areas with no out lets to the sea. In 16 months of frenetic activities, the Municipality of Gaza now has its systems back on line thanks to UNRWA and USAID. Phase 1 of the Gaza Wastewater Project accomplished the following feats:

1. Put back into operation, through rehabilitation, the storm water pump station at Sheikh Radwan Reservoir.

2. Restored the inlet works at the Sheikh Radwan pump station, stabilized the inlet pipe works from slope erosion, modified the inlet pipes to enhance operational flexibility and constructed an access platform to allow cleaning of the inlet screens and adjustments to the inlet flap-gates.

3. Cleaned the storm water inlet sand traps of 4,500 m^3 of sludge and modified the inlet pipes to allow dry weather sewage flows to be diverted to the sanitary sewer system.

4. Excavated deposited sand and sludge at Sheikh Radwan Reservoir to clear the inlet pipes to the pumping station and to enlarge the interim storage capacity of the reservoir.

5. Provided permanent electrical power to the stormwater pump station and sewage pump station at Sheikh Radwan Reservoir.

6. Excavated over 30,000 m^3 of sludge, sand, and debris from Waqf Land/Asqoula Pond to provide temporary storage for relief from storm water flooding.

7. Constructed security fencing at Sheikh Radwan Reservoir and Waqf Pond to prevent public access to the reservoirs when flooded.

8. Installed twin 6" force mains to allow pumping of over filled Waqf Pond to the storm water culvert during severe flooding events.

9. Cleaned 3.7 km of storm drains to restore the drainage capacity of the City's major storm drain facilities.

10. Cleaned and inspected over 37 km of sanitary sewers and 1,601 manholes and restored flow capacity to some sewers that were 100% clogged prior to cleaning.

11. Constructed the replacement of about 1,820 m of the highest priority, most damaged sanitary sewers.

12. Prepared an assessment report and a rehabilitation plan for the 37 km of sanitary sewers and 1,600 manholes that were cleaned and inspected.

13. Procured about $2.8 million of vehicles, equipment, tools, safety gear, sewer inspection apparatus, sewer cleaning machines and computer hardware and software to provide the City with a capability to begin to initiate their own wastewater operation and maintenance programs.

14. Provided nine guidance documents and standard operating procedures for management of contracts and for services and training related to sewer cleaning and inspection, safety, sludge handling, record keeping, quality assurance, manhole cleaning and manhole inspection.

15. Provided training to the Municipal staff in sewer cleaning and inspection procedures, pipeline detection, safety, pump station O&M and sewer construction procedures.

16. Provided a number of planning documents to be used as a framework for subsequent phases of the GWWP; for pump station O&M; for sludge handling and disposal; for water quality monitoring and for commodity procurement for sewer system O&M program development.

17. Provided miscellaneous consulting services to the City for wastewater reuse, pump station O&M, and employee and public safety.

However, left unaddressed are a number of factors which will have a continuing negative influence on the public health and quality of life in Gaza, due to waste water generation, if significant, effective steps are not taken to improve the situation. Some of the most urgent moves that need to be made are as follows:

1. The Municipality of Gaza should establish a dedicated staff organization, with the necessary depth, training and equipment, to operate and maintain the current physical system of storm and sanitary sewers.

2. Donor agencies should assist the Municipality in setting up the organizational structure, job descriptions, training, policies and data management procedures to accomplish number 1 above.

3. Rehabilitation of sanitary pump stations must be accomplished immediately. Also, all existing pump stations should be "put on line" as soon as possible to eliminate all of the separate discharges to the sea within the City limits of Gaza.

4. The non-functional sewage treatment facility near Wadi Gaza should be expanded to handle current potential maximum inflow demands, and upgraded to effectively treat the wastewater prior to discharge or reuse, and last, but not least,

5. Donor agencies participating in support of the various wastewater projects within the Municipality should develop a high-level technical coordination group to review current project coordination, to recommend project coordination where little exists, and assist the Municipality to see that available resources and funding are utilized more effectively.

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1.0 PROJECT BACKGROUND AND DEVELOPMENT

The United States Agency for International Development (USAID) grant to the United Nations Relief and Works Agency for Palestine Refugees in the Near East (UNRWA) for Phase I of the Gaza Wastewater Project (GWWP) took place during a dynamic period in the history of the Palestinian people. Following the signing of the Declaration of Principles in October 1993 and the emergence of the Palestinian Authority as an agency of government in Gaza, both public sector and private sector activity has grown exponentially. Private sector financing has expanded business opportunities and generated a housing and office construction boom. Public sector development, supported in large part by donor assistance affirming the peace process, has resulted in a rapidly emerging government which is beginning to be able to articulate the needs of a population soon to be released from over twenty eight years of occupation. These changes have resulted in a dynamic and fluid planning and development environment as a myriad of donors seek to provide assistance to the Palestinian people while the emerging Palestinian Authority is still organizing and being given substance. It is within this context that the Gaza Wastewater Project was implemented.

1.1 Historical Context

Prior to the 1948 war, Gaza City was a relatively minor trading center with limited infrastructure, few paved roads and a population of 75,000. Poorly equipped to accommodate the mass influx of refugees from the 1948 war, urbanization brought dense housing, compacted streets and massive drainage problems to the city. The 1967 War brought Israeli occupation and control of public sector infrastructure by the Israeli Civil Administration (CIVAD). During this period, all infrastructure planning was completed by Israelis and Israeli consulting firms without the full participation of resident Palestinians. Both wastewater and stormwater master plans were developed during this period. The Gaza City Wastewater Master Plan was developed by Tahal Consultants in 1972; the Drainage Master Plan by H.G. International Engineering in 1979. Portions of the currently existing wastewater and stormwater infrastructure were completed in accordance with these plans. Since these plans were developed and some plan elements constructed, population growth and the resulting residential and commercial development within Gaza City has outstripped their usefulness as working documents. Today, with an estimated population of more than 250,000, Gaza City's wastewater and stormwater systems have become overloaded. The wastewater treatment plant is not functional, surface runoff accumulates throughout the City in pools; structural foundations, roadbeds and road surfaces are being damaged; traffic flows and commerce are constantly disrupted; health hazards are pervasive; and large parts of the city cannot be readily developed.

The refugee influx has increased water demand from the area's two underground aquifers for agricultural use and potable water. At the same time, groundwater pumping in Israel, largely for agricultural use, has exacerbated aquifer depletion. Even though authorities have restricted new well development and fresh water use, over-pumping of groundwater has severely damaged the aquifers of the Gaza Strip and caused acute shortages of potable water. As early as 1987, the water table was dropping 5 to 10 inches (12 to 25 cm) annually and there was over a mile of inland salt water encroachment into what had once been a sweet water aquifer.

In addition, intrusion of brackish water from the east has adversely impacted water quality. The dropping water table has exacerbated groundwater pollution problems; rainwater percolation is now unable to adequately dilute the aquifer's increasingly concentrated levels of pollutants which derive from saltwater intrusion, untreated sewage disposal, commercial and industrial wastes, solid waste leachates, street runoff and irrigated agriculture's use of pesticides and fertilizers.

Today, a wide range of private and public development activities are being initiated as a direct result of the Peace Process. Public sector activities include establishment of the Palestinian Authority, urban master planning, urban infrastructure planning, environmental profile development, roads and power development, and housing construction, as well as a range of water and wastewater design and construction projects. Private sector investment has resulted in a significant increase in business activity.

1.2 Geographical Context.

The city of Gaza covers an area which is part of the foreshore plain bordering the Hebron Mountains in the Northeast, the Negev desert to the southeast and the Northern Sinai to the south. The exposure of ridges parallel to the coastline creates a large scale undulating landscape rising gradually to the east. Within Gaza City there are four such ridges. This topography creates a near coast zone that drains naturally to the sea and a series of interior catchments and sub-catchments that drain to low lying areas inland from the first ridge.

The original Municipality of Gaza Drainage Master Plan (H.G. International Engineering, 1979), divided Gaza City into six catchment areas, five of which drain into the sea. The sixth--Catchment A--covers the interior areas that do not drain naturally to the sea (see maps in Appendix A). Over half of the eastern portion of the city and lies in this topographical depression. Catchment A is in turn divided into two sub-catchments - A1 and A2. Area A1 is located in the northeastern part of the city . Much of this area drains naturally to the Sheikh Radwan depression. Area A2, which lies to the south of A1 in the southeastern quadrant of the city, drains to several low points within its bounds.

The original Wastewater Master Plan (Tahal, Consultants, 1972) divided the city into nine sanitary districts, each to be served by gravity sewers meeting at a central collection point and then pumped by force mains to the wastewater treatment plant. Sanitary Districts 5, 6, 7, 8 and 9 lie partly or wholly within drainage catchments A1 and A2. To date, the only pump stations which exist in Catchment A are in Sanitary Districts 6 and 7 and at Sheikh Radwan Reservoir (this pump station was not a part of the original plan). Significant areas in both A1 and A2 remain unsewered.

These two master plans formed the basis for current geographically descriptive terminology related to sewerage and drainage. Catchment A and its two major sub-catchments (A1 and A2) continue define the interior catchments of Gaza City.

Numbered pump stations continue to correspond to the numbered sanitary districts. However, significant population growth, changes in land use over the past twenty years, and a more regional planning perspective of the Ministry of Planning and International Cooperation (MOPIC) now require a careful re-examination and updating of these plans.

1.3 Project History and Problem Definition

In 1977, the Mayor of Gaza City began development of a Gaza Municipal storm drain project intended to harvest stormwater, largely from area A1 and recharge underground aquifers for municipal use. The 1979 Stormwater Drainage Master Plan expanded the initial concept of stormwater harvesting by including a catchment reservoir that would collect runoff, provide a surface water source for irrigation in the summer and provide a means of recharging groundwater during the winter. Pumping of excess flood waters from the reservoir to the sea was anticipated, even in drought-prone years. This Gaza Municipal storm drain project was financed in part by Saudi Arabia and Abu Dhabi. USAID contributed $2.3 million and helped Gaza City implement the project through American Near East Refugee Aid (ANERA), a US private voluntary organization (PVO). The Gaza City storm drain system, including the Sheikh Radwan Reservoir, now drains stormwater that would otherwise flood a large part of the city. Over the years, however, the storm drain system has been gradually converted into a *de facto* sewage collection and storage pond system for sewage overflows. This problem has been caused by an inability to resolve the problem of sewage entry into the storm drain system, both as a result of illicit sewer connections to the storm drain system and the limitations of the wastewater system which cause overflowing of sewage into the storm drain system. Additionally, no provision was made originally for pumping excess water to the sea. Pumps, along with a force main were installed in 1993 to allow emptying the reservoir but, by 1995, were inoperable due to sand entering the system. The aquifer recharge system was never implemented. Still today a large body of polluted water accumulates periodically in the heavily urbanized area.

In 1993, USAID retained the Center for Financial Engineering and Development (CFED) to carry out a diagnosis and recommend a strategy for resolving the stormwater drainage problem. The CFED study, *"Assessment of the Gaza Stormdrain Project"* concluded that "AID should take a proactive leadership role in guiding the stormdrain project to completion, but should not fund further new sewer construction until the sewerage system is operating at a level that ensures sewage no longer enters the stormdrain network." For USAID, the CFED study was a catalyst. The Israeli Civil Administration (CIVAD) provided $50,000 in funding to the City to survey the status of the stormwater system. USAID provided assistance to help the city assure quality control of the contractors performing sewage system inspection and lab tests. This work resulted in a *Preliminary Engineering Study of Sewerage Problems Impacting on the Storm Drainage Project* (Foundation International for Planning and Development: 1995) which concluded that to address the issues related to the storm drainage system and Sheikh Radwan Reservoir, a whole range of actions were required for repair and upgrading both the stormwater and wastewater systems in areas A1 and A2.

In early 1995, based on the survey results, an action plan including cost estimates for immediate and short-term needs was developed. USAID approached UNRWA as the only local organization with the technical and management capacity and experience to

implement the project as envisioned. During discussions with UNRWA, USAID agreed to expand the original scope of the project to include planning and feasibility studies and design/construction elements to expand stormwater and sewerage in Areas A1 and A2. UNRWA also emphasized that international consultants would be required to assist in supporting UNRWA implementation and to contribute to feasibility and design elements prior to construction.

This was considered necessary so that UNRWA would continue to have the resources to implement its own priority programs. In late February 1995, a proposal and broader but more detailed engineering action plan was produced by UNRWA addressing planning and mid-term operation and maintenance (O & M) and construction, in addition to immediate and short-term construction needs in areas A1 and A2.

Together, these documents served as a framework to guide USAID and provided the overall basis for the Grant Agreement signed with UNRWA. However, the need for rapid finalization and signature of the Grant Agreement precluded detailed project planning. In addition, there was no project paper mutually agreed upon by all parties. By mutual understanding, technical refinements would be made while developing Project work plans. Specific concerns included provision of short term technical support for the Project, implementation of a Project component related to operation and maintenance support, the use of consultants for the planning studies and engineering design component, and details related to UNRWA and USAID contracting and procurement regulations.

In December 1995, USAID and UNRWA decided that the Grant Agreement could not be effectively carried out under the arrangements specified in the Agreement. This decision was based in part on USAID's perception that the Project was not progressing quickly enough following delays in mobilization of short-term technical support, conflicting perceptions on the part of Gaza Municipality as to how the project should be structured and implemented, changes in Palestinian institutional structure, and recent actions taken by MOPIC to plan wastewater and drainage within a regional context. By mutual agreement, the USAID's grant to UNRWA was modified. A range of activities broadly described as Project Phase I included emergency actions undertaken to temporarily relieve the most serious wastewater and drainage problems, cleaning and rehabilitating existing sewers and storm drains, and procuring commodities would be completed by UNRWA. All other project Phases would be managed directly by USAID. All further references to the Gaza Wastewater Project (GWWP) address only the UNRWA Phase 1 component and not the USAID managed components, unless otherwise noted.

An important event that took place in 1995, which impacted the originally planned Project and led to the decision to modify the Grant Agreement, was the completion of planning documents to guide development of water, wastewater, and drainage programs and projects under the newly formed MOPIC. This *Emergency Structural Plan for Gaza City: Assessment of Water Sewage and Solid Waste*, completed with bi-lateral technical and financial support, identified seven Municipal wastewater and five stormwater issues that needed to be addressed in the near term. These were:

- Wastewater treatment and wastewater reuse,

- Sheikh Radwan sewage system,
- Unsewered built up areas,
- Existing pumping stations,
- Sewage systems for the recently built up southern areas,
- System mapping and operational data collection,
- Weak operation and maintenance,
- Sheikh Radwan Reservoir,
- Illegal sewer connections to the storm drain system,
- Flooding of the sewer system,

- Catchment A stormwater drainage, and
- Sub-catchment depressions.

This identification of issues, many of which have been partially addressed by the GWWP, and the availability of these planning documents now allows the four phase Gaza Wastewater Project to be placed within the overall scope of a development plan created and agreed upon by the relevant Palestinian authorities rather than a project based only on the need to address the problems related to the Sheikh Radwan Reservoir.

1.4 Project Framework and Rationale

Superimposed on the history of events leading to Gaza City's stormwater and wastewater problems are almost two years of dramatic movement in the peace process. This movement has helped change the focus of UNRWA's strategy and programs, prompted the creation of Palestinian Economic Council for Development and Reconstruction (PECDAR), and resulted in the development of an emerging Palestinian Authority with a growing capability to plan and manage development activities.

UNRWA has provided assistance to the refugee communities in Gaza for forty-five years. The Agency established a Department of Environmental Affairs under the Health Department in Gaza in 1992 and initiated a range of environmental health initiatives in support of its overall mandate in Gaza. A year later this became the Special Environmental Health Programme still under the Health Department. This Programme included a broad sectoral review and strategy, and the initiation of sewerage and drainage feasibility studies related to Beach Camp, Rafah, Jabalia Camp and town, Deir El-Balah camp and town, and the three middle camps. Following the Declaration of Principles in September 1993, UNRWA launched a Peace Implementation Programme designed to upgrade social infrastructure, create jobs, and improve living conditions for Palestinian refugees. UNRWA's focus over the years has been primarily related to the refugee population. However, the movement of refugees out of camps and into the surrounding communities and the inter-related nature of infrastructure projects has prompted UNRWA to support a range of projects outside of camp perimeters to address problems common to municipalities and refugee camps. These projects include renovation work at the existing wastewater treatment plan for Gaza City, extension of the coastal interceptor sewer system, and upgrading work on sewage pump stations one and two and construction of pump station three.

The recent establishment of a Palestinian Authority to provide government to the Palestinian autonomous areas resulted in the formation of two Palestinian agencies key to the four phase GWWP. These were the Ministry of Planning and International

Cooperation (MOPIC) and the Palestinian Water Authority (PWA). The Physical Planning Unit within MOPIC has been tasked with a broad range of planning and coordination responsibilities. These include master planning and planning for water, sewage, and solid waste management within the Gaza Strip (including Gaza City) and serving as a clearing house for all proposed infrastructure projects. In response to urgent needs, this unit prepared an Emergency Structural Plan for Gaza City which examines a range of infrastructure issues for Gaza City and provides broad guidance for infrastructure development for the next 30 years. Before the four phase GWWP is complete, other Palestinian agencies will influence Project activities.
The Ministry of Local Government, the Ministry of Health and the Ministry of Public Works are only the most obvious.

As the mandate and responsibilities of the various Ministries and Agencies are being worked out and these organizations staff up to meet the challenges ahead, the four phase GWWP must be prepared to respond to a changing and sometimes uncertain institutional environment

At the same time that these political and institutional changes are taking place, there remains an overwhelming technical need to help fix the city's deteriorating stormwater and wastewater systems. There is also an overwhelming need to implement immediate and high visibility activities that solve problems directly affecting the lives of Palestinians. The Sheikh Radwan Reservoir is one of several highly visible environmental problems which warranted immediate attention. Sewage running in the streets which results largely from blocked sewer lines is another visible problem requiring immediate repair as well as a long term plan for rehabilitation and maintenance. Gaza City's wastewater and stormwater problems are clearly large and complex. Their final resolution will require a long-term, coordinated effort between donors and Palestinian authorities. The four phase Gaza Wastewater Project will nonetheless make a dramatic and highly visible contribution to these efforts in the short-term and has the opportunity to make tangible, as well as substantive, contributions to long term plans to address wastewater and stormwater issues.

Palestinian agencies currently lack adequate financial and technical capacity to effectively address wastewater and stormwater problems in Gaza Municipality. These problems pose health and environmental risks to the residents of Gaza City and impede economic development. Evidence of these problems includes a highly contaminated reservoir, raw sewage and stormwater on the streets, with 60% of the population living in unsewered areas. Responding to these continuing, highly visible problems while supporting the mandates, planning initiatives, and capacity building needs of emerging Palestinian agencies and Gaza Municipality, offers an opportunity to realize real tangible benefits to Palestine.

Response to emergency sewage and drainage problems through cleaning and rehabilitation of existing networks provided a measure of immediate but temporary relief from existing conditions. Planning studies will provide a framework for development of a rational long term plan for meeting the sewerage and drainage requirement of Gaza City. The design and construction of new sewers, storm drains, and related wastewater and storm drainage provides the infrastructure to make the most important of these plans a reality. Operation and maintenance support and public awareness will help ensure that investments made now will continue to provide benefit well into the future.

The rationale for completing Phase I under the Grant Agreement with UNRWA was to move forward with the Project while arrangements were being made for management and implementation of Phases II through IV. The amended Grant Agreement focused UNRWA's work on responding to system emergency needs, initiating and managing much of the necessary Project commodity procurement, and initiating several critical sewer system cleaning and assessment activities. The completion of these activities directly addressed the specific goals of the Project while at the same time, provided a foundation for later Project implementation activities.

2.0 PROJECT PURPOSE AND SCOPE

2.1 Project Purpose

The purposes of the four phase Gaza Wastewater Project are to:

- Address the emergency requirements of the existing wastewater and stormwater system in Gaza City,
- Provide vehicles and equipment to support the Municipality's growing program.
- Help provide long-term solutions for wastewater and stormwater management,
- Develop a permanent solution to the problems of Sheikh Radwan Reservoir, and
- Assist Gaza Municipality develop the institutional capacity and skills to operate and maintain the wastewater and stormwater systems thereby improving the quality of life for citizens of the Municipality.

2.2 Project Scope

The original concept of the Gaza Wastewater Project was to conduct a four year Project that would fund engineering infrastructure and capacity building activities related to planning, rehabilitating, improving, and expanding the Municipality of Gaza's wastewater and storm water drainage system. UNRWA and a U.S. Contractor would implement the project in close collaboration with Gaza Municipality and in coordination with other Palestinian and international agencies. The project was composed of seven major inter-related elements. These include:

- **Project "Fast Start" and short-term emergency actions** to get the Project off to a quick start and alleviate the most pressing and urgent wastewater and stormwater collection problems within areas A1 and A2,

- **Planning studies and engineering design** to provide a strategic framework for wastewater and stormwater management and to select and design sub-projects (sub-projects are discrete design and construction activities to be considered under the Project),
- **Construction** to complete wastewater and stormwater sub-projects in areas A1 and A2 or affected by the systems in these areas,

- **Operation and maintenance (O&M) support** to provide direct technical assistance and training to strengthen Gaza Municipality capacity to complete the ongoing O&M for the wastewater and stormwater system,

- **Commodity procurement and training** to support the O&M component of the project,
- **Public Awareness** through a program to strengthen the civic ethic towards wastewater and stormwater management, to improve public relations and provide information concerning wastewater and stormwater improvements within Gaza Municipality, and

- **Water Quality monitoring** as part of a water quality surveillance program to monitor basic groundwater and surface water chemical and biological parameters and the impacts of sewerage and stormwater improvements on the affected environment.

Under Project Phase I, UNRWA implemented the "Fast Start" short-term emergency actions, comprising sewer and storm drain cleaning and related activities to relieve flooding and stormwater removal under the construction element. Also, UNRWA completed two of three commodity procurements under the commodity procurement and training element, and prepared a water quality monitoring plan under the water quality monitoring element. All other elements were to be managed and implemented during Phases 2, 3 and 4 by a U.S. Contractor selected by USAID.

2.3 Project Strategy

The Gaza Wastewater Project strategy for meeting Project objectives was to provide support and assistance to Gaza Municipality to alleviate immediate problems through the Project "Fast Start" and short-term emergency actions element and build toward comprehensive long-term sustainable solutions to Gaza's sewage and stormwater problems through the remaining Project elements. The Project contributes to meeting the needs of the Palestinian Authority and the people of Gaza City by working within the structural framework outlined by MOPIC and agreed upon by all relevant Palestinian agencies.

Specifically, the Project worked with the Municipality's Technical Department and the Mayor's Office to identify a program to meet sewage and drainage system emergency needs and then planned and executed a short term program for sewage and stormwater improvement. Project "Fast Start" and short-term emergency actions consisted of deciding, with the Municipality, what most immediate actions were required to control flooding by stormwater and sewage within the Municipality. Work to alleviate these problems was accomplished through private and public sector contracts and was facilitated by a range of contracting and procurement waivers.

The strategy for commodity procurement and training for supporting the Municipality's Wastewater Section was divided into three staged components, emergency procurement, intermediate procurement and long term procurement components. Emergency procurement, completed with appropriate waivers, provided the most critically needed materials and equipment. Intermediate procurement items, purchased using normal tendering procedures, provided a range of equipment and materials that the Municipality requires to meet its longer term needs. Tendering of these two components and delivery of the emergency procurement were completed by UNRWA. Delivery of the intermediate procurement is proceeding to be managed by UNRWA as this is written.

3.0 DESCRIPTION PROJECT OF ACTIVITIES

The four year Gaza Wastewater Project (GWWP) implemented by UNRWA, in collaboration with Gaza Municipality, was designed initially to include six major operational elements be completed in four overlapping phases. A fifth phase evolved as a strategy to allow the Project to focus on the short-term emergency actions in response to needs of the City. These immediate action activities were always a part of the GWWP but were given priority during the Project "Fast Start". The "Fast Start" elements are described in the sections that follow. Shortly after the GWWP activities were started by UNRWA, USAID decided to amend the Grant Agreement and to provide funding to UNRWA only for the Phase 1 elements below.

3.1 Project Phase 1: Emergency Actions

Although all elements of the Emergency Actions phase were originally part of the Project, this initial phase was agreed upon to enable the project to move forward rapidly on a number of emergency actions. The activities included in this phase, always part of the project, were broken out for priority attention. This Project phase was managed by UNRWA. In order to facilitate this project phase, USAID provided short-term technical assistance in a number of areas including:

- Project management
- Interim O&M engineering support
- Project planning assistance,
- Pump station O&M
- Commodity procurement, and
- Water quality monitoring planning.

This assistance allowed for "Fast Start" activities in project planning, management, and administration, commodity procurement and training, stormwater system rehabilitation, construction, sewer and storm drain cleaning, and water quality monitoring. This phase was designed to cover the four month period following project start-up. In addition to project administrative and procurement activities related to project initiation, the "Fast Start" technical team focused on a range of emergency activities identified by the Mayor of Gaza, These included:

- Clean up of Sheikh Radwan Reservoir by getting the Sheikh Radwan Stormwater pump station back in service,

- Excavation of the Waqf land in Zeitun area for collection of surface water run-off and construction of force mains for pumping run-off to Sheikh Radwan Reservoir via the existing storm drain culvert, and

- Sewer and storm drain cleaning focusing on the El Mansoura Street (sewer cleaning), Jaffa street (storm drain cleaning), and the main storm drain box culvert.

Contracting was carried out with both private sector contractors and Gaza Municipality to ensure that these activities could be completed quickly. Emergency commodity procurement, facilitated by waiving selected procurement requirements, allowed purchase of necessary materials and equipment including a jetter-vacuum truck for sewer cleaning and dewatering pumps for stormwater pumping from the Asqoula Pond.

Additional "Fast Start" project assistance focused on project planning and development of work plans and progress indicators, development of water quality monitoring and sludge handling plans, preparation of standard operating procedures and technical guidance documents, and evaluation of emergency and long term needs for pump station and force main O&M.

3.2 Planning Support

The Planning Studies and Engineering Design element of the Project will be implemented by the selected USAID consultant. Although these activities were originally planned for completion in year one, they may well continue into following years due to the complexity of the planning environment in Gaza and the lack of clarity about priority facilities and their design requirements. In preparation for Municipality master planning, and sewage and storm drainage system infrastructure planning, aerial survey and topographic mapping of the Project area to two scales (1:5000 and 1:500) was to be completed under UNDP auspices. Originally the mapping was to be part of the GWWP. With contracts already in place, it was decided to have UNDP complete this work with the provision that 1:500 scale maps of the Project area be included. As Phase 1 ends the mapping project has not been completed and much remains to be done to develop an adequate, extensive data base. Additional specific types of planning and study exercises will be required to complete construction of conveyance system upgrading. The information provided from Phase 1 to the USAID consultant includes:

- Sewer and storm drain mapping including a physical and hydraulic assessment of conditions, along with recommendations for needed repair and upgrading of about 37 km of sanitary sewer lines.

- Preliminary planning and assessment for sewers, pump stations, storm drains and force main in a limited evaluation of Areas A1 and A2 of the city; and

- Recommendations for upgrading of the stormwater system, and for specific target sewers, storm drains, streets and pumping stations related to Areas A1 and A2.

3.3 Construction

Initial Project planning and budgets were developed without a full understanding of the rehabilitation and construction requirements of the sewage and stormwater systems. However, certain critical needs were identified and those incorporated into the Phase 1 construction activities fell within one of three categories:

- Sewer and storm drain cleaning
- Sewage and stormwater conveyance system rehabilitation
- Sewer replacement construction

3.3.1 Sewer and storm drain cleaning

Sewer and storm drain cleaning in areas A1 an A2 was implemented and managed by UNRWA as part of Phase I activities. This work included locating and cleaning of manholes, a main storm drain box culvert and drains in Jaffa Street, cleaning and inspection of the main sewer pipelines, disposal of materials removed from the manholes and pipelines, and a physical survey to provide a record of pipeline locations and elevations, pipe diameters, the location of connections and laterals, etc. as required for system analysis and planning studies.

3.3.2 Sewage and stormwater conveyance system rehabilitation

Urgent actions to rehabilitate existing wastewater and stormwater systems were managed by UNRWA. Plans for this rehabilitation work were based on first hand evaluation and discussions with the City. A detailed report providing recommendations for priority system repair needs and information helping to identify system elements which need rehabilitation resulted from the sewer cleaning activities.

A number of individual contracts were implemented to improve operating capacity at Shiekh Radwan Reservoir and to reduce sewage flow into the storm water conveyance system for the reservoir.

3.3.3 Sewer Replacement

From the sewer inspection and assessment activity and discussions with the City, a contract effort was implemented to replace "up to 5 km of sewer lines". Sewers were identified by the City for replacement in order to reduce commingling of sewage flow with stormwater runoff and to reduce sewage overflows at manholes which caused sewage to run in the streets.
The sewer replacement activity is discussed in Section 5.2.5 of this report.

3.4 Commodity Procurement

Commodity procurement has been managed in two phases to date. Emergency (Fast Track) Procurement identified and procured equipment and materials necessary for completion of the short-term emergency actions and the Intermediate Procurement to meet additional project related needs focusing on O&M equipment and materials necessary for the on-going work of the Wastewater Section of Gaza Municipality.

Emergency (Fast Track) Procurement: A set of emergency, "fast-track" procurement were required to address the obvious urgent needs of the Wastewater Section to immediately upgrade the ability of the Municipality of Gaza to provide both routine and emergency cleaning capabilities for the sewerage and stormwater collection systems. For this emergency procurement phase, bidding procedures were streamlined or waived, with the objective of shortening the period needed to obtain equipment, especially sewer cleaning equipment. Standard procedures were waived in order to speed procurement. In their place, UNRWA allowed direct procurement to be made to local (Palestinian or Israeli) firms once a responsive quotation was received. USAID agreed that UNRWA's procurement procedures would be used for the emergency procurement and the US source and origin requirements will not strictly apply. However, US-source commodities were selected where practical.

Intermediate Procurement: Additional commodities and equipment items which support the Municipality of Gaza and offer expanded capabilities to the Wastewater Section were provided as part of the intermediate procurement package. For the intermediate procurement phase, UNRWA procurement regulations were followed. For these procurements, few waivers to competitive bidding occurred. Typically the time required from the submission of bills of material to arrival at customs varies from five to seven months. The UNRWA international procurement process was expedited to improve arrival times at customs.

Shipping costs, equipment checking, and training support costs were also funded under this element. As per USAID requirements, all appropriate commodities procured by UNRWA were marked with the USAID logo.

4.0 PROJECT MANAGEMENT AND ADMINISTRATION

As mentioned previously, UNRWA acted as the implementing agency for the Gaza Wastewater Project Phase I which included the emergency "Fast Start" activities and a number of other activities from the project elements described in Section 2 and 3 above.

4.1 Project Phase 1

Participants in the Project under Phase I included UNRWA, the Municipality of Gaza, and USAID. The roles of each are described briefly below.

4.1.1 UNRWA

Under the Grant Agreement between USAID and UNRWA, UNRWA acted as the implementation agency for Phase 1 of the Project and as such was responsible for Phase I Project management. The project was implemented in close coordination with Gaza Municipality who participated in the Project and was the primary institutional beneficiary. As part of "Fast Start" implementation, USAID had agreed to provide UNRWA, through AID's Environmental Health Project (EHP), the services of Project Manager who reported to the Director of Environmental Health, UNRWA/Gaza Operations through the Chief of Special Environmental Health Programme. Also, USAID provided funding for an Operation and Maintenance Advisor and additional short-term assistance. Concurrent with amending the Grant Agreement, USAID agreed to continue providing project management, and Operation and Maintenance consultancy support to UNRWA to alleviate the need for UNRWA to recruit international staff for the remaining duration of Phase 1. The interim Project Manager and later the Project Manager directed activities of a dedicated Project staff within several broad areas which included: project administration, procurement support, contract monitoring, and site engineers for construction inspection and oversite. UNRWA provided additional support to the project from its Administration, Financial, Legal, and Supply and Transport Departments. Technical assistance was provided by the Special Environmental Health Programme's Project Planning, Design, and Implementation (PPDI) Unit. UNRWA provided offices to the Project Manager and O&M Advisor, along with staff assigned to administration and construction at their Field Office compound in Gaza City. The management of major Phase 1 activities is described in the following paragraphs:

Sewer and Storm Drain Emergency Services, Cleaning and Repair: UNRWA entered into contracts to obtain the services of private firms and the public sector to complete the necessary sewer and storm drain cleaning and repairs. UNRWA entered into contracts that included:

- Emergency services related to storm drain system cleaning, maintenance, and repair
- Sewer cleaning and inspection
- Sewer replacement

UNRWA provided monitoring and evaluation of contractor performance prior to releasing payment.

Procurement: Procurement falls into two broad categories, materials and equipment for Project operations and commodity procurement (including training) in support of Phase I Project activities and anticipated future O&M support activities. Materials and equipment required for Project operations were purchased and used by UNRWA in accordance with UNRWA rules and regulations and were not charged to the Commodity Procurement and Training component of the Project. Commodity requirements were initially identified by a procurement specialist. All procurement activities funded under the commodity procurement and training component were reviewed by UNRWA's Project Manager and were subject to USAID approvals. All UNRWA and USAID procurement regulations were adhered to unless specific procurement waivers were requested and received . UNRWA tried to maximize US Procurement of goods and services to the extent practicable and reasonable. Ownership of items procured under the commodity procurement budget were formally transferred to Gaza Municipality as quickly as possible after receipt into UNRWA's supply warehouse.

Short-term technical assistance: In support of "Fast Start" activities and to provide for Project staffing and special needs during implementation of Phase 1, USAID provided limited short-term technical assistance in support of Phase 1 though a support contract with the USAID's EHP. This technical assistance was provided upon mutual agreement on scopes of work for each individual consultant. Specific short-term consulting requirements included:

- Project Management
- Technical Assistance,
- Operation and Maintenance,
- Water Quality Monitoring,
- Sludge Handling and Disposal, and
- Sewer Cleaning and Maintenance Procurement

Coordination: The GWWP Project Manager was responsible for coordination of all Phase 1 Project activities with the Gaza Municipality and all other agencies and projects which impacted on the GWWP. The Project Manager chaired a weekly technical coordination meeting held to inform participants about Project progress, alert them of possible problems, and reach agreement about implementation issues.

Project reporting, finance, and administration: UNRWA's GWWP Project Manager was responsible for all project reporting requirements under the Grant Agreement and that all USAID required approvals were obtained. UNRWA kept the Project administrative and financial records to document Project activities and costs. UNRWA will make these records available to USAID in accordance with the requirements of the Grant Agreement.

4.1.2 Gaza Municipality

As a partner and institutional beneficiary of the Gaza Wastewater Project the Gaza Municipality assigned a full-time Project Manager who coordinated the participation of the Municipality in planning, implementing, and monitoring activities on a day-to-day basis and provided liaison with the UNRWA Project Manager. The Gaza Municipality established a GWWP Project office under the direction of the Municipality's GWWP Project Manager who initially reported to the City Engineer, Head of the Technical Department until a reorganization took place. The Municipality's GWWP Project Manager then reported directly to the Mayor, and participated and contributed to all planning and implementation activities which affected the Municipality's staff and the city's physical infrastructure.

Day-to-day participation of the Municipality was directed by the City's Project Manager. During Phase 1, participation also included extensive contact with the Wastewater Section Chief and the staff.

4.1.3 USAID

As the Project donor, USAID had approval, monitoring, and evaluation roles. USAID's relationship to the project was through UNRWA's Chief of Environmental Health (Headquarters), Chief of Special Environmental Programmes (Gaza) and the GWWP Project Manager . UNRWA provided reporting of Project progress through monthly and quarterly reports. These reports, along with minutes of technical coordination meetings, were the principal mode for USAID Project monitoring. As necessary, USAID visited project sites and recommended adjustments and improvements to Project activities for UNRWA's consideration.

Approvals: USAID reviewed and approved the following Project documents:

- Project work plan
- Commodity Procurement Plan
- Sludge Disposal Protocol
- Water Quality Monitoring Plan
- Operation and Manintenance Planning Report

Short-term technical assistance: USAID contracted for short-term technical assistance as described in Section 3.1. All short-term technical assistance was managed and directed by UNRWA and the GWWP Project Manager.

Evaluations and audits: USAID may contract separately for a final evaluation if it so chooses. UNRWA will provide the necessary information and assistance to facilitate this evaluation. UNRWA will also make available all project financial records for inspection by USAID or its designees as part of any formal audit procedure required by USAID.

4.2 Technical Implementation Plan

The Grant Agreement was signed on June 30, 1995. After the Agreement was signed, a series of meetings were held among the participants and a number of mobilization issues were raised and resolved. However, in late December 1995, UNRWA and

USAID jointly agreed that the "implementation program specified in the Grant Agreement cannot be satisfactorily carried out under the arrangements specified." At that time, it was decided that UNRWA would complete Phase 1 activities and Phases II, III, and IV would be deleted from the Grant agreement.

This section provides a more detailed description of each project element implemented by UNRWA under Phase 1, the objective of each, the strategy employed, and the implementation plan. An overall schedule that was implemented is shown for these activities. Phase 1 as implemented by UNRWA can be divided into three sub-phases: project mobilization, emergency activities, and rehabilitation activities.

4.2.1 Project Mobilization

Objective: To conclude the necessary project arrangements and to mobilize project start-up by providing essential project equipment and logistical support, and to plan and initiate "emergency" activities.

Strategy: The strategy for meeting these two objectives was to work closely with USAID and Gaza Municipality to conclude project arrangements, to initiate project staffing and procurement through UNRWA's overall support to the Project, and to obtain assistance through USAID to initiate emergency activities.

Plan of Action: The plan was divided into those activities in which UNRWA must participate with local authorities and USAID (Project arrangement), those over which UNRWA has direct responsibility under the Grant agreement (logistical support and staffing), and those which depend on USAID provision of short term assistance.

Almost immediately following the signing of the Grant Agreement, UNRWA began the process of establishing offices and procuring essential Project equipment, materials, and supplies. Nearly 900 square feet of office space in the form of 6 serviced (electrical power, telephones, and heating/air conditioning) units were made available. Office furniture including desks, work tables, and lockable cabinets were installed. Office equipment including computers with appropriate software, a laser printer, photocopy machine, and fax machine were procured and installed. Procurement of Project vehicles, including two sedans and three 4-wheel drive vehicles, was initiated with an expedited delivery schedule. The sedans were received in early December and the 4-wheel drive vehicles arrived in mid-February 1996 .

Project staffing included both international and local staff. Recruitment for the two international staff positions (Project Manager and O&M Engineer) included networking with international experts and advertising in US and international journals and jobs bulletins.
Applications were received for both positions and the position of Project Manager was offered to one candidate who appeared willing to accept it at the time the Grant Agreement was amended. Recruiting was suspended as a result of the amendment to the Grant Agreement. Project management support was, therefore, provided directly by USAID through a support contact. Local staffing was staged to coincide with

Project needs. Six local staff were hired for the first year of the Project. A Project Administrative Officer, an Assistant Maintenance Engineer, two site engineers, and two support staff were hired. When construction activities peaked two additional site engineers were hired.

During the planning for Project start-up it was recognized that delays in fielding qualified international staff would take time and that initial Project activities as well as a number of emergency actions could not be delayed. It was important that emergency actions be completed before the onset of the winter rains. As a result, arrangements were made for USAID, through its Environmental Health Project (EHP), to provide an international staff (project manager and O&M engineer) along with a range of consultants to support important early project activities. Unfortunately, administrative and contractual delays compromised much of the anticipated gain of the "fast start" approach as the consultants, who had originally committed to begin in August, did not begin to arrive until October. Although many of the emergency actions were incomplete as the rains began in late 1995, substantial progress was made on relieving several major problems.

4.2.2 Project "Fast Start" Activities

Objective: To "fast start" the project and to complete detailed project planning and a series of emergency actions prior to the onset of the winter rains.

Strategy: The strategy for meeting the Project objective of short-term emergency actions was four-fold:

- Engage an interim Project team of a Project Manger and O&M engineer and support this team with additional short-term experts through USAID's EHP to focus on emergency actions while initiating project start-up activities;
- Work closely with the Gaza Municipality's Technical Department and more specifically the Wastewater Section to scope the work and develop an action plan for the activities;
- Procure emergency materials and equipment, using waivers when possible, for completion of priority activities, and
- Engage private contractors or the Municipality to facilitate immediate action and early completion of Gaza Municipality's priority projects.

USAID's interest in initiating the GWWP quickly and UNRWA staffing limitations led to agreement between USAID and UNRWA to engage an interim Project Manager and O&M Engineer to "fast-start" the Project. This assistance was planned for four months duration, prior to the onset of the 1995-96 rainy season. Additional short-term assistance was also agreed upon to facilitate emergency actions. These actions were to include urgently needed maintenance and procurement as identified by the Mayor and the Head of the Municipality's Technical Department. The Mayor identified eight actions of urgent priority. They were:

- Sewer cleaning Area A1,
- Sewer cleaning Area A2,
- Storm drain system cleaning,
- Equipment for sewer and storm drain cleaning,

- Creation of stormwater detention pond at the Asqola Waqf land,
- Equipment for Wastewater Section,
- Gravity sewage line in Karkash, and
- Repair of Sheikh Radwan stormwater pumping station.

Arrangements to address these problems were made through for provision of short-term services by USAID's EHP. Administrative difficulties resulted in delays in fielding the interim Project Manager and O&M Engineer until October, more than three months after the Grant Agreement was signed. This limited the time available for emergency actions which required attention prior to the rains. During meetings with the Mayor in October, a revised list of priority emergency actions were agreed to. They included:

- Repair of the Sheikh Radwan stormwater pumping station,
- Creation of a stormwater retention pond at the Waqf land in Asquola, and
- Sewer cleaning on El Mansoura Street.

The work at Sheikh Radwan Reservoir was divided into work on the pumping station and work on the Reservoir itself. Work on the pumping station included pulling, repairing, and replacing the pumps, cleaning the wet well, and provision of grid electricity to replace the diesel gen-set operating at the site. This work was completed through a contract with the Municipality. Work on the reservoir itself consisted of exposing the pump station inlet pipes, building slope protection and a retaining wall to protect the inlet pipes, and fabrication and installation of riser pipes on the inlet pipes to protect against sand and other material entering the pumping station, and construction of an access platform and flap-gates to control inlet flow elevations. This work was completed through a series of contracts to private sector firms.

The work at the Waqf land in Asquola included excavation of a low lying area where stormwater naturally pools to create a stormwater reservoir, installation of force mains linking the reservoir to the head end of the box culvert leading to Sheikh Radwan Reservoir, and purchase and installation of security fencing around the excavated area. This work was completed through private sector contracts.

Emergency sewer and storm drain cleaning work focused first on El Mansoura Street (sewer) and Jaffa Street (storm drain). The need for specific equipment and material to complete this work let to the development of the emergency procurement list and the strategy of staged procurement to meet Project needs. Important items on the list included a jetter/vacuum truck, sludge vacuum truck, wheeled loader, dump truck, skid loader dewatering pumps, and safety equipment. Appendix B provides more complete information on procurement. Identification of other equipment needs along with development of detailed specifications was initiated by a Procurement consultant in October with follow-up provided by the Project Manager and O&M advisor. Equipment began arriving in November 1995 and the Municipality, under a limited contract, began storm drain cleaning in early December.

Emergency activities placed demands on the interim Project Manager and the Operation and Maintenance Engineer that precluded any substantive progress on development of detailed project documents and implementation plans. In order to

facilitate this planning process, an additional short term consultant was provided by USAID. Project Planning activities took place over the period between the end of November to the middle of February 1996.

A consultant was engaged under the EHP umbrella during the first three weeks of December to develop an environmental monitoring plan focusing on water quality issues related to both wastewater and storm water. That report formed the basis for a recommended environmental monitoring and water quality testing plan.

4.2.3 Rehabilitation Activities

Objective: To complete Phase 1 of the Gaza Wastewater Project by completing emergency and intermediate procurements, sewer cleaning in areas A1 and A2, replacement of sewers in the highest priority areas, and to provide the inertia necessary for completion of the overall Gaza Wastewater Project.

Strategy: The strategy for meeting these objectives was:

- to work closely with the Municipality of Gaza to prioritize and then finalize procurement requirements, develop a Procurement Plan, and complete purchasing by waiving certain requirements for emergency procurement and using UNRWA's procurement regulations for items of the intermediate list,
- to work with Municipality staff to outline an operation and maintenance support program and produce a preliminary operation and maintenance action plan,
- to utilize consultant services to complete and environmental monitoring report and develop a Water Quality monitoring Plan and a Sludge Disposal Protocol,
- to enter into contacts to clean, inspect, and repair specific sections of the sewage collection system in areas A1 and A2 and to prepare a comprehensive assessment report, and
- to replace up to 5 km of sanitary sewers in areas A1 and A2.

This strategy was designed to meet the requirements of the Grant Agreement and to provide USAID and USAID's Contractor for subsequent project phases, with equipment and information that would allow the rapid initiation of these Phases.

Plan of Action: The activities outlined in the three broad areas of procurement, sewer cleaning and sewer replacement began during the "Fast Start" period and carried through to the expiration of the Grant Agreement on October 31, 1996.

4.2.4 Phase 1 Schedule

Overall Implementation schedules for all major Project components and major sub-tasks that were performed are provided in Appendix C. Descriptions of the work completed during Phase 1 are included in Section 5 below.

4.3 Project Inputs

The four phase Gaza Wastewater Project was originally designed to be implemented completely by UNRWA. These implementation plans were changed. As described earlier, only Phase 1 activities of the Project were implemented by UNRWA. This Section outlines the project requirements for the UNRWA managed Project Phase 1.

4.3.1 Project Management and Technical Assistance

The Project management and technical assistance requirements consisted of dedicated international and local staffs, short-term consultant technical assistance, and support provided by UNRWA's support staff. UNRWA began recruiting for the Project's international staff to include a long-term Project Manager and an Operation and Maintenance Engineer as soon as the Grant Agreement was signed. When UNRWA and USAID agreed that the Project would be amended, UNRWA ceased this recruitment effort. The Project was managed by an interim Project Manager and an interim Operation and Maintenance Engineer during the first months of the Project.

Recruitment for local staff resulted in the hiring of the staff critical to the completion of the Project Phase 1 activities. The local staff included:

- Administrative Officer
- Administrative Assistant
- Assistant Maintenance Engineer
- 3 Site Engineers
- Secretary
- 2 Drivers

UNRWA originally proposed a strategy to initiate the Gaza Wastewater Project rapidly through a series "Fast Start" activities in order to mobilize the Project quickly and initiate a range of emergency measures. In order to comply with this request and at the same time meet prior program requirements and other project activities as well as its Peace Implementation Programme, USAID agreed to provide short term assistance during completion of "Fast Start" activities. This strategy allowed initiation of project activities while recruitment for international and local staff took place. The immediate short-term consulting staff included:

- Interim Project Manager
- Interim Operation and Maintenance Engineer.
- Project Planning Specialist
- Pump Station O&M Specialist
- Procurement Specialist
- Environmental Engineer

An agreement in principle was made at the time the Grant Agreement was modified that USAID would provide the services of a Project Manager through the expiration date of the Agreement and an O&M Advisor during the sewer cleaning and assessment.

4.3.2 Logistics and Support Services

UNRWA provided logistical support services to the Project for mobilization, staff support, and operations. During Project mobilization this support included:

- Provision of office space (about 70 m^2),
- Procurement of office equipment and supplies,
- Procurement of vehicles,
- Recruitment and employment of local staff, and
- Provision of vehicles from UNRWA's pool prior to arrival of vehicles (including fuel, insurance, maintenance and repair)

During emergency activities, UNRWA provided all necessary logistical support which continued throughout Phase 1. This support included:

- Provision of communications equipment (telephone and fax service) and all utilities,
- Fuel (tax-free) and maintenance services of UNRWA's workshop for vehicle servicing and repair for Project vehicles,
- Drivers for dedicated Project vehicles,
- All necessary office supplies,

In addition, UNRWA provided the management and administrative services of the Special Environmental Health Programme (SEHP) staff (both international and local) and technical support from the Project Planning, Design, and Implementation Section of (SEHP). Additional UNRWA staff support to the Project included:

- Office of the Chief, Environmental Health
- Legal Department for contracting issues and review of contracts
- Supply and Transport Department for local transportation management and commodities procurement,
- Supply Division (Amman) for international procurements
- Administration Department for personnel matters, equipment servicing, computer systems support, travel arrangements, and mail services,
- Finance Department for budgeting and accounts control and financial reporting.

This additional staff support was provided as a necessary requirement for Project management and was included as UNRWA's Project support costs.

4.3.3 Project Budget

In accordance with the amended Grant Agreement, the Grant funding was reduced to cover only the costs incurred by UNRWA for completion of Project Phase 1. UNRWA's budget requirement for Phase 1, including emergency activities was $5,304,000. This sum covered actual costs only and did include any profit or fee. The budget line item summary is provided in Table 4.1:

Table 4.1
UNRWA USAID Grant Budget Summary

Grant Activity	Cost
Commodities: Maintenance Equipment	$2,800,000
Sewer and Storm Drain Cleaning	$1,500,000
Equipment, Logistical Support, & Other UNRWA Costs	$435,714
Project Support Costs	$568,286
TOTAL	**$5,304,000**

A detailed breakdown of the UNRWA Grant Budget can be found in Appendix D. It should be noted that funding for the international consultants hired through EHP to assist UNRWA in the Project was not an UNRWA expense and did not come from UNRWA's budget.

The final dollar allocations, based upon final expenditures, will be different slightly than the dollars shown above. This is due primarily to the inability to manage actual construction work "to the dollar", a short time schedule with a late start, and a date certain conclusion, beyond which no work could be done.

5.0 PROJECT ACCOMPLISHMENTS

Activities carried out during the Phase 1 period of the GWWP were generally pursued consistent with the understandings set out and explained in the Grant Agreement. However, when the Grant Agreement was amended the affected parties seemed to focus more intently on the truely short-term needs and priorities of the Municipality. This was done to provide the city with added operationl flexibility to carry them through the next planning phase of the GWWP and until the construction phases could be completed.

This section explains the outputs and accomplishments derived from the Phase 1 activities. Emphasis is placed on describing the planning (reports), construction, and procurement elements.

5.1 Project Reports

5.1.1 Project Implementation Framework

USAID conceived the Gaza Wastewater Project over a several year period culminating in a USAID Project Document which was completed in March of 1995. However, following meetings with UNRWA and preparation of a draft outline and proposal by UNRWA in February, 1995, the concept and scope of the project was greatly expanded. USAID developed the project over the following 21/2 months, and a Project Grant Agreement with UNRWA was signed at the end of June signaling the initiation of the Project. It was understood at that time that the Project would proceed in a staged approach which would allow Project mobilization and a range of preparatory and urgent activities to move forward while the Project planning was taking place. However, the rapid preparation of the project by USAID precluded involvement of the Gaza Municipality and UNRWA, and there was no project paper. The GWWP Implementation Framework document was originally conceived as a project working document, work program, and schedule, for the USAID Grant to UNRWA to be used as a guide for implementation of the Gaza Wastewater Project.

The project faced a number of constraints, including delays in mobilization of short term consultants by USAID, disagreement with organizational and implementational requirements on the part of Gaza Municipality arising out of the lack of involvement in project development, and a changing planning environment and concepts which severely impeded progress. There was a clear need for an increased emphasis on fundamental planning, organization, and activities and more coordination with local agencies. By December, it became clear to USAID and UNRWA that the project as defined by the Grant Agreement could not be effectively carried out under the existing Agreement. An understanding was reached during a meeting on December 28 that UNRWA would complete Phase 1 activities already initiated under the Grant and USAID would manage Phases 2, 3, and 4 directly. These changes had several important implications for the Implementation Framework report .

First, the document longer constituted an overall planning document for all phases of the Gaza Wastewater Project. It evolved into a planning document including a work program and schedule for Phase 1 to be implemented by UNRWA. It also provided a framework for the remaining phases of the project.
During the course of preparing the Framework Report it became clear that the creation of an autonomous Palestinian Authority and comitments of other donors had significantly changed the environment in which the Gaza Wastewater Project must be implemented. This changed environment was a major factor in the decision to change the project implementation arrangements. Information pertaining to this changed environment, which was collected as part of preparing the work plan and schedule for Project Phase 1, was available to USAID as it planed for management of the later phases of the project. Also the initial conceptual plan that UNRWA developed for implementation of Project Phases 2,3, and 4 provided value to USAID. Therefore, the Gaza Wastewater Project Implementation Framework had three purposes which were:

- to satisfy the requirement for a work plan and schedule for Project phases to be implemented by UNRWA
- to provide information about current and potential initiatves including planning and feasibility studies, infrastructure projects, and institutional development activities which may have impact on the Gaza Wastewater Project and
- to suggest, by way of outlining how UNRWA would implemint Project phases 2 through 4, one possible framework for implementation of the Gaza Wastewater Project.

5.1.2 Wastewater Pumping Stations and Force Mains Assessment

A pump station O& M Specialist conducted an assessment of the sewage pump stations and force mains leading to the existing over-loaded nonoperational wastewater treatment plant. This assessment was a part of the "fast start" activities, and resulted in the assessment report.

There were three (3) major components of the scope of work for the pumping stations assessment, as follow:

- Conduct a physical assessment of each pumping station. Indentify short term (emergency) needs and intermediate needs. Prepare 'order of magnitude" cost estimates for emergency needs . Based on the physical assessment, prepare a set of standard design guidelines that can be followed by engineers during the design of pumping stations.
- Conduct an assessment of the operation and maintenance (O&M) procedures that are employed at the puming stations. Identify short comings and provide recommendations for improvement.

  Develop basic standard operating procedures (SOPs) for the pumping station staff.
- Conduct assessments of the management, organizatinal structure, and training program. Identify areas that are in need of improvement and provide recommendations. Develop an organizational structure, basic

job descriptions and prepare a suggested training curriculum for management, operators and maintenance personnel.

The work included a review of background information, on-site inspections at each pumping station, interviews / meetings with Gaza Municipality Sewge Department management and staff, and discussions with Project team members and UNRWA engineers. The end product of the assessment was the report, which identified deficiencies, provided recommendations for improvements and suggested a plan for implementation of the recommendatios.

The major findings were as follows:

Physical Assessment:

- Inadequate safety facilities and equipment
- Indadequate supply of tools and electrical / mechanical spare parts
- Excessive quantity of sand entering the pumping statins causing damage to pumping equipment
- Inadequate electrical power supply
- Lack of flow meters and pressure gauges (for measuring pump performance)
- General lack of critical redundancy (back-up pumping units)
- Inadequate force main system which limits the number of pumps that can be operated simultaneously
- General poor condition of most of the electrical / mechanical equipment and in some cases poor structural condtion
- Inadequate pump control and alarm systems
- Excessive vibration at PS 7A

O&M Procedures Assessment:

- Lack of attention to occupational safety
- No standard operating procedures for routine inspections, maintenance, or dealing with abnormal conditions
- No records of pump / motor performance and duty cycles
- No records of maintenance performed
- Lack of attention to housekeeping
- No documented preventive maintenance program
- No manufacturer's literature available for developing preventive maintenance schedules, ordering spare parts and anlyzing abnormal operating conditions
- No mechanism for prioritizing system deficiencies, referral for corrective maintenance and folow-up / tracking of maintenance.
- No formal agreements with outside contractors for performing emergency repairs

O&M Management and Training Assessment:

- Ineffective organizational structure
- Lack of job classifications and descriptions
- Inefficient work schedules

- No standard guidelines for the design of pumping stations
- No training program for the development of managenment and O&M staff.

5.1.3 Operation and Maintenance Planning Report

Within the project, as originally conceived, UNRWA would have provided O&M support (including advisors and training) to the Municipality to work with Wastewater Section staff. This effort was to include a range of instituional development activities including development of an action program to address the most serious deficiencies of the wastewater and stormwater conveyance systems, organizational analysis, definition of staff responsibilities and job descriptions, staff training, work on scheduling, budgeting and cost recovery issues, and the formulation and implementation of a long-term operation and maintenace management plan. This work was initiated by the Project's interim Operation and Maintenance Engineer. As a result of the Grant Agreement amendment, UNRWA no longer had responsibility for the operation and maintenance support element of the Project. However, some background work and planning had already been completed. As part of Phase I activities, UNRWA produced this preliminary operation and maintenace support plan which summarizes the planning work completed as part of Phase 1 activities.

To operate and maintain stormwater or wastewater collection systems properly and successfully, the Muncipality must have the correct equipment, have adequately-trained staff and use appropriate managemęnt techniques. The Wastewater Section of the Municipality requires strengthening in each of these key areas.

To attack the problems causing chronic flooding of the sewerage system, an ongoing program to clean, inspect and assess the sewerage and stormwater systems followed by emergency repair work was required. The Municipality's initial efforts to identify critical areas of the systems, coupled with the initial cleaning, assessment and replacement effort, formed a good basis for developing such a program.

To support the cleaning efforts, a set of standard job procedures were included since past practices were unsafe and unhealthy.

Organization of the Municipality's Wasewater Section was reviewed and a plan to revise and to streamline operations and to reflect more accurately the types of services and levels of effort required was included with an organizational chart and associated job descriptions.

Operation and maintenance activities were poorly recorded. A maintenance management system, including work records and equipment maintenance records, was recommended. In addition, basic information managemnt capabilities, including accurate mapping and physical surveys of existing systems, was also suggested.

Training of staff at all levels was required. Therefore, a technical training approach based on standard operating procedures was recommended to promote better operation and maintenance practices. Management training, combined with an improved management system, will result in better, more effective use of equipment and labor.

The Operation and Maintenance Planning Report provided the basis for devolping an effective program to implement an O&M Plan properly and successfully. It is noted that in the long run, an effective program of O&M will require renovation of the existing system based on extensive engineering studies, design, and new construction.

At the end of the Gaza Wastewater Project's Phase 1 activities, the most critical issues and steps that remained to be addressed were:

- Physical works - sewage pump station rehabilitation, upgrading and expansion coupled with construction of new force mains and modification of the existing force main system.

- Sewerage systems - eliminate combined sewers, stop pump station overflows to the storm drain system (see physical works above) and overall keep sewage out of the storm drains.

- Sewer maintenance - take strong steps to keep sand and debris out of the sewer systems by street cleaning, inlet modification, routine sewer cleaning and city ordinances to eliminate and prevent future misuse of the systems.

- Sewer capacity - based upon a comprehensive analysis and design replace overloaded, improperly designed or constructed lines and provide sewers in unsewered areas and areas still subject to storm water flooding; eliminate untreated sewage flow to the near shore sea areas.

- Institutional and organizational - develop an immediate and on-going training program to reach staff and management regarding operation and maintenance procedures; develop and enforce a program to ensure legal connections and revenue collections; develp and carry-out employee and public safety procedures; and develop a more effective organizational structure and internal procedures.

In moving from a series of reactive O&M actions to a coordinated, proactive O&M Plan with an effective preventive maintenance component, the Municipality must develop the institutional resources and management abilities to support the program to ensure success. The key components of a strategy to make this happen includes:

- Providing proper and adequate equipment
- Put in place an appropriate organizational structure
- Train the staff

- Provide effective management tools
- Create financial stability and community support

5.1.4 Procurement Plan

Through observations of the sewer problems in Gaza, the equipment available, and the skills levels of Municipality O&M staff a staged procurement was proposed. A list of appropriate equipment was developed, and technical specifications were prepared. The list included both emergency iems and items not considered urgently necessary but required for the ongoing needs of the Sewerage Department. Following approval of the emergency procurement list by the Municipality, the procurement process began. During this period a detailed Procurement Plan was developed for review by USAID. It was understood that the final details of both the emergency list and the intermediate list depended upon agreement with the Municipality based on their requirements and on the total funds budgeted for commodity procurement.

To address the obvious urgent needs of the Wastewater Section to immediately upgrade both routine and emergency cleaning capabilities for the sewerage and stormwater collection sytems, a set of emergency "fast-track" procurements were required. The focus of the procurements was on sewer cleaning equipment such as suction/vacuum trucks and sludge vacuum units; on support equipment such as loaders, dump trucks, generators and personnel vehicles; and on safety equipment such as protective clothing, gas detectors, air blowers and personnel harnesses. Also associated with those procurements was supplier-based training. Procurements initiated during the "Fast Start" period followed UNRWA procurement regulations but a waiver to the formal competitive bidding process was granted because of the emergency nature of the work. USAID also agreed to relax its regulations regarding the US source and origin of procurements made with US funds. This relaxation, combined with the need to secure reliable local service and spare parts assistance, resulted in all procurements being solicited from, and purchase orders being issued to, Israeli firms.

In conjunction with the emergency procurement, an initial list of intermediate procurement items was developed. The technical specifications for the intermediate procurement packages were completed by the Phase 1 Project Manger and the O&M Advisor. The actual procurement process for approved items began in March 1996 following consultations with the Municipality and continued through Phase 1. During procurement, UNRWA regulations were followed without the benefit of waivers to competitive bidding. These procurements were administered by UNRWA's Supply and Transport Department, in support of the program staff.

Some equipment suppliers were required to provide short-term training for Municipality staff as part of the equipment purchase. This requirement was mandated only for those equipment items requiring specialized knowledge of operation and safety procedures and those items with which Municipal staff were unfamiliar. The complete list for both emergency procurement and for the intermediate procurement

are in Appendix B, as approved by the Municipality and USAID. Due to the lengthy delivery times on some items, as the Phase 1 Grant Agreement period ended, October 31, 1996, UNRWA was still processing receipt of equipment from the intermediate list for turn over to the City.

5.1.5 Water Quality Monitoring Plan

In 1977, the Mayor of Gaza, Rashad Shawwa, initiated construction of a stormwater retention pond in Gaza City, Sheikh Radwan Reservoir. The reservoir is sited in a natural depression at the city's northern edge where runoff accumulates. The project was designed to recharge over pumped groundwater resources within the hydraulic limitation of stormwater storage, while irrigating nearby citrus groves with the surface water.

Gaza Strip in general, and Gaza City specifically, relies principally on groundwater for domestic and agricultural uses. The reservoir scheme was envisioned as a way to augment water resources. It was hoped that the reservoir could support recreational activities and serve as an aesthetically pleasing open space. An updated design concept suggested that infiltration wells drilled in the bottom of the reservoir would assist in infiltration of the stormwater. Plans called for 8 wells, 1 m in diameter and 28 m deep, to be dug for groundwater recharge. These wells were never put in place.

Over the years, Sheikh Radwan Reservoir has gradually evolved into a de facto collection system for sewage overflows. This situation has arisen because sewage enters the storm drain system, mainly due to two conditions. First, illicit sewer connections have been made to the storm drain system. A steady contribution of household wastewater is conveyed to Sheikh Radwan Reservoir. This problem appears to be particularly pronounced in unsewered areas adjacent to the storm drain system. Second, blockages in the existing sewer system and pump station failures cause overflows which are conveyed on the surface or through the sub-surface storm drain system to the reservoir. This problem has been particularly acute during the rainy season when both wastewater and stormwater systems were overloaded.

The purpose of the GWWP is to improve wastewater and stormwater infrastructure in Gaza City to address the health and environmental problems related to these overloaded systems. Therefore, the Project included a provision for development of a systematic water quality monitoring program. This program was to assess the quality and levels of contaminants in the stormwater storage system, the sewae conveyed for treatment, the near-shore marine waters, and groundwater within the region of Sheikh Radwan Reservoir. The purposes of the monitoring program specified in the plan are threefold:

- to establish a baseline for evaluating the effectiveness of the various drainage and sewerage system investments

- to determine on an ongoing basis the quality of the stormwater to help measure the effectiveness of the project in reducing environmental contamination, and

- to provide information for evaluating stormwater run-off as a potential source of reclaimed water.

5.1.6 Sludge Disposal Protocol

Stormwater carries with it the surface contaminants of the watershed and, in some cases, the contaminants found in surchaging manholes; cesspits/septic tank ponding; illegal sanitary sewage and industrial waste connections; and solid waste from urban runoff. The quality of stormwater reflects the activities of the inhabitants living in the drainage area. Table 5.1 characterizes, in a general manner, the composition of the various types of sludge and solids associated with the Gaza City storm drain and sanitary sewer systems.

Table 5.1 Components of Various Wastewater Solids (by approximate composition)

	Sewage	Sand	Tile Dust	Garbage
Septage/cesspits	XXX	0	0	0
Pump station cleanout	X	XX	X	X
Sanitary Sewers	X	XXX	X	0
Stormwater collection system	X	XXXX	X	0
Stormwater reservoir	X	XXX	0	XX
Wastewater treatment	XX	XX	0	0

X represents estimated proportion of total volume, 0 represents minimal composition

For example, sand is a major contaminant in both the stormwater system and the sanitary sewers. Sand accumulating in the stormwater collection system reduces the hydraulic capacity of the lines and thus contributes to local flooding and, subsequently, to the inflow of stormwater into the sanitary sewers. This process can often be seen when residents of a flooded intersection remove the manhole covers of the sewers to drain the intersection. In such instances, a cross-connection occurs between the stormwater collection system and the wastewater collection system, resulting in an increased sediment load to the sanitary sewers, lift stations, and the wastewaer treatment plant.

Better options for disposing of sludge should be investigated. While landfill disposal is relatively easy to manage, landfill space that is necessary for proper disposal of municipal solid waste is consumed. With proper stabilization of sludge prior to disposal, some of the material could be used as a fertilizer for nondirect food chain

crops and trees and lawns, as well as used as fill for landfill reclamation. A public education program should be developed and implemented as soon as possible, so that the citizens will not oppose or delay progress toward improving the performance of the systems.

The sludge Disposal Protocol calls for special handling provisions and sludge disposal at a dedicated area within the existing Municipal solid waste disposal site. The head of the Municipality's Environmental Health Depatment which is responsible for solid waste dsposal has indicated his willingness to set up such an area. Specific procedures for sludge handling were included as part of the contract provisions for the sewer cleaning contract. The Sludge Disposal Protocol was developed under separate cover for use of the Municipality, any contractors working on sludge collection or disposal, and for application, as appropriate, to the subsequent phases of the larger scale GWWP.

5.1.7 Standard Operating Procedures and Project Guidance for Sewer Cleaning and Inspection

In accordance with the Scope of Work and the Service Performance Requirements of the Tender for sewer cleaning and inspection of the Municipality sewerage system a number of guidance documents and standard operating procedures were required to be developed to assist the contractor in successfully completing the somewhat complex scope of work. Nothing like the scope of work proposed had ever been initiated in Gaza or carried out by any of Gaza's contractors. The following guidance documents were written to allow effective implementation of the sewer cleaning and inspection contract. However, a secondary, and possibly more important benefit that derived from the effort was that the guidance documents could be used by the Municiality in any ongoing or future sewer cleaning and inspection activities and for routine operation and maintenance. The guidance documents were as follows:

- Safety Plan for Sewer Cleaning and Inspection
- Quality Control Plan for Sewer Cleaning and Inspection
- Record Keeping and Reporting for Sewer Cleaning and Inspection
- Handling and Disposal of Waste Materials

Each of the standard operating procedures that was published was a stand-alone document. They each contained descriptive text, diagrams, and forms in enough detail to allow most readers to pursue the procedure to its logical end point. The standard operating procedures (SOPs) developed for the sewer cleaning and inspection effort were as follows:

- SOP for Sewer System Physical Survey
- SOP for Sewer Cleaning
- SOP for Manhole Cleaning

- SOP for Manhole Inspection
- SOP for Sewer Inspection and Assessment

5.2 Construction

The original plan to activate the "fast start" strategy of the project, knowing that the recruitment and hiring of permanent international staff would take several months, was to obtain the services of short-term consultants who could be on the job in a matter of weeks, if not in days. The first members of the project staff were fielded early in the second quarter. This staff consisted of short-term consultants who had been recruited through the Environmental Health Project (EHP), under a contract arrangement with USAID, to act in an interim capacity on the project until permanent staff could be recruited and hired.

The critical element driving the emergency phase of the "fast start" strategy was the knowledge that the rainy season in Gaza begins in mid-November to early December. Since the Interim Project Manager did not arrive in country until 7 October this meant that instead of having approximately 13 to 15 weeks to accomplish the work required to alleviate flooding in the City, the short-term consultants were faced with doing the work in 6 to 8 weeks. In spite of this halving of time available before the rains started, the short-term consultants were able to take specific actions which temporarily resolved some of the most urgent flooding situations.

Three priority jobs were identified by the Gaza City Mayor in a meeting held at the Mayor's office in mid-October 1995 and attended by UNRWA and USAID representatives. These jobs and emphasis on contracts with the Municipality drove activities during the second quarter. The three priority jobs were:

1. To do all the necessary work to put the non-functioning pumping station at Sheikh Radwan stormwater reservoir back into operation. This reservoir, which receives most of the city's stormwater flows, is the lynch-pin to the city's stormwater drainage system. If the pumping station does not function, the low-lying zones of the city become flooded.

2. To excavate the natural stormwater drainage pond on the Waqf land at Asqoula/Zeitoun to provide temporary storage capacity for stormwater and to install a pumping system to dewater the pond, and

3. To alleviate the sewage flooding along Mansoura Street. This work required the procurement of sewer cleaning equipment on an emergency basis.

Brief descriptions of the work performed at these sites, and the additional major construction activities undertaken during Phase 1, are presented below.

5.2.1 Sheikh Radwan Reservoir

Three separate service contracts were let for work related to rehabilitation of the inlet sructure of the pumping station. The purpose of the first contract was to unearth the inlet pipes which were estimated to be buried under more than 5 meters of overburden. Execution of the contract confirmed that the inlet pipes were buried to that depth. The first contract was awarded to General Construction Company on 24 October 1995 and completed on 28 October 1995. The total cost was $17,000.

The purpose of the second contract was to remove the large mounds of earth blocking the entrance to the inlet pipes and to place the excaveted material along the sides of the reservoir. The contract was awarded to General Construction Company on 5 November 1995 and completed on 13 November 1995. The total cost was $36,000.

The third contract had three separate, but related work items. The first was to construct a reinforced concrete retaining wall and mat around the ends of the inlet pipes. The second was to extend the inlet pipes by welding a riser pipe and bar screen to the ends of the inlet pipes. The third item was to stabilize the soil on the slope bank above the inlet pipes to control erosion. This contract was awarded to General Construction Company on 21 November 1995. The start of work was delayed due to the heavy rains which flooded the work site. Work was completed as soon as the physical conditions at the site permited. The cost of the contract was $32,200.

UNRWA entered a contract with Gaza Municipality to remove, repair, and reinstall the two pumps at the stormwater pumping station. This work was completed in time to start pumping stormwater, which accumulated during the first heavy rains and continued to pump stormwater during subsequent storms.

The two vertical turbine pumps at Sheikh Radwan reservoir were removed, dismantled, motors rebuilt, shafts rebuilt or replaced, reassembled, and re-installed. The 50' deep wet wells were mucked out by hand. Some 10 cubic meters of sand and debris were hauled up a bucket at a time. The three 20" diameter inlet pipes which were also filled with sand, were jetted clean.

The regular daytime sewer crews worked overtime every night until 10:00 p.m., over a period of more than 3 weeks, in order to put the pumping station in working order before the heavy rains arrived. They were succesful in their mission and were applauded for their extra efforts. This work was carried out through a contract with the Municipality for a total cost of $41,000.

Final remedial modifications were made to the inlet pipes when "flap-gates" were added to allow better management of the water level in the reservoir. Also, an access stairway and service platform were constructed to provide employees a safe location from which to clean the intake screens and to open or close the inlet flap-

gates. Additional safety precautions were taken by constructing a hand rail along the top of the slope stabilization area. These tasks were contracted for $7,520.

A contract was signed between UNRWA and the Palestinian Energy Authority to provide a permanent power source from the PEA network to the stormwater and sewage pumping stations. Costs were shared on these electrical connections and the Project cost was $50,000.

In order to increase the storm water management capability at the reservoir contracts were let for sludge removal from the sedimentation basin at the inlet headworks to the reservoir. Approximately 4,500 m^3 of sludge were removed, placed in temporary drying beds, and transported to the Municipal landfill. Most of the dried sludge was placed in designated areas separate from the areas where public dumping was occuring. Total contract costs for the excavation and disposal of sludge were $45,758.

Because of the rather large amounts of sewage flow into the reservoir caused by pump station overflows, manhole surcharging and illegal connections to the storm drains, two separate contracts were implemented to construct three sewage dry-weather flow diversions. These efforts cost $24,500, and will eliminate most of the sewage flowing into the reservoir. One last short term effort to improve the storm water management capacity of the reservoir was a contract to clean the small sand trap at the end of a 24" storm drain directly to the reservoir. Another contract provided for extension of the sand trap storm drain outlet to help prevent erosion of the side slope of the basin. These tasks cost approximately $14,000.

The Muncipality was contracted with to improve the public's security and welfare through the repair of the fence around the perimeter of the reservoir and the sedimentation basin. As part of that effort warning signs were posted on the fence about every 100m. The signs warned of the dangers to the public and requested that no debris be dumped into the fenced area.

The total amount of funds spent on restoring Sheikh Radwan Reservoir as a major factor in managing Gaza's storm water runoff and in improving the quality of water flowing into the reservor, was about $269,000.

5.2.2 Waqf Land/Asqoula Pond

The Waqf Land was excavated to provide over 30,000 cubic meters of storage capacity for stormwater flowing into the newly created pond. A fast-track purchase order was made to procure two dewatering pumps to withdraw stormwater from the pond, and a contract to install force mains to discharge the stormwater into the main stormwater culvert on Port Said Street was awarded.
The excavation cost approximately $70,000, while the installation of the twin force mains cost over $51,000. Partial fencing cost about $18,000.

Because the quantity of the excavation was underestimated, not all of the area could be excavated under the first contract. A second contract was written and awarded. The new contract was to provide for excavation of another 12,000 m^3 and to extend the pond. The security fence around the pond was to be completed under the new contract, also. These activities and the contract were cancelled at the last minute due to objections from the Waqf Land Authority. After meetings with the Authority, the Technical Coordination Committee, the contractor and the Mayor, the Mayor requested, and USAID agreed, that the contract be cancelled since no one could foresee a short term solution to the objections of the Authority.

Even with this cancellation of "final" Phase 1 activities, the Waqf Land area now has the capability to manage a much greater amount of storm water runoff than previously. Also, the pond has a less than satisfactory "security" fence with some signage to warn trespassers. Total costs for the Waqf Land/Asqoula Pond remedial activities was over $141,000.

5.2.3 Storm Drain Cleaning

Flooding along Jaffa Street due to blockage of the storm drain was a major problem during past rainy seasons. To solve this and other storm drainage problems, UNRWA entered into a contract with Gaza Municipality to utilize their staff to clean the storm drainage system. Through this contract, 1200 meters of drains were cleaned along Jaffa Street and to the main drainage culvert located along the extension of Port Said Street. As a result of this effort, there was no blockage-related stormwater flooding along Jaffa Road during the rains in November or December 1995.

Plans were developed early for cleaning the main culvert but the work could not begin until the necessary cleaning equipment and safety gear for the work crews were on hand. The general plan to clean the stormwater drainage system was based on packages developed by the Municipality. After receiving the emergency procurement package consisting of cleaning and safety equipment, the City with about 50 laborers, formed crews to clean about 550 m of the storm drain (box culvert) manually, and the larger new box culvert with a small skid loader. Total length cleaned was about 2.5 km. The removed sludge was hauled to the municipal landfill for disposal. During the cleaning activities a number of illegal sanitary sewers were observed connected to the storm drain. A map was prepared and provided to the city showing the locations of the illegal connections. Total cost of the storm drain cleaning was over $81,000, not including the equipment provided to the city under the emergency procurement.

5.2.4 Sanitary Sewer Cleaning and Assessment

As with the stormwater drainage cleaning program, the sewage collection system cleaning program was modeled on the preliminary work planning packages prepared by the Municipality. These packages envisioned cleaning, inspection and rehabilitation being taken forward as a single contract for 39 specific streets in the A-1

and A-2 areas. In reviewing this strategy, it was agreed between the Municipaltiy and UNRWA that the work should be separted into a cleaning and inspection phase followed by a rehabilitation and repair phase. This strategy allowed the rehabilitation and repair contract to be based somewhat on information developed from the cleaning and inspection phase.

Alleviating the sewage flooding on Mansoura Street was identified by the Mayor as one of his top three priority emergency jobs. Due to errors in the design and construction of the sewers serving this street, the sewer repeatedly overflowed throughout the year, including during the dry season. To address this problem the project ordered a combination jetter/suction machine on a fast track procurement order. The cost of this unit was $135,000. This combination unit was delivered to the Municipality on 30 November 1995 and was put into operation on 5 December 1995. Delivery of this unit essentially doubled the Municipality's capacity for sewer cleaning. This unit was used, not only on Mansoura Street but, throughout the City as needed.

Following crew training, work began on the Mansoura collector on Bassatine Street. The network of sewers between Pump Station 7 and the intersection of Salah El Din Road and Mansoura Street contains 33 manholes and over 1,100 m of sewers ranging in size from 400 mm to 750 mm. The Municipality crews cleaned this reach over a period of 8 days. The entire reach was actually cleaned five times because of heavy solids loading, hydraulic overloading, and sand deposits created by the storm water flooding which occured in this area with each storm. An additional 330m and 10 manholes on Jaffa Street were cleaned three times, and 364 m and 16 manholes on Om El Lamon Street were cleaned five times. In addition to emergency work to remove blockages, the jetter worked a total of 100 hours, or 63% of the available time, on routine maintenance work. In conjunction with the cleaning process, a system of advance planning and scheduling, and preparation of daily reports was started.

While Municipality staff began the process of implementing a routine sewerage system O&M program, there was constant pressure to divert the vacuum/jetter unit to address emergency problems. These needs resulted in significant disruptions to the routine work during December 1995. These disruptions can be expected during any rainy season.

In order to move the larger sewer cleaning effort forward the Municipality requested UNRWA to fund the cleaning and inspection work. In December, UNRWA advised that funds could not be provided directly to the Municipality for this work. The emergency arrangements used previously by UNRWA to fund the stormwater drainage and pump station cleaning and repair contracts were not available. To comply with UNRWA's regulations, competitive bidding for cleaning and inspection services had to occur. UNRWA allowed the Municipality to participate in the bidding process.

It was agreed that UNRWA would advertise for pre-qualification submissions from private sector contractors for the main sewer cleaning and assessment contract in areas A1 and A-2 for cleaning and inspection of about 37 km of sewers. It was further agreed that, should no qualified private sector contractors be identified, the Municipality could be contracted directly. Should qualified contractors express interest in competing for the contract, it was agreed that the Municipality would be permitted to compete.

It was made clear that should the Municipality compete, it would have to do so on the same basis as any other contractor. Should the Municipality win the contract, it would carry out its obligaions under the contract solely as a contractor, and not as a client or beneficiary. All decisions on site would be made by UNRWA. Furhtermore, the Municipality would have to meet all the obligations required of other contractors, including bank guarantees, and would be subject to penalties as would any other contractor.

Advertisements were placed in the main Arabic newspapers in West Bank and Gaza during the last week of January 1996. Responses were received from seven contractors, four of which were considered qualified to submit tenders. Invitaitons with tender documents were distributed to these qualified contractors and to the Municipality in late March.

The sanitary sewer cleaning and assessment tender for areas A1 and A2 was accepted on June 2, signed and mobilization started through a Notice to Commence sent to the contractor on 19 June. The Contractor's mobilization ran from 4 June through 4 July. Time for completion of the work ran from 5 July through 17 October 1996. The final contract price was $744,092.

One of the most surprising and gatifying observations derived from the sanitary sewer cleaning and inspection activity was that overall the existing domestic sewer system of Gaza is in fairly good physical shape, once the sand is cleaned out of the sewers and manholes!

Five copies of the Final Assessment Report, were turned over to the City along with the actual video tapes of sewer inspections; diskettes for the physical survey, daily field reports, manhole inspection reports and both priced and unpriced bills of quantities; rehabilitation work plans for pipelines and manholes and the report text; and all work related photographs. Additionally, as a result of this effort the City was able to gain experience and benefit from all of the published standard operating procedures and quality control and safety guidelines.

The Assessment Report includes discussions on performance productivity, rehabilitation strategies, construction factors and conclusions and recommendations to assist the City in future rehabilitation endeavors.

5.2.5 Sewer Replacement

As part of the Phase 1 activities UNRWA was to administer contracts for construction totaling $1,500,000, including replacement of up to 5 km of sewer. The construction of replacement sewers was for an amount not to exceed $265,000, which was the approximate amount of remaining budget funds after all of the other construction tasks were completed.

The tender documents and contract were written to be administered on the basis of the unit prices incorporated in the Bill of Quantities up to the maximum available funds. Eight contractors were invited to submit propsals for the contract. The contractors were selected because they were listed on the Municipality's "A" list of contractors, and were UNRWA's top rated contractors for water and sewerage related works. All of the eight obtained the tender documents. A pretender conference was held on July 24 and seven of the eight potential bidders participated.

Five contractors submitted bids. The lowest bidder, General Construction Co., quoted $337,000 for completion of the work contained in the bill of quantities, which was for the 5 km of sewers plus manholes, street repairs, etc. Based upon the tenders submitted, the available funds made it seem likely that approximately 3.8 km of sewers could be replaced

The contract was signed August 11th and the "turning over notice" was sent to the contractor immediately so that construction could begin anytime after August 26, as soon as materials were delivered.

Hostitities broke out between the Israelis and Palestinians at the end of September and early October resulting in tighter controls and restrictions at the Erez checkpoint. Accordingly, materials were difficult to obtain in Gaza and delayed the start of some works.

Eleven streets were identified by the City as priority for sewer replacement with from 50 m up to 1,100 m of pipeline and accompanying manholes planned for replacement. Due to the time available to fully implement the replacement work only 1,820 meters were constructed of the potential 3.8 kms possible through the contract.

The sewers to be replaced, approved by the Municipality in priority, were as follows:

Street Name	Length	Diameter of Pipes	Remarks
Sheikh Radwan	580	10"	Priority No. 1
Ayyad (Souk)	160	10"	Priority No. 4
Wadi El Arayes	138	8"	Priority No. 1
Sahouyn	180	8"	Priority No. 5
El Louh	300	8"	Priority No. 7 (cancelled)
Ullayyan	150	8'	Priority No. 6 (cancelled)
Abu El Araneb	158	8"	Priority No. 1
El Shama'	215	10"	Priority No. 3
El Nadi	850 300	8" 10"	Priority No. 2 (not finished)
Bakroun & Foukhir	450	8" and 10"	Priority No. 3 (not finished)

5.3 Commodity Procurement

The Project Paper identified the urgent need to augment the Municipality's ability to clean the stormwater and sewerage systems. To accomplish the first step towards equipping the Municipality to carry out sewer cleaning and maintenance, a comprehensive procurement strategy was developed. This strategy divided the procurements into three stages. The strategy, detailed below, also supported the approach proposed for the O&M services.

5.3.1 Emergency Procurements

The first stage, or "emergency" procurements focused on providing the Municipality with some immediate support to address emergency sewer cleaning issues. Gaza Municipality prepared and submitted to UNRWA an emergency procurement list of eight items. The EHP short-term procurement consultant worked with the Municipal staff and developed an expanded list consisting of 13 specific items plus worker safety equipment, mechanics' hand tools, and mechanical spare parts for pumping station equipment.

items plus worker safety equipment, mechanics' hand tools, and mechanical spare parts for pumping station equipment.

This initial procurement group, valued at approximately $1 million, focused on cleaning equipment (vacuum trucks, jetters and dewatering pumps), support equipment (loaders, excavators, generators, dump trucks and personnel vehicles) and safety equipment (gas detectors, air blowers and safety clothing). Fourteen separate technical specification packages were developed which covered all items. The emergency procurement packages were approved by the Municipality. Complete tender packages were finalized in early November, and UNRWA secured a waiver to competitive bidding.

The process to obtain at least one responsive quotation for each package began on 12 November 1995, and was substantially completed by 14 December 1995. UNRWA's Supply and Transport Department began issuing the purchase orders on 28 November 1995. Of particular concern was the inability to locate suitably-sized dewatering pumps for use with the Waqf Land pond system. The local, Israeli and European markets were contacted, and suitable units were eventually located in Israeli customs. The pumps were purchased, matched with diesel engine power sources, and were prepared for delivery to the Municipality in early January 1996 for use with the Waqf Land pond and force main system.

Problems with identifying a qualified local source for the residual items, not mentioned above, were resolved slowly. Most of the items listed on the emergency procurement were delivered to the city during the third quarter of the Project. Those items which were not, were delivered during the fourth quarter except for the dump truck and vehicle spare parts. The emergency vehicle spare parts and the dump truck were received during the fifth quarter.

The final emergency procurement list and approximate final unaudited costs are shown in Appendix B.

5.3.2 Intermediate Procurement

The second group, designated "intermediate" procurements, focused on the fact that further equipment and spare part needs existed in the Municipality, and that the experience with the first group provided the Municipality with a basis for setting priorities for additional equipment needs; equipment types, quantities and technical features were more easily justified following the emergency work. The work undertaken in October through December focused primarily on the emergency procurement activities. The original list of equipment identified in the project paper and that requested by the Municipality were reviewed and revised as required and detailed specifications were developed for each of the agreed upon items. Modifications for most items on the list were completed by April 1996.

Based upon the equipment supplied through the emergency procurement, and a review of the entire intermediate list with the Municipality, all of the specifications for the intermediate list were rewritten, updated and issued during April and May 1996. Bills of Materials were issued for most of the listed items in early June. Based upon the urgency of needs of the City some intermediate items were processed for local procurement which expedited delivery to the City.

Computers and computer program software, portable offices and safety equipment were delivered during July and August. Mobile generators and sewer detection equipment were delivered during September. All of the vehicles will be delivered through UNRWA after the Grant expiration date. The suppliers specified delivery dates of from 4 months to 6 months after signing the purchase orders. That meant that delivery to UNRWA could be as late as March 1997; likewise with all of the items tendered in July and with offers received, evaluated and purchase orders issued in October. The proposals by tenderers specified up to five months FOB, which put delivery to UNRWA approximately March 1997.

The current status, as of the publication of this report, is shown in Appendix B. UNRWA will continue to follow each item until delivery and turn-over to the Municipality.

5.4 Special Assistance

One of the extra benefits that should be derived from a project such as the GWWP is that the recipient of the grant aid, in this case the Municipality of Gaza, receives miscellaneous assistance from the consultants and contractors. The topics discussed below are just the highlights of a few of the extra benefits which accrued to the City through the GWWP.

5.4.1 Wastewater Reuse

Because of the Municipality's concerns regarding the need for consideration of wastewater reclamation or reuse, the consultants were requested to review a facility existing near the City's waste treatment ponds.

The Municipality's existing waste treatement works was originally constructed in 1977, and consisted of two ponds. A UNDP project increased the capacity between 1985 and 1989 when two additional ponds were added, among other facilities. In 1996, UNRWA carried out a renovation project at the treatment works that would not result in additional capacity, but increased the degree of treatment.

The UNDP upgrade project included the construction of reuse facilities along the City's old force main. These reuse facilities have three components:

- One 5000 m^3 storage reservoir which overflows to three infiltration basins.

- A booster pumping station with four 12" pumps.

- An irrigation system comprised of several 4" taps from the force main downstrem from the booster pumping station. These taps terminate at orange groves on both sides of Salah El din Street.

The 5000 m^3 reservoir can be filled via a pressure line branching off the old force main. A valve downstream of the branch has to be closed during the filling operation. The overflow from the 5000 m^3 reservoir is piped down to the infiltration basins. The embankments of the basins have been stabilized with concrete, while the beds seem to consist of sand layers. The reservoir can be drained back to the force main. This draining procedure is accomplished by opening the valve that was closed to fill the reservoir.

While the treatment ponds must be improved greatly to improve the effluent quality, the effluent is a good potential source of water for irrigation. It is likely that the local farmers would be agreeable to purchase the treated wastewater to offset the Municipality's O&M costs.

5.4.2 Pump Station Operation and Maintenance

On many separate occasions the consultants were requested to assist the City in conducting reviews of various pump stations and to make recommendations for actions to be taken. By far the most helpful effort was the reveiw by the Pump Station O&M Specialist. He conducted an assessment of the pump stations and force mains. The resultant report recommendations were used to scope much of the emergency program and to establish a foundation for longer term upgrading, O&M management planning and training related to the City's pump stations.

5.4.3 Employee and Public Safety

With implementation of construction and cleaning contracts by UNRWA came an increased awareness of the need for improved safety precautions. The Safety Plan for Sewer Cleaning and Inspection brought to Gaza a set of guidelines and concepts which had never been implemented previously. Both through the work of the Municipality's staff and the contractors, procedures were put in place for vehicle driving, manhole entry, traffic control, pipeline cleaning and inspection, storm drain cleaning and pump station O&M. These will assist the city from this point forward. As a result the City's employees and the public should be more safe from potential accidents.

5.4.4 Training

In conjunction with equipment arrival, supplier-based training for Municipality staff began. Most of the procurements have come from Israeli sources, but travel restrictions resulting from closure of the Gaza Strip have prevented Municipality staff from being trained at the supplier's facilities in Israel, nor have

Israeli trainers been permitted to enter the Gaza Strip to conduct training sessions. Training for the jetter was accomplished by sending one senior Municipal staff member to Israel in November 1995 for training; he, in turn, returned to Gaza to train the rest of the local staff on 6 December 1995.

In January 1996, the Pump Station O&M Specialist conducted a one day workshop for pump station operators that included topics such as record keeping, scheduling, routine maintenance and safety practices.

Upon delivery of the sewer inspection TV equipment the supplier conducted a 4½ day seminar for Municipality and UNRWA local staff members. About eight technical staff and engineers were provided the training which included how to implement a TV inspection program, the procedures to use to conduct an inspection, record keeping, interpretation, and application of the results as a part of sewer maintenance and rehabilitation.

Following receipt of the sewer detection equipment, training was conducted for the Municipality wastewater system staff by the supplier. The training was conducted over a three day period and included techniques on the use of metal detectors, plastic pipe detection, use of sonde instruments, and interpretation of the detection data.

To assist the City in upgrading the construction services provided by the local contractors a ½ day contractors' workshop was held. The Project staff conducted the workshop based upon the video results of the sewer inspection work. Defects in sewer construction were discussed, as were the recommended corrective actions to be taken and the procedures used in conducting sewer inspections as applied to assessments of new construction.

6.0 FINAL UNOFFICIAL FINANCIAL ALLOCATIONS

The April 3, 1996 Grant Agreement Amendment authorized $5,924,000 to be expended on the GWWP Phase 1 activities. The allocation was as shown in Table 6.1 below:

Table 6.1
USAID GWWP Phase 1 Grant

Grant Activity	Allocation
Project Support	$568,286
Logistical Support	$435,714
Construction	$1,500,000
Procurement	$2,800,000
Technical Assistance	$620,000
TOTAL	**$5,924,000**

6.1 Staffing and Logistical Support

The $620,000 for technical assistance was administered directly by USAID through a direct contract with the Environmental Health Project and an American consulting firm. These funds supported the international short term consultants, advisors, specialists and project managers assigned to UNRWA for Phase 1. The remaining budget allocation of $5,304,000 was administered by UNRWA, according to the distribution of funds shown in Table 6.1 above.

The $1,004,000 were allocated to the mobilization, logistical support and procurement of equipment and supplies that UNRWA needed for the conduct of the Project and funds which were used to fund UNRWA's local staff costs, international staff costs, mobilization costs, operating expenses, supervision, management, legal, procurement, and administration support costs. The unaudited Phase 1 budget detail is shown in Appendix D. Final actual distribution of costs will not be known until all of the final invoices are approved and recorded. The figures in Appendix D were prepared by the program staff and are not official UNRWA Finance Department, Budget Office or Controller's figures. Those numbers will be developed after the end of the Grant period and records are finalized.

6.2 Construction

The Grant specified that the Phase 1 funds ($1,500,000) allocated toward construction would be used as follows:

"Urgent short-term actions will be financed under Phase 1 and carried out over the period through October 31, 1996. Sewer cleaning will be undertaken on about 40 kilometers (km) of sewer line in area A-1 and A-2, and approximately five km of existing sewer line in A-1 will be replaced. The materials removed from the sewers (largely sand and sewage) will be disposed of under the direction of UNRWA in the most appropriate landfill facility available. Also included in this activity will be emergency repairs and modifications to the Sheikh Radwan Reservoir and pump station, including the provision of a power supply and the Waqf Land storm drainage reservoirs."

Based upon program staff unofficial calculations funds from the construction allocation were expended approximately as shown in Table 6.2 below.

Table 6.2
Estimated Allocated Construction Expenditures

Description	Estimated Expenditure
Sheikh Radwan Reservoir	$270,000
Waqf Land	$142,000
Storm Drain Cleaning	$82,000
Sewer Cleaning/Inspection	$744,000
Sewer Replacement	$262,000
TOTAL	**$1,500,000**

6.3 Commodity Procurement

The amended Grant Agreement described UNRWA's role in commodity procurement as follows:
"UNRWA will procure equipment and supplies required for the Project by the City of Gaza based on the City's emergency and intermediate needs, as described below or in

workplans approved by USAID. Longer-term procurements required for the Project will be executed through mechanisms outside this Grant.
Training in the maintenance and use of commodities procured by UNRWA will be carried out under UNRWA supervision. Training in the maintenance and use of more sophisticated equipment, such as the jetting-vacuum trucks, will be included in the commodity procurement package and provided by the supplier.

Commodities to be procured include, inter alia, sewer cleaning and associated equipment (e.g., jetting-vacuum trucks, bucket machines, rodding, machines, front end loaders, excavators, pumps and hoses, etc.); occupational safety equipment and supplies; sewer inspection equipment; and miscellaneous tools, supplies and equipment. Shipping costs, equipment checks, and training support costs will also be funded under this element. All markable commodities procured by UNRWA under this Grant will be marked with the USAID logo. Equipment and supplies purchased by UNRWA for project utilization and support will remain the property of UNRWA."

The approximate final allocation of budget funds toward procurement of items to be turned over to the Municipality is shown below in Table 6.3. This does not include the rather extensive list of equipment to be turned over to the City by UNRWA from the logistical support portion (about $247,000) of the Grant. Included in this equipment are vehicles, office furniture and computers.

Table 6.3
Approximate Commodity Procurement Expenditures

Commodity	Estimated Cost
Vehicles and Heavy Equipment	$1,853,000
Sewer Cleaning Equipment	$471,000
Safety Equipment/Tools	$366,000
Computer Equipment	$80,000
Equipment Training	$30,000
TOTAL	**$2,800,000**

Of the above $2,800,000, approximately $936,000 was finally allocated to the "emergency list" while $1,845,000 was assigned to the "intermediate list". Some $31,000 was set aside for training Municipality staff in the use of the new equipment such as jetters, detection equipment, inspection equipment and surveying.
The final list of equipment for both emergency and intermediate procurement is in Appendix B.

7.0 SUMMARY AND CONCLUSIONS

In 1993, USAID retained the Center for Financial Engineering and Development (CFED) to carry out a diagnosis and recommend a straegy for resolving the stormwater drainage problem. The CFED study, "Assessment of the Gaza Stormdrain Project" concluded that "AID should take a proactive leadership role in guiding the stormdrain project to completion, but should not fund further construction until the sewerage system is operating at a level that ensures sewage no longer enters the stormdrain network." For USAID, the CFED study was a catalyst. The Israeli Civil Administration (CIVAD) provided $50,000 in funding to the City to survey the status of the stormwater system. USAID provided assistance to help the city assure quality control of the contractors performing sewage system inspection and lab tests. This work resulted in a Preliminary Engineering Study of Sewerage Problems Impacting on the Storm Drainage Project (Foundation International for Planning and Development: 1995) which concluded that to address the issues related to the storm drainage system and Sheikh Radwan Reservoir, a whole range of actions were required for repair and upgrading both the stormwater and wastewater systems in areas A1 and A2. In early 1995, based on the survey results, an action plan including cost estimates for immediate and short-term needs was developed.

An important event that took place in 1995 which impacted on the originally planned Project was the completion of planning documents to guide development of water, wastewater, and drainage programs and projects under the newly formed Ministry of Planning and International Cooperation (MOPIC). This Emergency Structural Plan for Gaza City: Assessment of Water Sewage and Solid Waste, completed with bi-lateral technical and financial support, identified seven Municipal wastewater and five stormwater issues that need to be addressed in the near term. These were:

- Wastewater treatment and wastewater reuse
- Sheikh Radwan sewage system
- Unsewered built up areas
- Existing pumping stations
- Sewage systems for the recently built up southern areas
- System mapping and operational data collection
- Improve operation and maintenance
- Sheikh Radwan Reservoir long-term role
- Illegal sewer connections to the storm drain system
- Flooding of the sewer system
- Catchment A stormwater drainage, and
- Sub-catchment depressions

This identification of issues, many of which have been addressed by the Phase 1 GWWP, and the availability of these planning documents allowed the Gaza Wastewater Project to be placed within the overall scope of a development plan created and agreed upon by the relevant Palestinian authorities.

As a result of the GWWP Phase 1 activities a number of the issues listed above have been addressed either completely or only in part due to the limited scope of Phase 1 compared to the magnitude of the problems facing Gaza Municipality.

1. As part of the sewer cleaning and assessment activity, a report was produced that included maps and descriptive information for portions of the sewer system that were cleaned and inspected. The report included a physical survey and descriptions of repair requirements and information relating to rehabilitation needs for these sewers. This information will be available for use during later Project phases which include the remaining planning studies and engineering design elements of the Project.

   One of the most surprising and gratifying observations derived from the sanitary sewer cleaning and inspection activity was that overall the existing domestic sewer system of Gaza is in fairly good physical shape, but sand must be kept out of the sewers and manholes!

2. Approximately 37 km of sewers in A1 and A2, ranging in diameter from 8" to 16" were cleaned and inspected. About 1,820 m of existing sewer lines were replaced to the extent that time allowed. A report detailing additional necessary repairs and needs for rehabilitation was completed. Mapping of the sewers included in the cleaning program was completed as a contribution to a sewer system database.

3. Sheikh Radwan Reservoir was made a functional part of the city's storm drainage system. A temporary stormwater collection pond built at Asqoula will help alleviate the worst of the flooding in this area of the City. In addition, the 2.5 km of storm drain box culvert along Port Said Street to the Sheikh Radwan Reservoir and approximately 1.2 km. of stormwater drain along Jaffa Street was cleaned and will provide draingage capacity not available in 1995 and before.

4. A preliminary Operation and Maintenance Management Plan, including a short-term action plan, was completed. In addition, a pump station and force main assessment report was prepared describing current conditions, needed improvements, required operation and maintenance procedures, and necessary training.

5. An extensive list of equipment deemed most necessary for the effective maintenance of the city's sewer and storm drain system was purchased and transferred to Municipal ownership and Municipality staff have been trained in proper care and operation of some of equipment. A total of $2.8 million of an original project equipment budget of $3.8 million was spent leaving $1.0 million for procurement identified during the later phases of the Project.

6. A Water Quality Monitoring Plan and a Sludge Disposal Protocol were completed. The Sludge Plan was used during sewer cleaning activities completed as part of Phase I. The Water Quality Monitoring Plan was developed for implementation during subsequent phases.

7. Gaza Municipality's system operation and maintenance capacity have been substantially strengthened through provision of direct technical support, training, provision of equipment and materials and the provision of operation and maintenance guidelines and "operating" procedures.

The various assessments and evaluations that were conducted as a part of Phase 1 produced a number of findings, some of which were resolved immediately. However, many of the issues were not resolved and part of the Phase 1 conclusions are that the following items must still be attended to:

- Inadequate attention to safety training and procedures
- Inadequate supply of electrical/mechanical spare parts
- Excessive quantity of sand entering the systems and the pumping stations causing clogging and damage to pumping equipment
- Lack of flow meters and pressure gauges for measuring pump performance
- General lack of back-up pumping units
- Inadequate force main system which limits the number of pumps that can be operated simultaneously
- General poor condition of most of the electrical/mechanical equipment and in some cases poor structural condition of the pump stations
- Inadequate pump control and alarm systems
- Excessive vibration at PS # 7A
- No records of pump/motor performance and duty cycles
- Lack of attention to housekeeping
- No documented preventive maintenance program
- No manufacturer's literature available for developing preventive maintenance schedule, ordering spare parts and analyzing abnormal operating conditions
- No mechanism for prioritizing system deficiencies, referral for corrective maintenance and follow-up/tracking of maintenance
- Ineffective organizational structure
- No formal training program for the development of management and O&M staff.

While these operation and maintenance issues remain to be resolved as Phase 1 concludes, and as important as they are to the successful, long term wastewater operation and management capacity of the Municipality, there exist many overriding issues which should be addressed urgently. The most obivious are described below:

1. Groundwater resources in the region are exposed to various types of pollution and damage, increasing their vulnerability and decreasing their potential for beneficial use. Groundwater aquifers in the Gaza Strip are already heavily overdrawn and suffer from salinization problems. As a result, the quality of the water in the aquifers has deteriorated considerably to the point where they no longer meet drinking water standards and are adversely affecting agricultural yields. Renewable reserves in the Gaza Strip are insufficient and fixed reserves have been seriously depleted, putting these aquifers at severe risk of permanent damage. Salinity is

increasing rapidly as withdrawals increase and can render groundwater unusable for most uses.

2. Discharge to the land of human and animal solid and liquid wastes, agricultural chemicals and industrial effluent represent major sources of groundwater pollution. Inappropriately sited, designed, constructed and maintained cesspools and septic tanks are additional sources of shallow aquifer pollution. Pollution of some shallow aquifers by nitrates due to fertilizer aplication constitutes a major risk for domestic requirements. The use of pesticides is also rapidly spreading but there are no precise data about the type of pesticides used and their adverse effects on ground water quality. Both inorganic and organic hazardous wastes may also be discharged which could seriously pollute the groundwater.

3. Poorly planned, poorly designed and undersized sewage and drainage collection systems present major health hazards in areas of overflow and system surcharging.

4. Discharges of raw and very poorly treated wastewater to groundwater, wadis, and the nearshore sea environments present major health hazards.

5. Most of the existing wastewater collection, treatment, and reuse systems were not developed as a part of an urban planning effort. Most of the systems were and continue to be built prior to any urban planning.

6. There are few industrial waste ordinances and no pretreatment guidelines to protect infrastructure investments and to permit maximum potential water reuse.

8.0 RECOMMENDATIONS

It is recommended that the Municipality of Gaza develop, adopt, and implement a comprehensive strategy for sanitary wastewater management and one for storm water management. Each strategy should include elements associated with sewer system operation, maintenance, rehabilitation, new area service and replacement; pump stations operation, maintenance, and expansion (new construction); financing and service rates; public awareness; and treatment, reclamation, reuse and disposal. However, in the short term the Municipality's most pressing problems are related to the sewage pump stations limitations, force mains lack of capacity and physical limitations to the treatment works and lack of quantity and quality sewage treatment capability.

Up grading of pump stations 1, 2 and 3 and construction of a new pump station 6A, will help tremendously to improve the city's ability to manage the quantities of sewage. Also, construction of a new force main from P.S. 6A to the treatment works and replacement of the 12" "bottleneck" with a 16" line will increase pumping capacity greatly. However, a comprehensive analysis of the amount of domestic and industrial wastewater produced from each of the various topographic and/or politically bounded areas of the city is an essential element of the planning to be done. Today the City does not know the quantitative magnitude of the quantitative problem that exists, nor can any valid projections be prepared to assess how much worse the problems might become, and when. It is recommended that these issues be addressed now, in parallel with the short term physical upgradings that are recognized as being needed now also.

Other broad ranging programs that are needed and are recommended for attention by the City and by the City's donors to the water/wastewater infrastructure improvement projects are:

- Development and implementation of a comprehensive groundwaer management plan that includes quality and quantity control, recharge enhancement, regulation, well standards, and public education

- Development, adoption and implementation of Wastewater Reuse or Reclamation Policy and implementation plans to optimize conservation of available storm waters and reuse of domestic wastewaters.

- Adoption and enforcement of municipal regulations to control within the city limits the placing of trash, sand, debris and construction materials to prevent these materials from entering the storm water and sanitary sewer systems.

- Adoption and implementation of a comprehensive management and staff training program for each element of the wastewater organization, including

but not limited to, operation and maintenance of the systems and pump stations, quality control, laboratory support, mechanical/electrical repair, vehicle repair, treatment plant O&M, water reclamation and construction. Further, training is recommended for the managers and supervisors, financial staff, meter readers, design engineers, surveyors, and computer operators.

- Development and implementation of "data base management" plan including records management, physical system data generation, quality of water data collection, data collation and analysis, data reporting and policies for data management.

- It is strongly recommended that more be done to affect comprehensive but detailed donor and Municipality coordination, communication, planning and funding of facilities improvements, operation and maintenance, new construction and training.

Two improvements and changes recommended in the short-term relative to the City's efforts to improve public health and to protect the water resources are elimination of the septic tanks and cesspits within the City by expanding the sanitary sewer system, and construction of a new wastewater treatment works with more capacity and treatment capability. The capacity should be based upon an analysis of wastes generated in the City and treatment capability should be based upon a scheme of maximum reuse for irrigated agriculture. Coupled with the above, it is recommended that all discharges of untreated sewage to the Mediteranian Sea be stopped as soon as practicable.

Detailed recommendations which resulted from Phase 1 project activities, evaluations and assessments are that the Municipality should:

- Institute procedures for controlling sand that gets into the storm sewers and manholes, and specify abrasion resistant internal pump components.

- Install flow meters and pressure gauges on all pumping station pumps and initiate routine recording of pump performance data and duty cycles.

- Institute improvements to pump control and alarm systems.

- Develop and implement a formal pump station preventive maintenance program and complete a daily station log which includes a record of maintenance performed.

- Implement upgrades to pumps, appurtenances, and structures on a priority schedule.

- Initiate use of the standard operating procedures for systems O&M, and establish a routine sewer cleaning schedule system-wide.

- Initiate use of a warehouse inventory and work order system to track jobs, spare parts and status of backup pumps.

- Follow-up on, expand and improve on recent steps to provide safety training and equipment provided to employees and institute procedures for maintaining safety records.

- Institute an on-going training program for development of management, supervisory and O&M staff using the procedures, guidelines and SOPs provided through this Project.

- Establish a formal O & M organizational structure with strict operating guidelines for staff and equipment assignments, personnel policies, position duty statements, reporting and accountability.

ACKNOWLEDGEMENTS

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The author of this report and Project Manager of Phase 1 from April 9 through October 31, 1996 was Thomas E. Bailey, P.E. assigned as special international consultant to UNRWA from the USAID funded Environmental Health Project in Arlington, Virginia, U.S.A.

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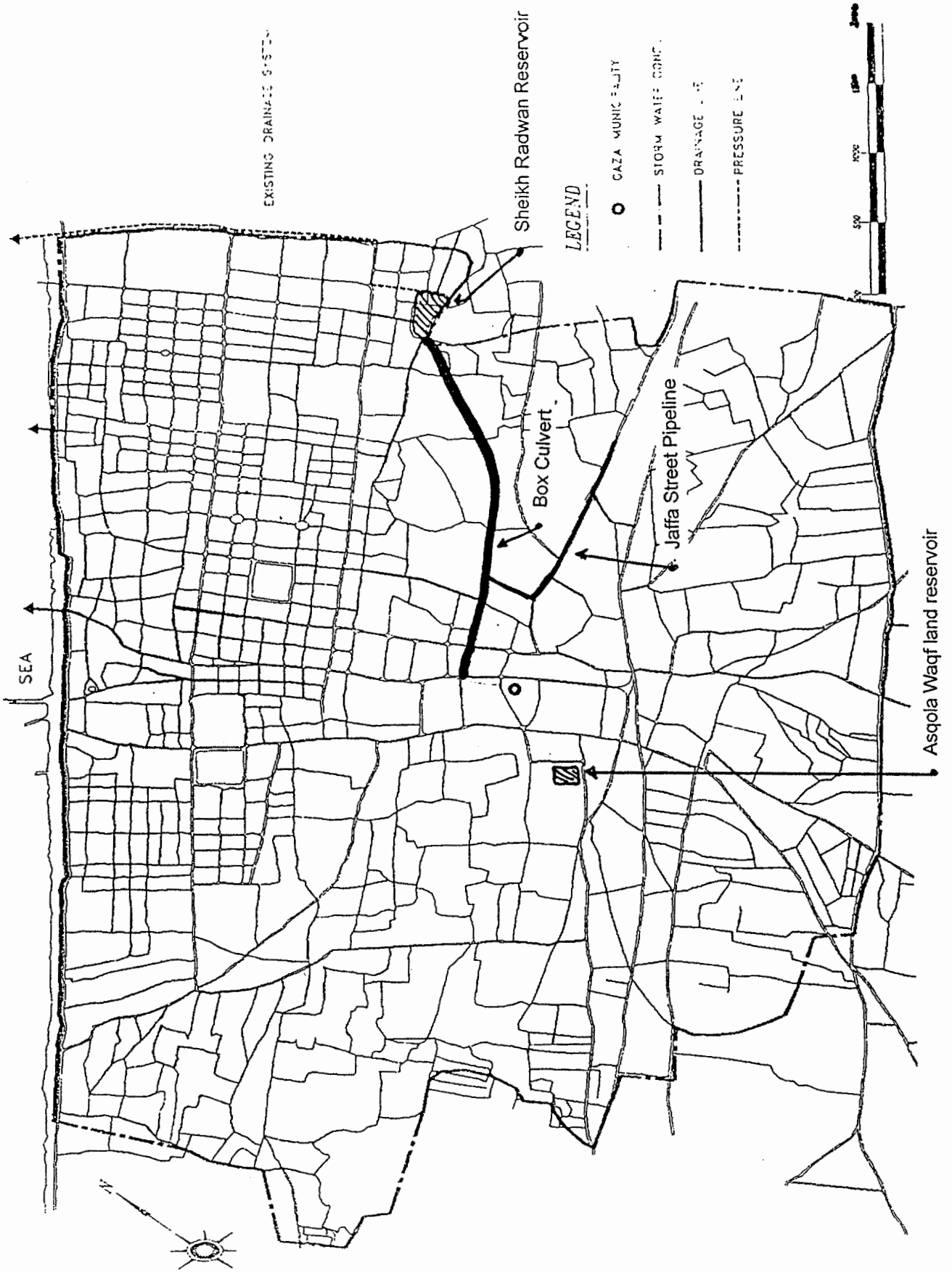
APPENDIX A

MAPS


MUNICIPALITY OF GAZA
بلدية غزة
GAZA CITY MAP
خريطة مدينة غزة
N
Tal Elhawa Area
Al Sheikh Ejleen Area
Alshati Camp Area
Almaser Area
Alsheikh Radwan Area
S. Remal Area
N. Remal Area
Tourist Information Centre
Al Sabra Area
Alzytoun W. Area
Aldaraj Area
Old City
Alzytoun E. Area
Alrimal W. Area
Alrimal E. Area
Alburkman Area
Alsudiya Area
To Rafah
To Beit Lahiya
To Beit Hanun
To Beit Sira
Old City
Fras Market
Pottery Shops
Palestinian Square
Taxis & Bus Station
Baptist Chapel
Ahli Hospital
Fahmi Baik
Porphyrios Church
K.Welayat Mosque
Gold Market
Great Umari Mosque
Latin Church
Salah Aldeen St.
El- Shajaia Market
Napoleon's Citadel
Samson's monument
Government Dept.
Police Station
Fire Brigade
Restaurant
Public Garden
Stadium
Bank
Parking
Built-up area
Industrial Area
Tourist Interest
Archeological Area
Hotel
Tourist Information Office
Main Road
Local Road
Beach
Hospital
Clinic
Mosque
Church
Cemetery
University
School
Post Office
Petrol
Cinema
SCALE : 0 50 100 200 300 400 500 meter
Date : April 1996

Gaza City Drainage Basins
indicating Areas A-1 and A-2

Source: Priority Projects Program for Gaza City 1996-(2000)



Existing Drainage System Gaza City

indicating:

Sheikh Radwan Reservoir, Asqola Waqf Land Reservoir,
Main Box Culvert, Jaffa Street Pipeline

Source: Priority Projects Program for Gaza City 1996-(2000)

Gaza City Sewage Pumping Stations and Pressure Mains

Source: Priority Projects Program for Gaza City 1996-(2000)

APPENDIX B

COMMODITIES PROCUREMENT

30-Oct-96

GAZA WASTEWATER PROJECT

Summary of Procurements

Emergency Package

	Emergency Items	Quantity	Estimated Unit Price	Estimated Total Price	Supplier	Quotation	Paid	Comments
1	Sludge/Vacuum Unit	1	$125,000	$125,000	Balotin Products	$113,400	$113,400	Delivered to Municipality on 14 February 1996
		LS			Balotin Products	$5,740	$5,740	Spare parts. Delivered to Municipality on 6.6.96
2	Jetter/Vacuum Unit	2	$140,000	$280,000	Balotin Products	$276,000	$276,750	First unit delivered to Municipality on 1 Dec 95; 2nd unit on 19/3/96
		LS			Balotin Products	$15,300	$15,300	Spare parts for first unit. Delivered to Municipality on 6.6.96
						$7,240	$7,140	Spare parts for 2nd unit. Delivered to Municipality on 24.10.96
3	Wheeled Loader	1	$180,000	$180,000	Palestinian Tractor/Caterpillar	$157,570	$157,570	Delivered to Municipality on 27 January 1996
		LS			Palestinian Tractor/Caterpillar	$6,929		***Spare parts (Purchase order issued). Expected delivery at the end of October***
4	Dump Truck							
	Chassis	1	$70,000	$70,000	Israeli Tractor/International	$45,500	$45,500	Delivered to city on 22.10.96
		LS			Israeli Tractor/International	$2,590		***Spare parts and lubricants for chassis (purchase order issued). Not received yet.***
5	Dump Box	1	$10,000	$10,000	El-Iy Company	$8,300	$8,300	Manufactured box received on 6.10.96
		LS			Wael Hassan Daoud	$810	$810	Services received on 27 Jan 96
6	Excavator/Backhoe	1	$80,000	$80,000	Palestinian Tractor/Caterpillar	$71,370	$71,370	Delivered to Municipality on 27 January 1996
		LS			Palestinian Tractor/Caterpillar	$3,583		***Spare parts (Purchase order issued). Expected delivery date end of Oct.***
7	Skid Loader	1	$33,000	$33,000	Waleed Ghazal/Bobcat	$19,000	$19,000	Delivered to Municipality on 27Jan 96
		LS			Waleed Ghazal/Bobcat	$2,670	$2,670	Delivered to Municipality on 4.2.96; and on 6.6.96
8	Trash/Dewatering Pumps	2	$15,000	$30,000	Balotin/Varisco	$45,000	$43,548	Delivered to Municipality on 27 Jan 96
		LS			Balotin Products	$6,475	$6,475	Spare parts delivered to Municipality on 27 Jan 96
9	Pickup Truck	2	$25,000	$50,000	Union Motors/Toyota	$35,740	$35,740	Delivered to Municipality on 5 May 96
10	TV Inspection Equipment	1	$20,000	$20,000	CUES Company	$33,421	$33,421	**Delivered to Municipality on 8 July 1996. Remaining s/parts not received yet**
11	Electric Generators	2	$10,000	$20,000	LADM/Ayerbc	$22,750	$22,742	***Delivered to Municipality on 5.5.96. S/parts not received yet.***
12	Air Compressors	2	$3,500	$7,000	Balotin/Assouline	$2,070	$2,070	Delivered to Municipality on 27 Jan 96
13	Worker Safety Equipment	LS	$14,000	$14,000	LADM/various	$28,050	$28,050	Delivered to Municipality on 4.2.96; and on 6.6.96
14	Miscellaneous Equipment							
	Sewer Plug Sets	3	$3,500	$10,500	LADM/Sava Kranj	$10,332	$10,627	Delivered to Municipality on 31 Jan 96
		LS			LADM/Sava Kranj	$1,758	$1,758	Delivered to Municipality on 6.6.96.
	Sewer Ventilators							
	Electric Motor-Driven	2	$2,000	$4,000	Balotin/Chicago Blower	$3,090	$3,179	Delivered to Municipality on 27 Jan 96
	Gasoline Engine-Driven	2	$2,000	$4,000	LADM/General Equipment Co	$2,880	$2,594	**Delivered to Municipality on 31 Jan 96. S/parts not received yet. 10 days delivery**
15	Spare Tires (Vehicles)	LS			Diyab Trading Co.	$8,545		Some tires delivered to UNRWA on 6.10.96
	TOTALS					**$936,113**	**$913,754**	
	ESTIMATED FINAL AMOUNT							
	PERCENT PROCUREMENTS PAID						**97.6%**	

Procure1

30-Oct-96

Intermediate Package

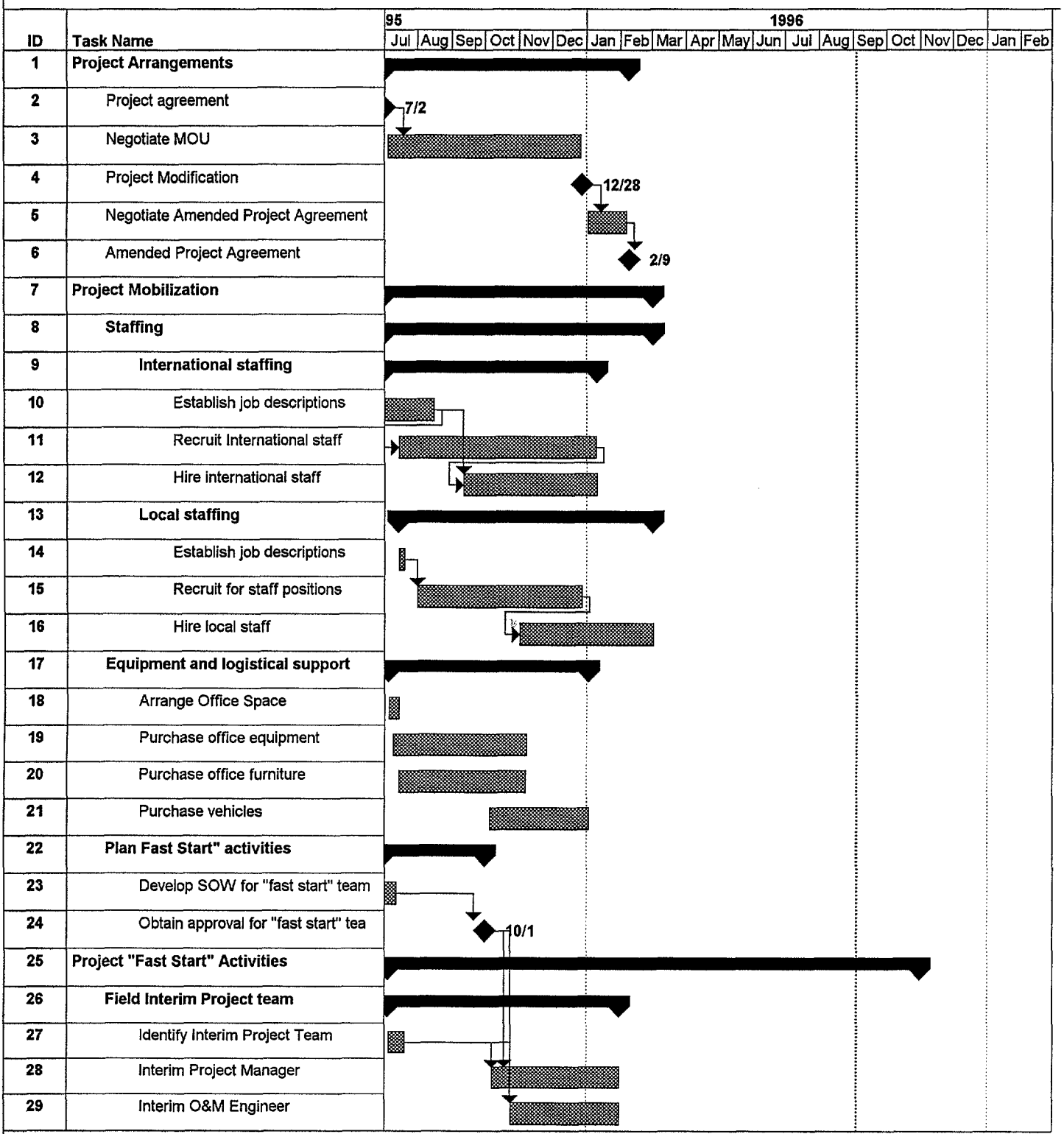
	Intermediate Items	Quantity	Estimated Unit Price	Estimated Total Price	Supplier	Quotation	Paid	Comments
1	Sludge/Vacuum Unit	4	$113,500	$454,000	Navister Inter. Trans. Corp.	$351,469		Purchase order PO6/00/3021/0095 including s/parts ($27,709) issued 25/9/96 Del Da
2	Jetting/Flush Unit (4,000 l)	4	$80,000	$320,000	Navister Inter. Trans. Corp.	$367,733		Purchase order PO6/00/3021/0095 including s/parts ($36,415) issued 25/9/96 Del Da
3	Mech Bucket Machine	1	$75,000	$75,000				Tendered and offers received 21.8.96
4	Pickup Trucks	3	$18,000	$54,000				Tendered and offers received 6.8.96
5	Small Dump Trucks	4	$30,000	$120,000	Navister Inter. Trans. Corp.	$181,877		Purchase order PO6/00/3021/0095 including s/parts ($11,285) issued 25/9/96 Del Da
6	Skid Loader	2	$25,000	$50,000	Melroe Ingersoll Rand	$34,844		P.O issued including s/parts ($3938) est. del. date 20.10.96. Not received yet
7	Submersible Pumps (portable)	5	$2,000	$10,000				Tendered and offers received 21.8.96
8	Dewatering Pumps (Mobile)	2	$24,000	$48,000				Tendered and offers received 21.8.96
9	Rodding Equipment	1	$35,000	$35,000				Tendered and offers received 21.8.96
9A	Portable Rodding Equipment	5	$6,000	$30,000				Tenders and offers received 21.8.96
10	Mobile Generators	2	$14,000	$28,000	Qwaider for Trading	$21,875	$21,875	Delivered to the City on 18/9/96
11	Portable Generators	2	$6,000	$12,000				Tendered and offers received 21.8.96
12	Welding Equip							
	Electric Driven	3	$2,000	$6,000				Tendered and offers received 21.8.96
	Gasoline Driven	2	$2,000	$4,000				Tendered and offers received 21.8.96
13	Cutting Equip							
	Electric Driven	2	$2,000	$4,000				Tendered and offers received 21.8.96
	Gasoline Driven	2	$2,000	$4,000				Tendered and offers received 21.8.96
14	Safety Equipment	LS	$55,000	$55,000	LADM	$53,360	$52,764	***Delivered to the city on 22 July ; and on 24.10.96***
15	Portable Air Compressors	5	$1,000	$5,000				Tendered and offers received 21.8.96
16	Mobile Compressor	1	$40,000	$40,000				Tendered and offers received 21.8.96
17	Hand Tools	LS	$22,000	$22,000	Qwaider for Trading	$22,404		**Purchase Order has been issued. Del. Date 30.10.96**
18	Mech/Elect Spare Parts	LS	$155,000	$155,000				Invitation to tender will be issued
19	Computers with printer & accessories	5		$49,115	Computer Land	$46,854	$44,604	***Delivered to the city on 22 July 1996***
20	GIS	LS	$26,700	$26,700	Computer Land	$26,620	$26,620	***Delivered to the city on 22 July 1996***
21	Sewer Detection Equipment	LS	$14,000	$14,000	Radiodetection	$14,000	$14,267	***Delivered to UNRWA September 10, 1996***
22	Portable Offices of 6m each	6	$3,800	$22,800	MIVAN	$26,710	$19,110	***Delivered to the City on 15 August 1996***
23	Survey Equipment	LS	$28,000	$28,000	TOOLQUIP	$21,950		P.O issued. Delivery est. date 26 Oct
24	Pump Workshop Equipment	LS	$38,000	$38,000				Tendered and offers received 21.8.96
25	Vehicle/Equipment Spare Parts	LS	$104,500	$104,500				Spare parts (included in ea. item above) Total $79346 todate.
26	Training	LS	$31,000	$31,000				Costs included in ea. item above.
	TOTALS			**$1,845,115**		**$1,169,696**	**$179,240**	

procure1

APPENDIX C

PHASE 1 IMPLEMENTATION SCHEDULE SUMMARY

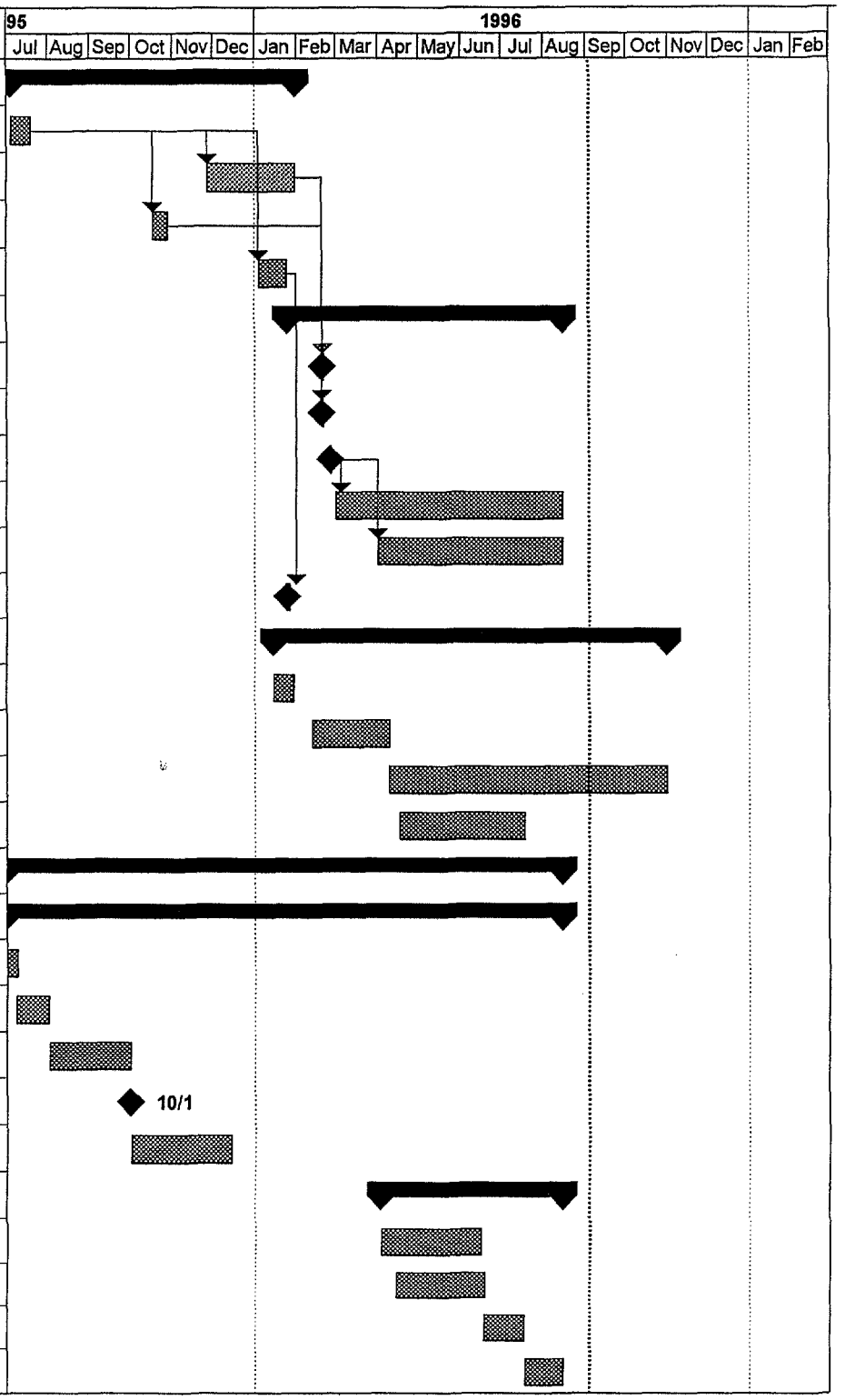
GAZA Wastewater Project
UNRWA Elements



Task
Progress
Milestone
Summary
Rolled Up Task
Rolled Up Milestone
Rolled Up Progress

GAZA Wastewater Project
UNRWA Elements

ID	Task Name
30	**Field Consultants**
31	Identify "fast start" consultants
32	Project Planning
33	Procurement
34	Pump station O&M
35	**Complete Project Planning**
36	Complete Project Work plan
37	Complete Procurement plan
38	Environmental Monitoring Report
39	Complete Sludge Protocol
40	Complete Water Quality Testing Pl
41	Pump Station assessment
42	**Consultant Project Support**
43	Develop Scope of Work
44	Identify Project Team
45	Consultant Project Manager
46	Consultant O&M Advisor
47	**Project Emergency Activities**
48	**Sheik Radwan Reservoir**
49	Contract: Rehab pump station
50	Contract: Expose pump inlets
51	Contract: Earth Removal
52	Initiate pumping
53	Contract: Pump inlet protection
54	**Contract: Pump power supply**
55	Contract: Second inlet mod.
56	Contract: Sewage Diversions
57	Contract: Sludge Removal
58	Contract: Storm Drain Ext.

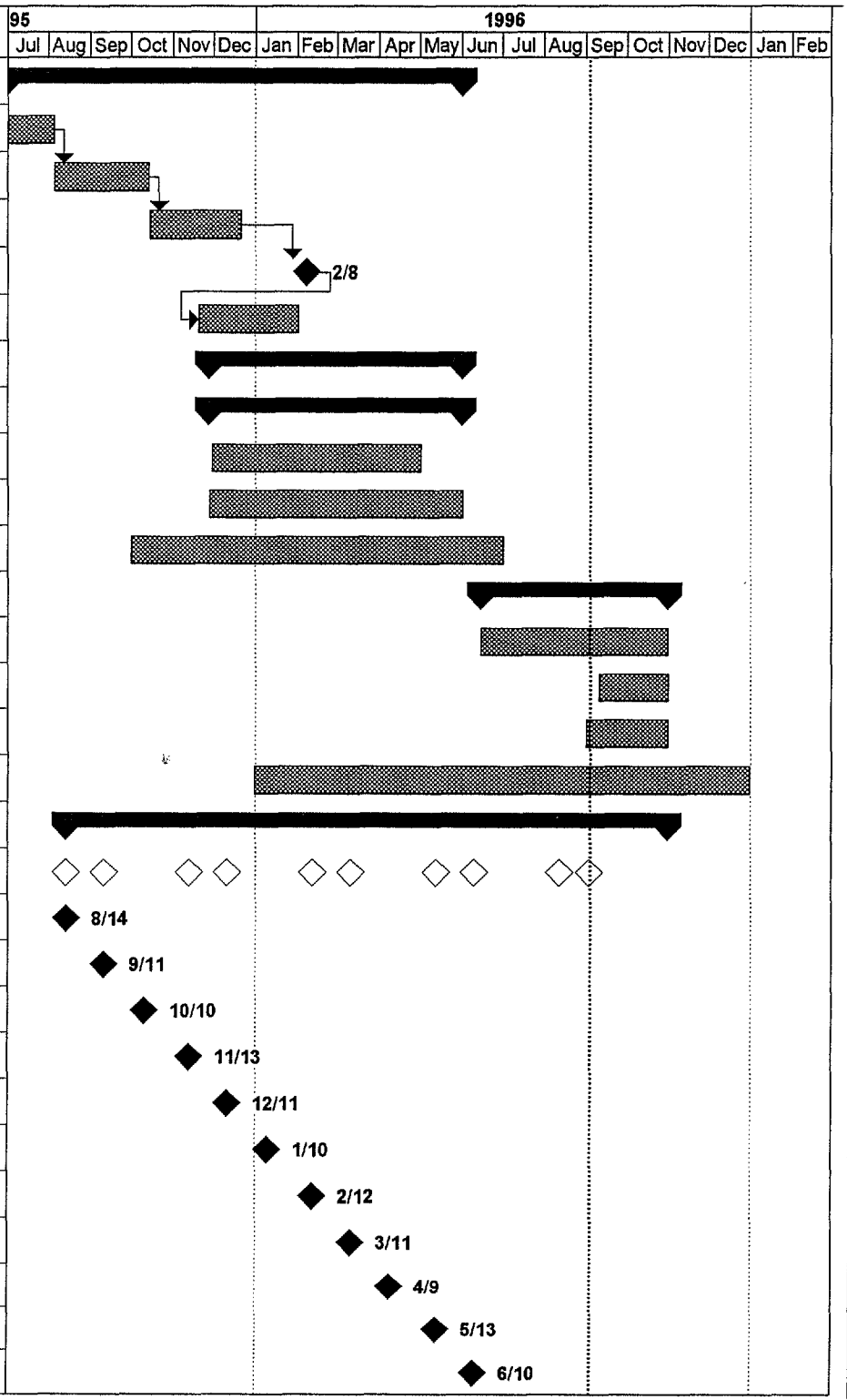


Task
Progress
Milestone
Summary
Rolled Up Task
Rolled Up Milestone
Rolled Up Progress

69

GAZA Wastewater Project
UNRWA Elements

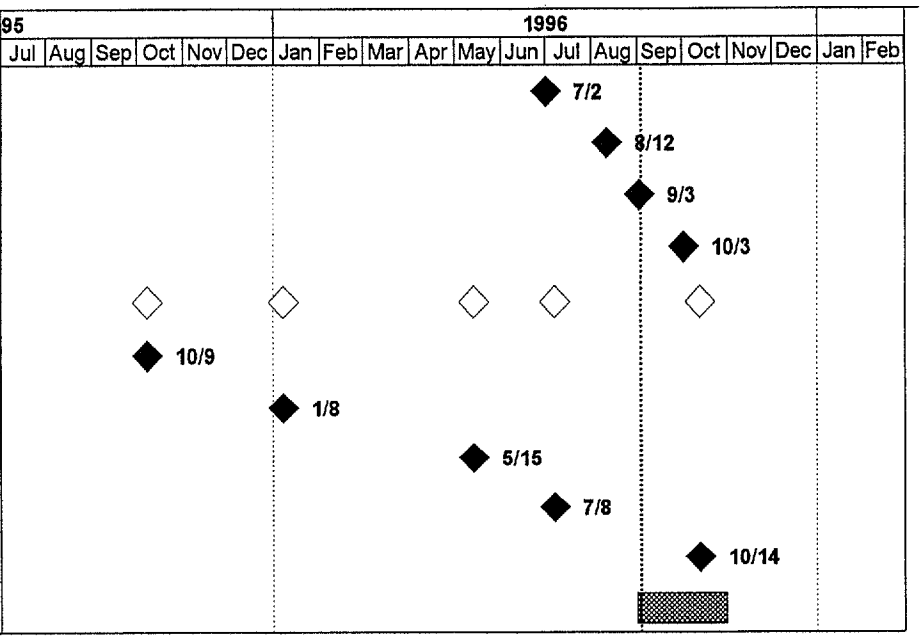
ID	Task Name
59	**Waqf Land Improvement**
60	Contract: Waqf land excavation
61	Contract: Emergency fencing
62	Contract: Install force main
63	**Initiate pumping**
64	Contract: Excavation contract #2
65	**Initiate storm drain cleaning**
66	**Contract: Storm drain cleaning**
67	Monitor Contract - Jaffa Street
68	Monitor Contract - Box Culvert
69	Emergency Procurements
70	**Project Phase I Activities**
71	Cleaning and Inspection of Sewers
72	Prepare Assessment Report
73	Sewer Replacement
74	Intermediate Procurements
75	**Reporting**
76	**Monthly Reports**
77	Monthly Reports 2
78	Monthly Reports 3
79	Monthly Reports 4
80	Monthly Reports 5
81	Monthly Reports 6
82	Monthly Reports 7
83	Monthly Reports 8
84	Monthly Reports 9
85	Monthly Reports 10
86	Monthly Reports 11
87	Monthly Reports 12



Task
Progress
Milestone
Summary
Rolled Up Task
Rolled Up Milestone
Rolled Up Progress

GAZA Wastewater Project
UNRWA Elements

ID	Task Name
88	Monthly Reports 13
89	Monthly Reports 14
90	Monthly Reports 15
91	Monthly Reports 16
92	**Quarterly Progress Reports**
93	Quarterly Progress Reports 2
94	Quarterly Progress Reports 3
95	Quarterly Progress Reports 4
96	Quarterly Progress Reports 5
97	Quarterly Progress Reports 6
98	Project Final Report



Task
Progress
Milestone
Summary
Rolled Up Task
Rolled Up Milestone
Rolled Up Progress

11

APPENDIX D

UNOFFICIAL PROJECT PHASE 1 BUDGET DISTRIBUTION

Appendix D

30 October 1996

GAZA WASTEWATER PROJECT PHASE 1

UNOFFICIAL (ESTIMATED) PHASE 1 BUDGET DISTRIBUTION

Description	Budget Allocation	Expenditures and Obligations	Cost Projections and Unallocated	Total Costs
UNRWA Activities, Equipment and Logistical Support				
- Mobilization Costs	247,026	247,026		247,026
- Staff Costs	155,186	114,215	40,971	155,186
- Operating Costs	33,502	31,426	2,076	33,502
Total UNRWA Activities	**435,714**	**392,667**	**43,047**	**435,714**
Commodity Procurements				
- Emergecy Procurements	1,000,000	936,113		936,113
- Intermediate Procurements	1,800,000	1,348,936	496,179	1,845,115
- Unallocated			18,772	18,772
Total Procurements	**2,800,000**	**2,285,049**	**514,951**	**2,800,000**
Sewer Cleaning and Related Emergency works:				
- Sheikh Radwan Reservoir		273,728		273,728
- Waqf Land Pond		141,169		141,169
- Storm Water Drain Cleaning		81,400		81,400
- Sewer Cleaning and Inspection		744,092		744,092
- Sewer Replacement		225,000		225,000
- Unallocated			34,611	34,611
Total Emergency works	**1,500,000**	**1,465,389**	**34,611**	**1,500,000**
Sub Total	4,735,714	4,143,105	592,609	4,735,714
Project Support Costs	**568,286**	**533,286**	**35,000**	568,286
Total Phase 1 Costs	5,304,000	4,676,391	627,609	**5,304,000**

30 October 1996

GAZA WASTEWATER PROJECT

UNRWA ACTIVITIES , EQUIPMENT AND LOGISTICAL SUPPORT FOR Phase 1 (UNOFFICIAL ESTIMATED FINAL DISTRIBUTION)

Description	Budget Allocation	Expenditures and Obligations	Cost Projections or Unallocated
Mobilization Costs:			
Vehicles	81,534	81,534	
Coputer Hardware	115,905	115,905	
Computer Software	9,175	9,175	
Major Office Equipment	18,342	18,342	
Minor Office Equipment	22,070	22,070	
Total Mobilization Costs	**247,026**	**247,026**	
Staff Costs:			
International Project Staff	60,157	43,883	16,274
Local Project Staff	95,029	74,529	24,697
Total Staff Costs	**155,186**	**114,215**	**40,971**
Operating Costs:			
Transportation Services	8,862	8,562	300
Telephone Calls	7,155	6,855	300
Electricity	3,613	3,513	100
Office Stationery	1,488	1,458	30
Office Supplies	1,263	1,238	25
Misc. Supplies	1,100	1,075	25
Travel Costs	4,000	3,525	475
Other Services	6,000	5,200	800
Budget Adjustment	21		21
Total Operating Costs	**33,502**	**31,426**	**2,076**
Total UNRWA Activities	**435,714**	**392,667**	**43,047**

30 October 1996

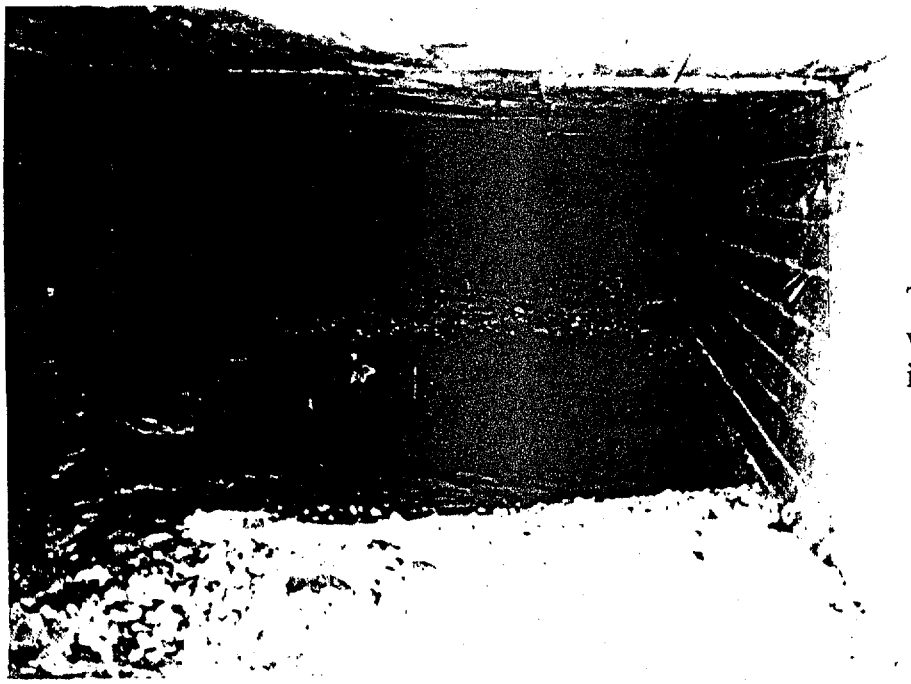
GAZA WASTEWATER PROJECT PHASE 1
SEWER CLEANING AND RELATED EMERGENCY WORKS

Contract Description	Expenditure and Obligation
Sheikh Radwan Reservoir:	
Pumping Sation Intake Excavation	17,000
Pumping Station Intake Eartworks	36,000
Pumping Station Cleaning and Rehabilitation	41,000
Pumping Station Intake Modification	32,200
Pumping Station Power Supply	50,000
Sedimentation Basin Cleaning	31,000
Sludge Disposal, Phase 1	1,080
Pumping Statopm Intake Railing	1,720
Dry Weather Flow Diversions	14,500
Pumping Station Intake Access	5,800
Sewage Pit Excavation	1,200
Sludge Disposal, Phase 2	12,478
Storm Drain Extension	14,000
Culvert End Modification	10,000
Culvert Access Closure	5,750
Total SR Reservoir	273,728
Waqf Land Pond:	
Soil Excavation, Phase 1	70,204
Soil Excavation, Phase 2 *	1,640
Fencing	18,164
Zaitun Force Main	51,161
Total WL Pond	**141,169**
Stormwater Drain Cleaning	**81,400**
Sewer Cleaning and Inspection	**744,092**
Sewer Replacement	**225,000**
Total Emergency works	**1,465,389**
Budget Adjustment	**34,611**
Total Budget	**1,500,000**

Summary1

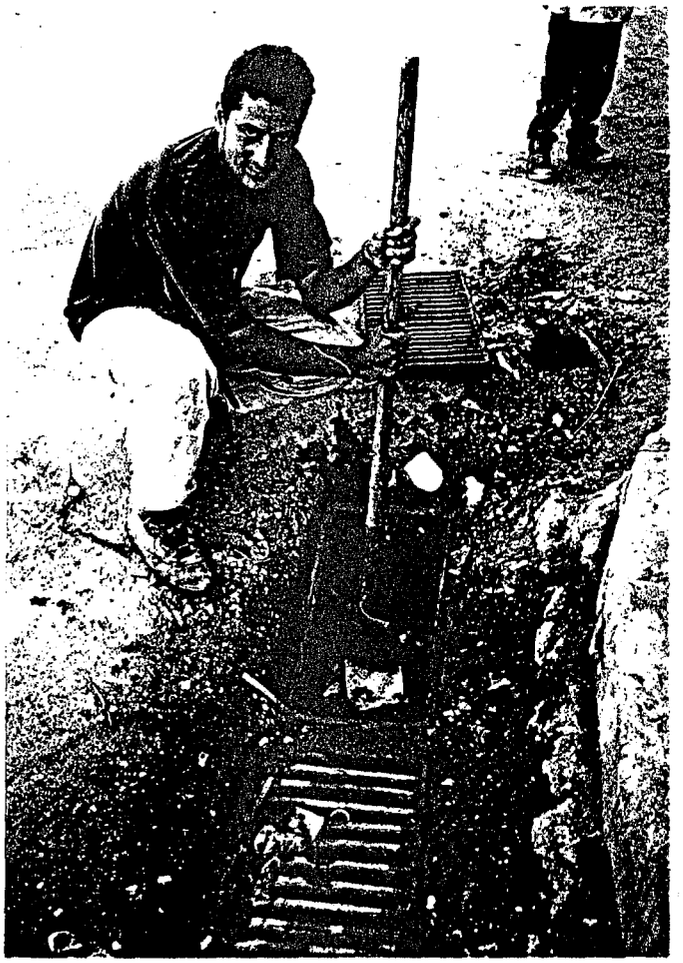
APPENDIX E

PHOTOGRAPHS



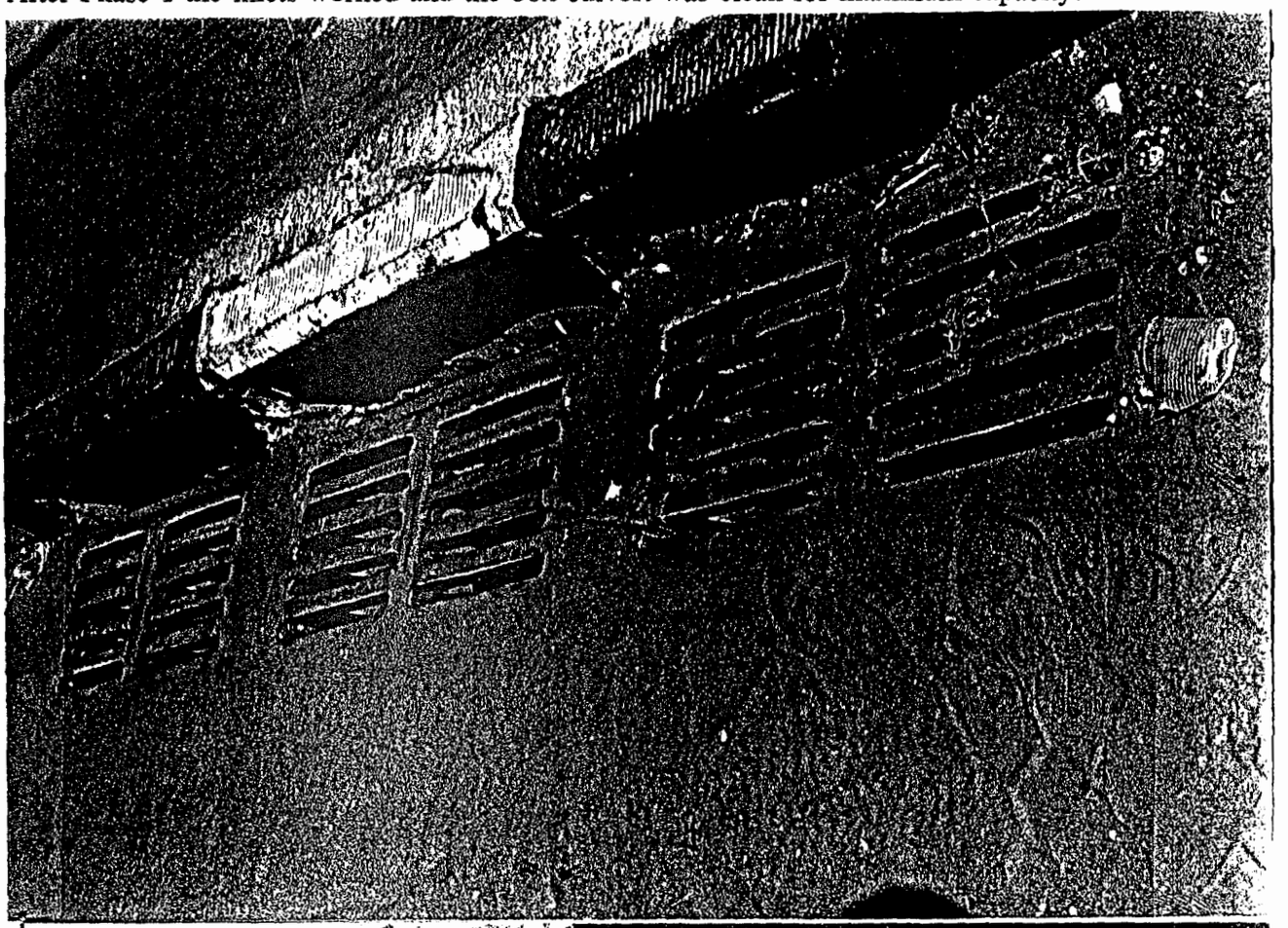
The storm drain box culvert was about 80% full of sand in some areas

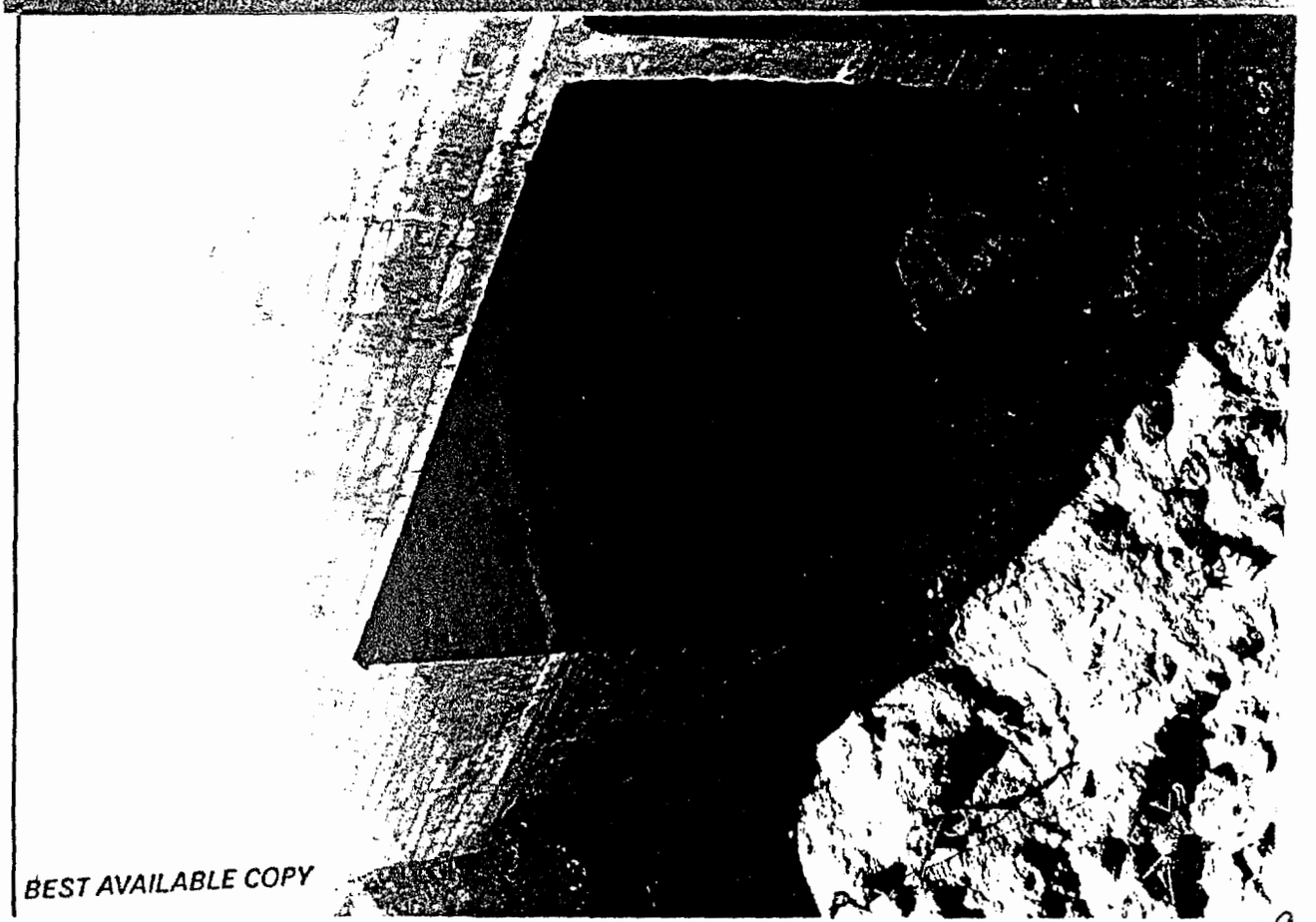
Storm drains were clogged before Phase 1



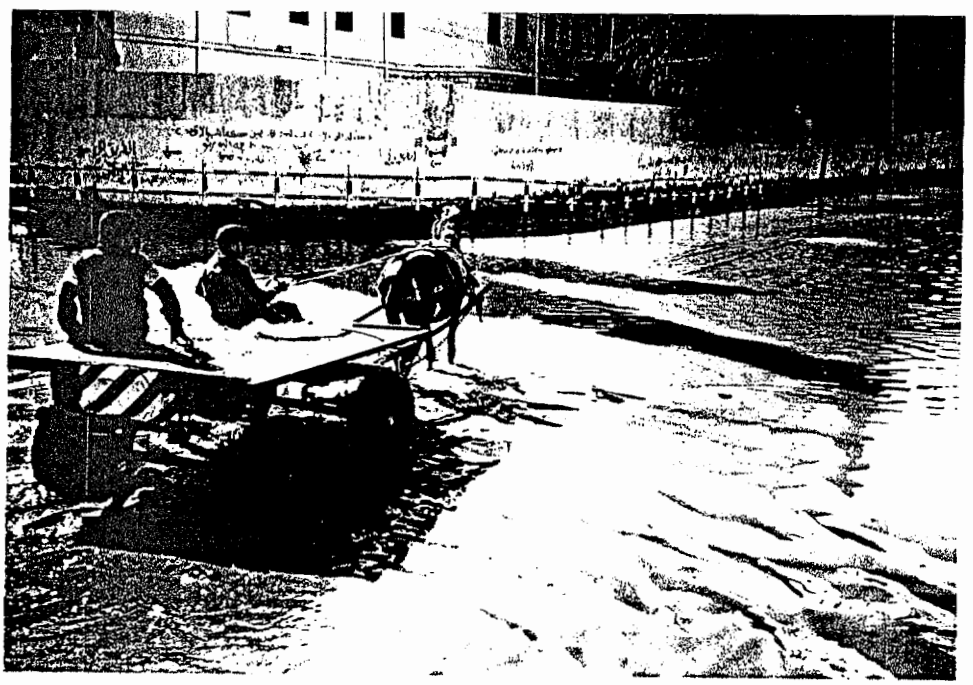
Storm drains and sanitary sewer manholes were cleaned to provide capacity in the system

After Phase 1 the inlets worked and the box culvert was clean for maximum capacity.

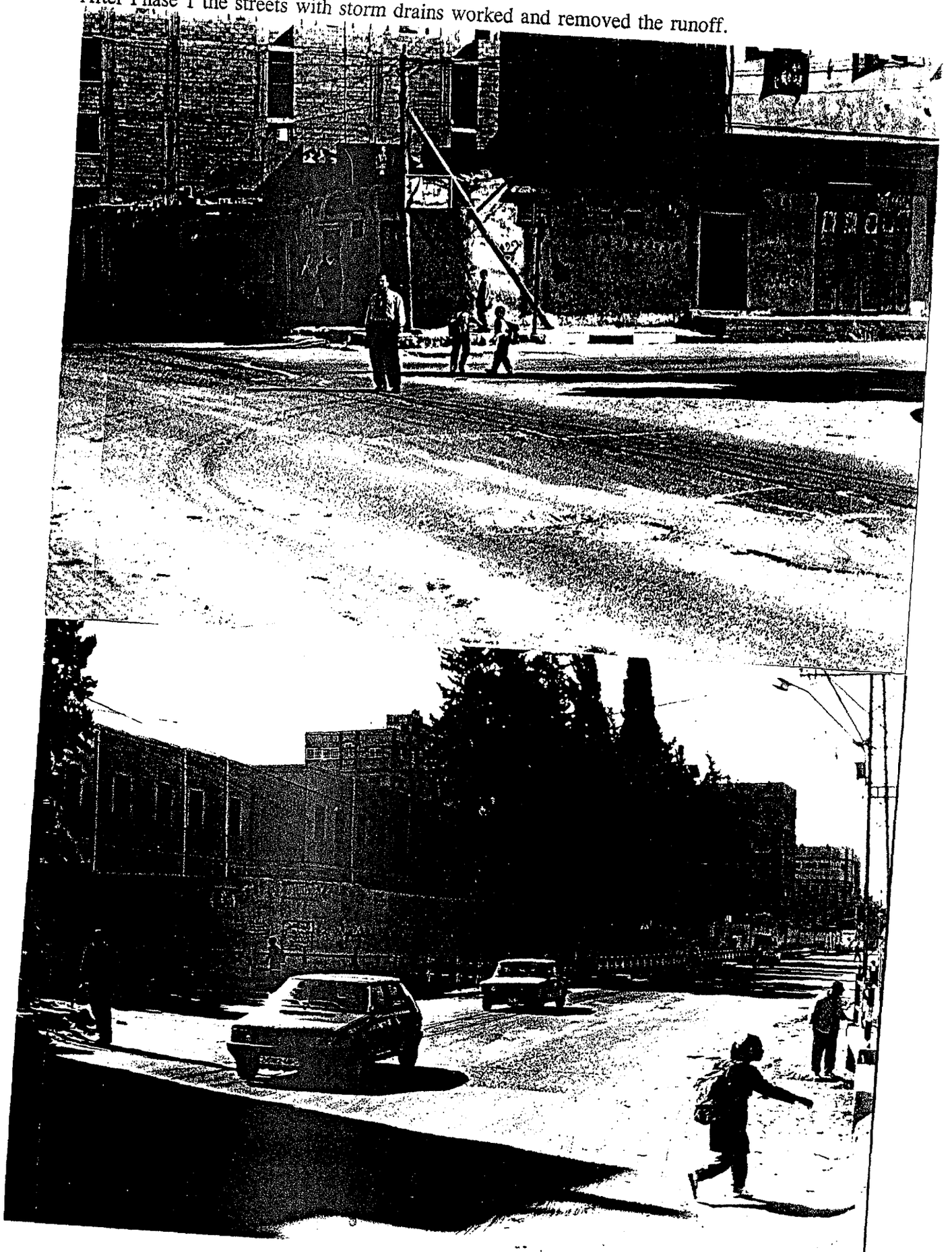




When storm drains did not work residents looked to the sanitary systems manholes for relief

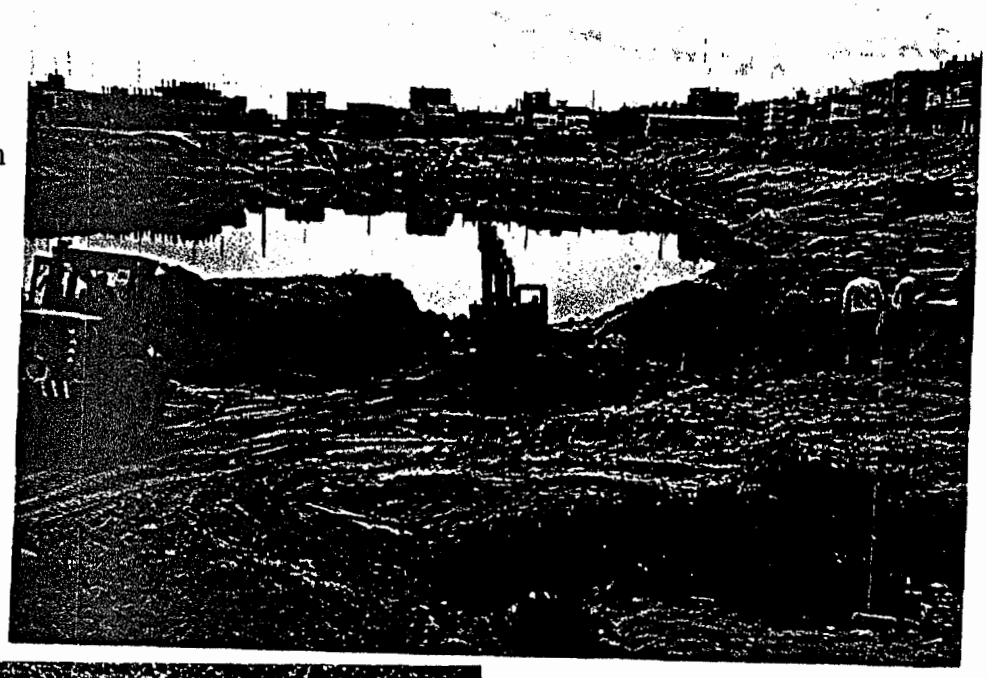


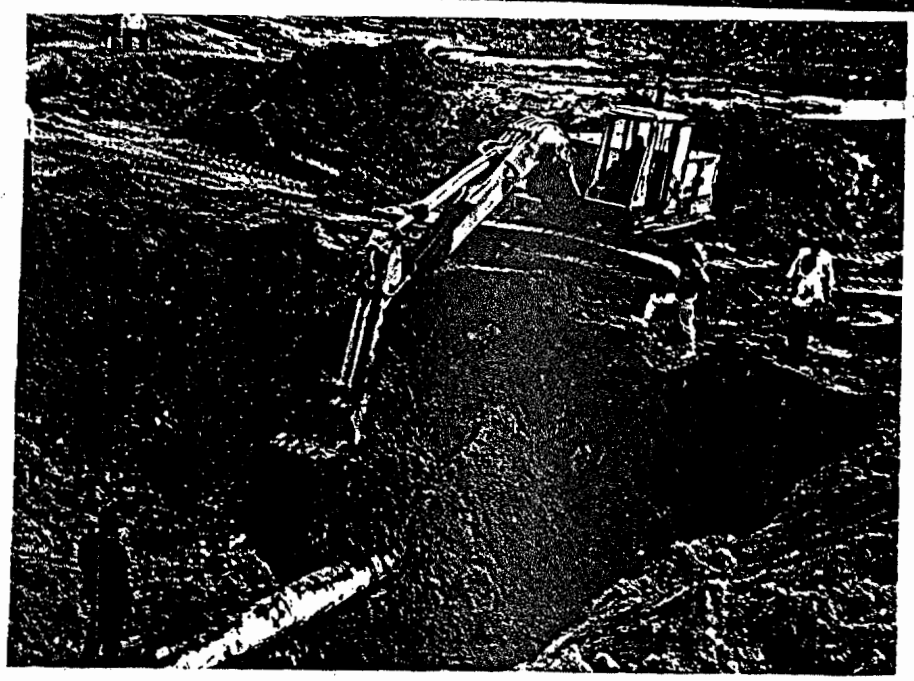
After Phase 1 the streets with storm drains worked and removed the runoff.



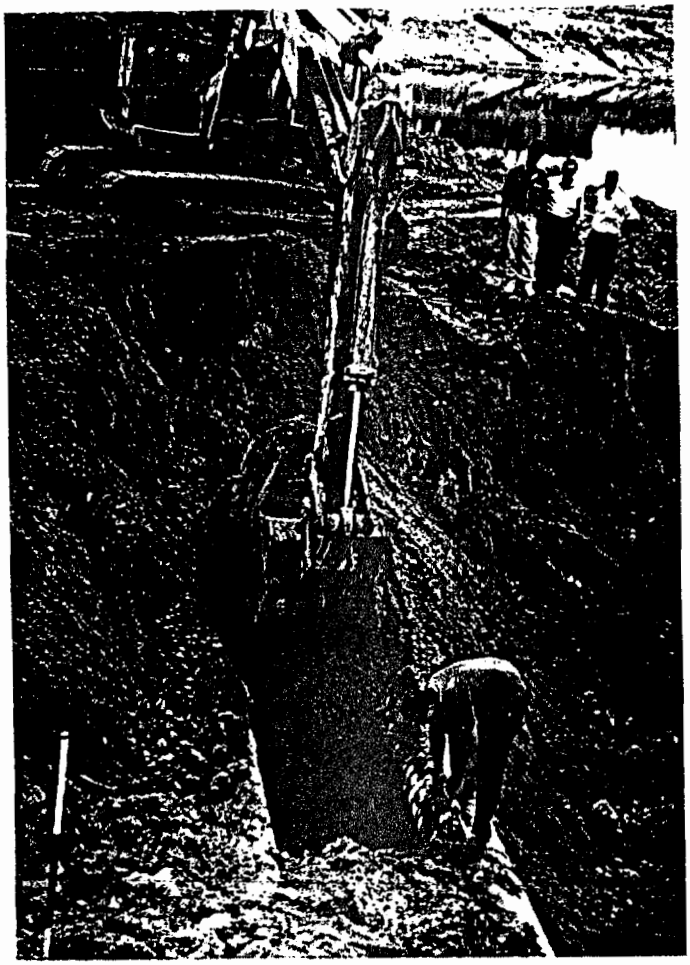
Excavation at
Sheikh Radwan Reservoir

Excavating for the inlet
pipes at the pump station





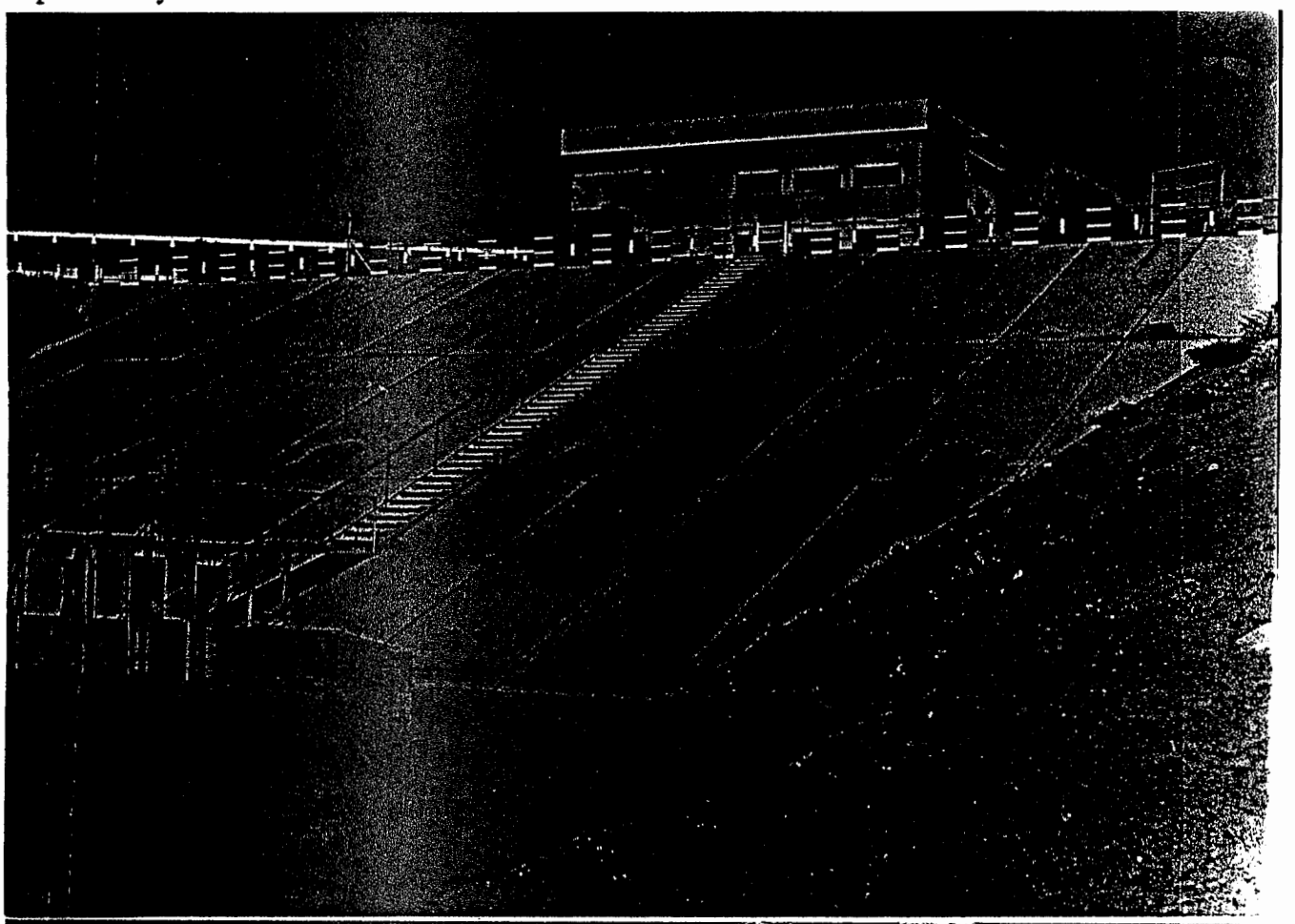
Found one!

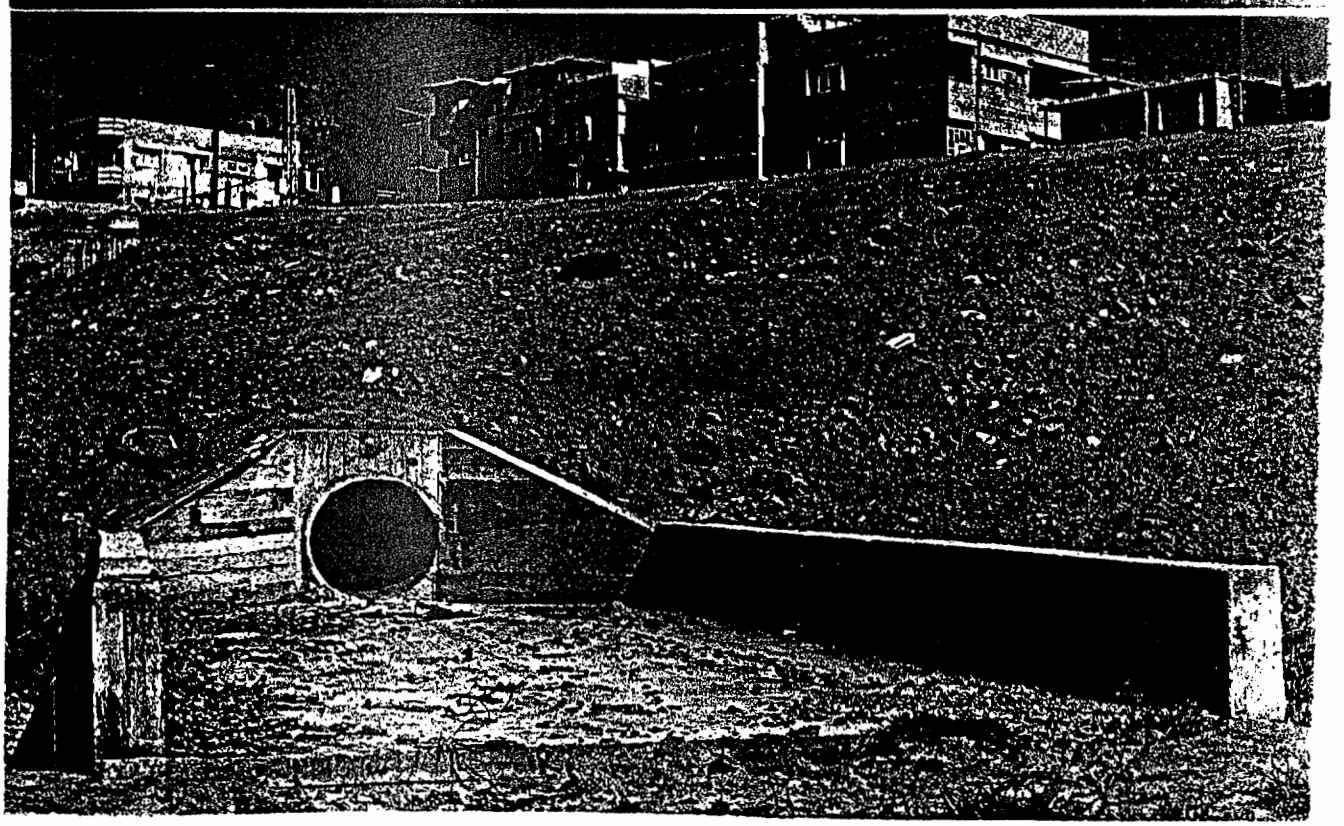


Found two out of three - not bad!

All three inlet pipes exposed

Sheikh Radwan Reservoir was rehabilitated to provide optimum capacity, clean inlets with operational flexibility, increased pumping capacity, new maintenance access and permanent slope stability.

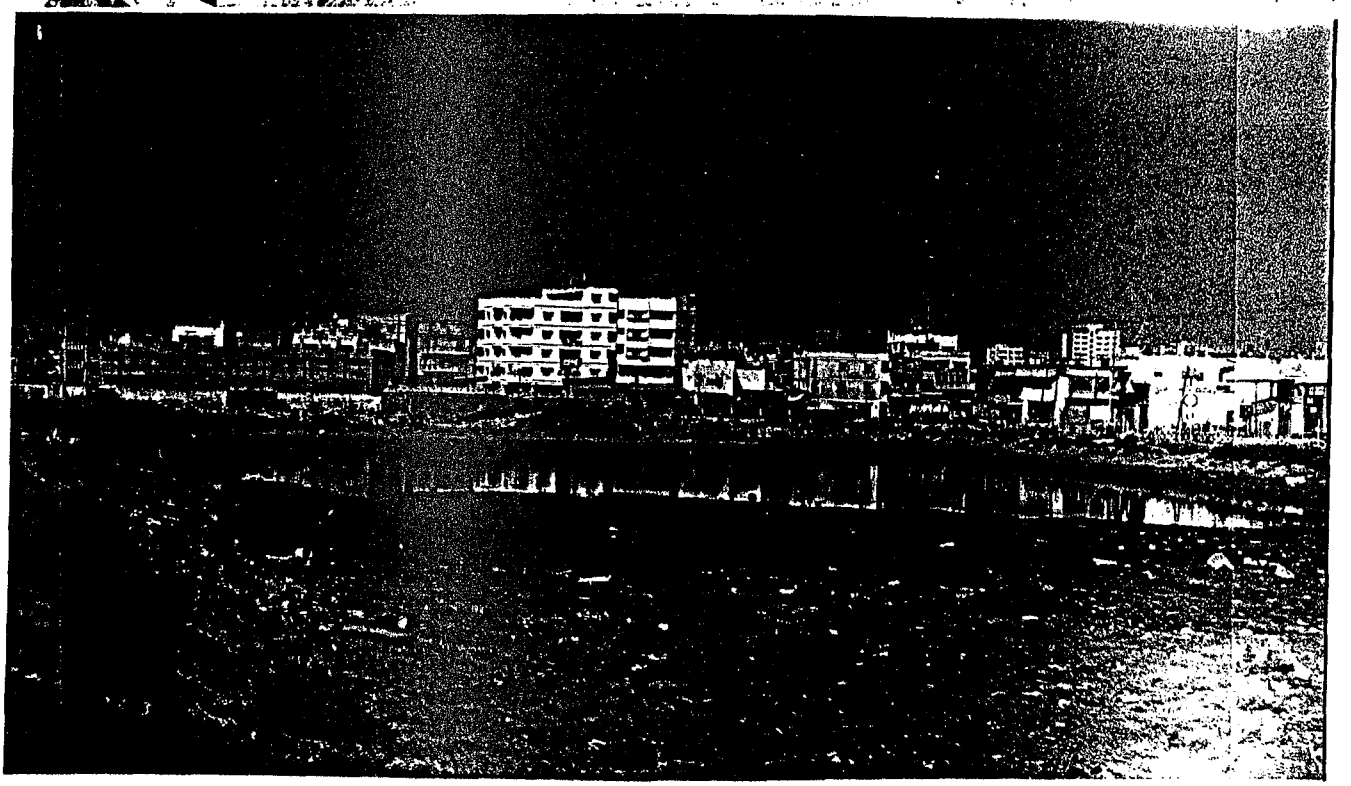




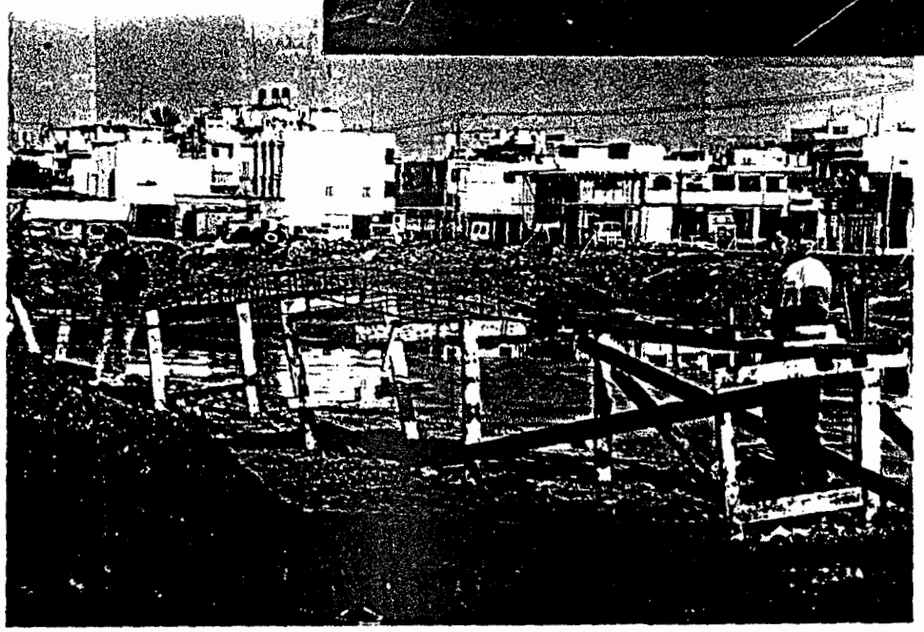
Excavation and trash removed at Waqf made the area look better

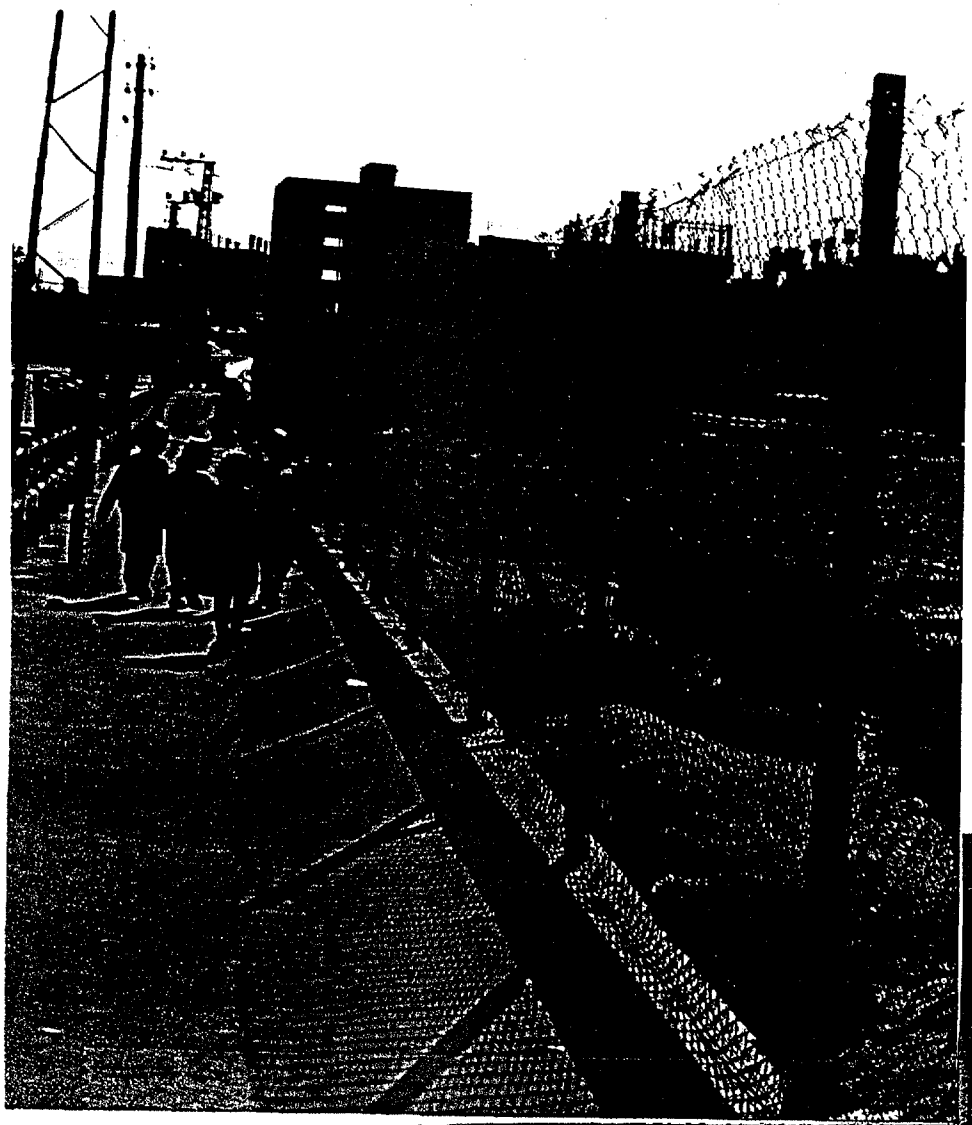
and about 30,000 m^3 of stormwater capacity was developed

After Phase 1, Waqf Pond had enlarged capacity, and pumping capability through the twin 6" force mains to the box culvert and the area was cleaned up and free of much trash and debris.



Fences were installed at
both Waqf Pond and
Sheikh Radwan Reservoir





The fencing helped provide increased security to protect the public

APPENDIX F

PHASE 1 PARTICIPANTS

GAZA WASTWEATER PROJECT
PHASE 1 PARTICIPANTS

Municipality of Gaza

Ragheb Attallah, Coordinator of International Donor Projects and Project Manager, GWWP
Husein Abu Zaid, Deputy Director for Wastewater Operation and Maintenance
Sami El Shaqra, Supervisor of Pumping Stations
Zaher Kuhail, Former City Engineer

USAID

Charles McElroy, Project Manager
Mohsen Ghazali, Project Engineer

UNRWA

Dr. William Hoadley, Chief, Environmental Health Programme
Mauri Uusihakala, Chief, Special Environmental Health Programme
Nabil Abu Tabikh, Administrative Officer
Freih Najjar, Assistant Maintenance Engineer
Asad Abu Daqqa, Site Engineer
Omar Masri, Site Engineer
Aysha Al Zayyan, Administrative Assistant
Mona Nour Eddin, Secretary

(USAID funded Consultants Seconded to UNRWA)
Thomas E. Bailey, Project Manager
Joesph Haratani, Interim Project Manager
Paul Gustafson, O&M Engineer
Osama Amad, O&M Engineer
Douglas Abbott, Pump Station O&M Consultant
Jonathan Hodgkin, Project Documentation Consultant
Robert Gearheart, Environmental Engineer
Kenneth Choquette, Procurement Specialist
Chris McGahey, Contracts Supervisor

Environmental Health Project

Environmental Health Project
1611 N. Kent St., Suite 300
Arlington, VA 22209-2111
USA (703) 247 - 8730