U.S. AGENCY FOR INTERNATIONAL DEVELOPMENT
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FAX MESSAGE

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Number of Pages: Date: July 10, 2001

Comments:

Seifalla:

I have attached, for the Mission's core files, a signed Record of Decision (ROD) approving the Environmental Assessment for the Minia FSIP Projects.

Best regards.

John O Wilson

John O. Wilson
ANE BEO

****

USAID

UNITED STATES AGENCY for INTERNATIONAL DEVELOPMENT

CAIRO, EGYPT

ACTION MEMORANDUM

TO: John Wilson
ANE Bureau Environmental Officer

FROM: Seifalla Hassanein
Mission Environmental Officer, Egypt

SUBJECT: Middle Egypt Water and Wastewater Master Planning Project: Request for Approval of the Environmental Assessment of the First Stage Investment Projects, Governorate of Minia, Egypt

DATE: June 25, 2001

ISSUE: Your approval is requested for the Environmental-Assessment for the First Stage Investment Projects, Governorate of Minia, Egypt.

BACKGROUND:

Egypt Utilities Management:

First Stage Investment Projects for the Governorate of Minia are proposed for funding and construction under the Middle Egypt Water and Wastewater Master Planning Project, part of The Egypt Utilities Management Results Package Grant Agreement between USAID and the Arab Republic of Egypt (USAID Grant No. 263-0270) (Hereafter "EUM Agreement").

The EUM Agreement is intended to benefit the Government of Egypt, (GOE) public sector water and wastewater utility organizations, and the customers they serve, in the Governorates of Alexandria, Fayoum, Minia, and Beni Suef. The results sought under the EUM Agreement are improved:

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- Recovery of operations and maintenance costs;
- Decentralization of utility management, and;
- Capacity to deliver services.

Specific activities to be undertaken under the EUM Agreement in Fayoum, Beni Suef and Minia (the "Middle Egypt Governorates") include, inter alia:

- The development of water and wastewater master plans;
- Special studies and action plans to address the immediate needs of the water and wastewater utilities in each of the three Governorates of Middle Egypt, and finally;
- Provide design and construction supervision of infrastructure improvements identified in the master plan as approved by USAID and the affected Governorates.

Middle Egypt Water and Wastewater Master Planning Project:
To this end, the Middle Egypt Water and Wastewater Master Planning Project was developed. The Project consists of a Water and Wastewater Utilities Master Plan to:

- Identify water and wastewater system needs in the Middle Egypt Governorates through the year 2022, and;
- A capital investment program which, will fund not only select capital investment projects identified through the master planning process, but also some of the highest priority needs of the water and wastewater utilities.

Minia First Stage Investment Projects:

First Stage Investment projects are intended to address selected infrastructure improvement requirements through the year 2012. Proposed First Stage Investment Projects (FSIP) for the Governorate of Minia (hereafter the "Projects") are:

The US WTP Expansion Project
The proposed project consists of constructing an additional 330 L/S conventional WTP module on the available space at the

existing Minia City USWTP site. This expansion will result in a total treatment capacity of 660 L/s. The new treatment components are to be similar to the existing units. Construction of the WTP expansion, depending upon the process selected by the design build contractor will include:

- Enlargement of the raw water pumping station and addition of six pumping units
- Flocculation tanks
- Clarifiers
- Rapid sand filters
- Associated alum and chlorine storage and feed facilities
- Additional sludge lagoon area
- Clear water reservoirs, and
- Enlargement of finished water pumping station and addition of four pumping units

Water Distribution System Improvements

The Minia City Water Distribution System Improvements Project will involve the strategic installation and replacement of critical major potable water transmission lines affecting the service of three major service areas of Minia City; the northwest, the west, and the south. Extensive residential and institutional development is occurring in the northwest portion of the city. To serve growing water demands in this area, improvements to the existing water transmission system must be made. Additional improvements are also required in the south and western portions of the distribution system to increase capacity of the transmission system, to accommodate increased supply resulting from the USWTP expansion, and improve service in localized low-pressure areas.

Wastewater Force-Main and Pump-Station Improvement

This project involves upgrading Minia City's wastewater pumping system. The Minia City Wastewater Force-Main and Pump Station Improvement Project will entail installation of:

- Approximately 4,200 m of new force main on the east and west sides of the Ibrahimiya Canal to connect Pumping Station (PS)#4 to the WWTP;

- Approximately 3,400 m of new force main from PS#2 to the new main pumping station PS#4, and;
- Approximately 1,200 m of new force main from PS#1 to PS#3.
- A new PS#4 on east side of Ibrahimiya Canal with structure to handle 2022 flow from PS#2, PS#3, Zone 4, and equipment to accept 2012 flows;
- A gravity line from Zone 13 to new main pump station PS#4;
- New PS#2 with capacity of 300 l/s, and;
- PS#1 will be upgradéd from three 50 L/s capacity pumps to L/s capacity.

The Zawiyat Sultan Water Treatment Facility

The project involves construction of a new slow sand filter water treatment plant with up to 60 L/s capacity. The WTP will have expansion capacity to meet future demands and support potential development of the area for tourism. The Zawiyat Sultan Slow Sand Filter (SSF) WTP will include the following major components:

- Intake and raw water pump station
- Up-flow roughing filter
- Slow sand filter
- Chlorine contact chamber/ ground storage tank
- High Pressure Distribution Pumps
- Transmission Main
- Administration building
- Storage area

The Bani Ibayd Sewer Collection System

The proposed project consists of the installation of a wastewater collection system, pumping station, and force main to serve the village of Bani Ibayd located northwest of the new NOPWASD Abu Qurqas WWTP. Components of the proposed Bani Ibayd wastewater collection system include the following:

- A gravity sewer collection system;
- A wastewater pumping station, and;
- A force main running southward directly to the NOPWASD Abu Qurqas WWTP

Purpose of the Projects

The US WTP Expansion Project
The proposed expansion of the Minia City USWTP will provide adequate potable water production to satisfy the projected maximum day demand of the water service area through the year 2012.

Water Distribution System Improvements
Improvements in the major water transmission system proposed under the Water Distribution System Improvement Project are intended to increase pressures and improve service in the Northern, Western, and Southern regions of the Minia City Potable Water Transmission System.

Wastewater Force-Main and Pump-Station Improvement
Upgrades to the wastewater force-main and pump-station system are required to maintain the current level of service, and to facilitate expansion of wastewater service as required by future population growth through 2012.

The Zawiyat Sultan Water Treatment Facility
Replacement of untreated groundwater with treated surface water of acceptable quality will address customer concerns raised over groundwater contamination.

The Beni Ibayd Sewer Collection System
Construction of the Beni Ibayd Wastewater gravity collection and force-main system will dramatically decrease the reliance on on-site systems thus reducing the incidence of septic overflows and improper septage waste disposal in Beni Ibayd village. Human and environmental health risks resulting from unmanaged wastewater discharge in Beni Ibayd Village will benefit both the inhabitants of Beni Ibayd as well as downstream users. Also, wastewater collection may also reduce limitations on water consumption.

Issues Addressed by the Projects

The US WTP Expansion Project

The Minia Potable Water System is supplied by three major water treatmnent facilities. The British, Czech, and US WTPs have a treated water production capability of 180, 200, and 330 L/s, respectively, resulting in a present total water production capacity of 710 L/s. The Minia City water service area has a current maximum day water demand of approximately 800 L/s and projected maximum day demands of approximately 1,200 L/s and 1,500 L/s in 2012 and 2022, respectively. To meet existing and future water demands, expansion of the Minia City water treatment facilities is required.

Water Distribution System Improvements

Based on the findings of the Existing Conditions Report (Harza Team, 2000), inadequate pressures are experienced in the northern and southern regions of Minia City under maximum day demand. A significant portion of the western portion of the City (west of the Aswan-Cairo Agricultural Highway) also receives water at inadequate pressures.

Wastewater Force-Main and Pump-Station Improvements

The proposed Wastewater Force-Main and Pump-Station Improvement Project will reduce wastewater loading to some of the existing pumping stations (PS#5 and PS#6) alleviating the need to expand these pump stations and will increase pumping capacity of some of the existing pumping stations (PS#1, PS#2 and PS#4) to handle projected future wastewater loads through 2012

The Zawiyat Sultan Water Treatment Facility

The population in the Zawiyat Sultan Project Area is served by wells located near the village of Sawadah. Water quality from the existing wells is poor due to presence of iron, manganese, bacteria, and/or other contaminants. Poor well water quality results in poor service and imposes possible adverse health risks to the residents of Zawiyat Sultan.

The Bani Ibayd Sewer Collection System Project

The Village of Beni Ibayd does not possess reticulated wastewater collection or centralized treatment. Consequently,

the majority of Beni Ibayd residents rely upon septic tanks. Existing septic tanks in Beni Ibayd are problematic due to poor design, maintenance, and inappropriate site conditions. As result, septic tanks are prone to failure and overflow thus requiring frequent pumping and cleaning at cost to the system owner. This additional cost often results in reduced water consumption. Additionally septage disposal laws are not enforced, therefore septic wastes are often improperly disposed of in unused open areas, and nearby drains and canals.

DISCUSSION

USAID/Egypt contracted with Harza Environmental Services Inc. ("Harza") to complete the EA in conformance with 22 C.F.R. 216 (Environmental Assessments). The resulting Environmental Assessment (EA) for the First Stage Investment Project in the Governorate of Minia follows the Middle Egypt Planning Project Scoping Report for the First Stage Investment Project for Minia Governorate. This scooping report was previously approved by the USAID/W Asia Near East CANE) Bureau Environmental Officer.

In accordance with the requirements set forth under 22 C.F.R.216.6, the submitted EA entitled "Environmental assessment of a First Stage Investment project for the Governorate of Minia, Egypt" includes the following chapters:

- Executive Summary;
- Project Description: which includes the purpose of the activity and alternatives including the Proposed Action and the No-Action Alternative;
- Environmental Setting, which includes a comprehensive description of the affected environment;
- Environmental Impacts: which includes the environmental consequences/impacts of the alternatives under consideration;
- Comparison of Alternatives and Recommendation;
- Management, Mitigation and Monitoring: which includes means to mitigate adverse environmental impacts and a monitoring plan; and,
- Exhibits and Appendices: which includes a List of Preparers.

FSIP Project Impacts

The submitted EA identified the following impacts of the projects on the environment and the following mitigation measures:

Negative Impacts: The EA has not identified any substantial negative impacts resulting from the proposed projects on the physical or natural environment.

Potential Negative Impacts:

- High metal concentrations: Sampling of raw water in the Nile River (the WTP source of water) identified three metals (aluminum, iron, and mercury) that occurred in concentrations near or above Egyptian Standards for potable water. Although water treatment in the proposed water treatment plants will reduce these metals to safe levels, careful surveillance of the WTPs operations should be conducted.
- Water treatment plant backwash: has to be treated prior to discharge;
- Sludge from the Minia City US and Zawiyat Sultan WTPs: have to be adequately disposed of; and
- Chlorine gas storage and use: adequate precautions have to be established prior to storage and use of chlorine gas in the WTP and an emergency response plan to address chlorine leaks should be prepared for each site.

Negligible Negative Impacts

Negligible negative impacts are expected in the following areas:

- Land use and regional planning;
- Air quality effects;
- Geology and hydrogeology;
- Climate and groundwater, and;
- Terrestrial and aquatic ecology.

Positive Impacts

- The US WTP Expansion, the Water Distribution System Improvements and Wastewater Pump Station / Force Main Improvements Program Projects will have a long-term positive impact on water quality , supply and sanitary services within Minia City;
- The water system improvements in Zawiyat Sultan should improve potable water quality and provide a basis to support population growth and tourism development in the area;
- The wastewater collection system proposed for Beni Ibayd will improve the sanitation conditions in the village.
- Improved water quality in Mohiet Drain due to elimination of discharges of inadequately treated wastewater effluent from Beni Ibayd Village;
- Some economic benefits including employment of a small local labor force during construction of the proposed projects, and;
- Domestic hygiene and overall public health - due to expected reduction in exposure to water-borne diseases

Comparison of Alternatives:

Minia City USWTP Expansion

No alternatives other than the no-action alternative were considered for this proposed FSIP Project.

Water System Distribution Improvements

No alternatives other than the no-action alternative were considered for this proposed FSIP Project.

Minia a City Wastewater Force-Main and Pump Station Improvements

No alternatives other than the no-action alternative were considered for this proposed FSIP Project.

Zawiayat Sultan Water Treatment Plant

An alternative site about 1.3 km west of the village of Hawarta was identified by MEGAWS for the development of the WTP. Although MEGAWS has indicated its intent to subsidize the cost of extra transmission line required to serve the Zawiyat Sultan Project Area, the additional costs of developing this site

precluded development of a detailed alternative prior to preparation of this EA.

The Bani Ibayd Wastewater Collection System

An alternative pump station site and an alternative force main alignment were identified for the Beni Ibayd Wastewater Collection System Project. The alternate pump station site is located at Nazlet Awolad Gueid, approximately 1 km southeast of the proposed pump station location. This site would offer the advantage of facilitating future connection of Nazlet Awolad Gueid to the WWTP via the same pump station used for Beni Ibayd. Based on available information, the proposed site and the alternate site appear to be at roughly equal elevations. Therefore, the proposed pump was recommended due to the shorter gravity flow distance from the village.

The alternative force main arrangement would follow unimproved agricultural paths from the proposed pump station site to the paved road at a point approximately one kilometer southeast of the pump station. This arrangement would shorten the force main length from the proposed pump station site by about 0.8 km. This may entail temporary negative impacts on the margins of surrounding agricultural fields if paths must be improved to allow access by construction vehicles that are involved in laying the force main. The cost of road improvements should also be considered. Such impacts would be greater than those anticipated for the proposed force main, which would follow village streets and paved roads. However, the force main alignment for the Proposed Project would incrementally increase construction-related impacts on the village from dust, noise, and potential service disruptions beyond those that would occur during installation of sewers. Essentially, both alternatives will have similar levels of impact, but will affect different sectors. From an environmental standpoint, both alternatives appear equivalent. The final force main alignment will likely depend on the restrictions imposed during detailed design of the system.

No Action Alternative

The no-action alternative was considered for each of the proposed FSIP Projects in Minia Governorate. The No-Action Alternative represents increased deficiencies in water and wastewater service, customer dissatisfaction, failure of existing water and wastewater infrastructure and ultimately slowly deteriorating sanitation and health conditions in affected areas. Over the long term, the average incidence of morbidity due to gastrointestinal infections, paratyphoid and typhoid would be expected to increase as a result of the no-action alternative.

Without the proposed Minia City Water Projects, the future water demand of the City would quickly outgrow the capacity of the existing WTPs. In the absence of expansions to the US WTP, general health and hygiene would decrease as available water per capita decreases as a result of stretching the existing or decreasing water supply over the increasing population.

Without the distribution system improvements to the northwest portion of the city, this area would likely experience outages. Areas in the West and south would continue to experience inadequate pressures and possible outages.

Without upgrades to the wastewater collection system, risk of catastrophic failures of wastewater system components within the city would greatly increase. This could result in backups and overflows of sewage into residential areas. Such occurrences would increase the risk of transmission of diseases such as typhoid and cholera, as well as create aesthetically distasteful conditions.

Without a new Sultan WTP, the residents within the Zawiayat Sultan Project Area would be forced to rely on the existing groundwater supply or untreated surface water. Shallow wells are often affected by bacterial contamination and agrochemicals. Other than the proposed projects, there are currently no plans to develop other sources in the area. This situation implies a decrease in public hygiene over time. The result would be deterioration in the public health situation of the area.

Without a collection system, the village of Bani Ibayd would continue to rely on existing infiltration basins while excess capacity continues to be unused at the nearby Abu Qurqas WWTP. Due to high groundwater elevations in the area, aquifer contamination from infiltration basins is more likely. As the village population increases, volumes of domestic wastewater disposed to basins will increase, thereby increasing risk of contamination of shallow groundwater. Because a large percentage of the population of the village depends on hand pumps that draw water from shallow wells, public health risks would increase.

The EA report recommends the implementation of the proposed FSIP Projects with appropriate mitigation and monitoring measures. A comprehensive list of the mitigation and monitoring measures for the projects are included in Chapter 5 of the EA. These mitigation measures, if fully implemented, will abate the minor adverse impacts that arise during the construction and Operation & Maintenance phases of the projects and prevent any potential negative impact from occurring.

CONCLUSION

The First Stage Investment Projects, Governorate of Minia EA was prepared in accordance with 22 C.F.R. 216.6 (Environmental Assessments). The proposed actions will have no significant negative impacts on the physical or natural environment. The proposed actions have no cross-sector or cumulative impacts. Any potential negative or minor negative impacts will be fully addressed through adoption of the mitigation and monitoring measures proposed in the EA. The proposed action offers substantial public health benefit relative to the No-Action Alternative.

USAID/Egypt recommends the approval of the proposed actions with the adoption of all the mitigation and monitoring measures proposed in the EA. Sufficient funds should be made available to conduct adequate monitoring.

USAID/Egypt will also ensure that: project agreements and construction contracts for all the project components include clauses that ensure that any archeological material that may be uncovered during excavation are reported to the Supreme Council of Antiquities (SCA); and, all construction work is implemented in full cooperation with SCA; and that any construction/excavation work near archeologically sensitive areas should take all the required precautions to avoid any damages to the structures.

RECOMMENDATION

The Mission recommends that the ANE Bureau Environmental Officer approve the EA for the First Stage Investment Projects, Governorate of Minia, Egypt, by signing in the space provided at the end of this Action Memorandum. The requested approval is based on the understanding that USAID/Egypt will ensure that the GOE and any USAID-funded contract under the project, including design and construction contracts, include the relevant mitigation and monitoring measures in the design, construction and operations phases of the project (listed in Chapter 5 of this EA report).

Action Memo to ANE Bureau Environment Officer: Approval of Environmental Assessment for the First Stage Investment Projects, Governorate of Minia, Egypt.

Decision of Environmental Officer,
Bureau for Asia and the Near East

Approved: John O Wilson

Disaaproved: _____

Date: 7/10/01

Clearances:

AMOmar, EI/WW — date June 25, 2001
TAlexander, RPTL,EI/WW — date 6/25/01
MSmith, LEG — date 6/28/01
JHarmon, SOTL,OD/EI/WW — date 6/28/01

CC:
ADavis , OD/EI/E

Draft: [illegible] 1 Edited(6): 6/26/01 ;u:\eiem\docs\2 1 6\PSIP Minia EA Memo

Project Number: 263-0270
Prepared by Harza Environmental Services, Inc.
Under Contract Number: 263-C-00-99-00008-00
With:

U.S. AGENCY FOR INTERNATIONAL DEVELOPMENT
MISSION TO CAIRO EGYPT

MIDDLE EGYPT WATER AND WASTEWATER
MASTER PLANNING PROJECT

ENVIRONMENTAL ASSESSMENT

OF

FIRST STAGE INVESTMENT PROGRAM PROJECTS GOVERNORATE OF MINIA, EGYPT

HARZA Environmental Services, Inc.

In Association With:

Camp Dresser & McKee International, Inc.
Environmental Quality International
Engineering Consultants Group S.A.

June, 2001

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3. **Minia City Water Distribution System Improvements**
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5. **Zawiyat Sultan Slow Sand Filter Water Treatment Plant Project Area**
6. **Bani Ibayd Wastewater Collection System Project Area**

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- D2. Archeology Reports
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- D5. Water Quality Sampling Plan

E. Summary of Scoping Reports and Other Public Comment

F. List of Preparers

ACRONYMS AND ABBREVIATIONS

ACRONYM OR ABBREVIATION	DEFINITION
Yr	Year
h	Day
h	Hour
min	Minute
s	Second
L/c/d	Liters per capita per day
m^3/s; m^3/h; m^3/d	cubic meters per second; cubic meters per hour; cubic meters per day (discharge measurements)
L/s	Liters per second (discharge measurement)
mg/L	Milligrams per liter
MEGAWS	Minia Economic and General Authority for Water and Sanitation
USAID	United States Agency for International Development
SCA	Supreme Council of Antiquities
EPA	Environmental Protection Agency (United States)
WHO	World Health Organization
WWTP	Wastewater Treatment Plant
WTP	Water Treatment Plant
SSF	Slow Sand Filter
NOPASD	National Organization for Potable Water and Sanitary Discharge
MIWR	Ministry of Irrigation and Water Resources (formerly Ministry of Public Works and Water Resources)
E	East
W	West
N	North
S	South
ESA	Egyptian Survey Authority
WGS84	World Grid System 1984
MSL	Mean Sea Level
MOHP	Ministry of Health and Population
MEMPP	Middle Egypt Master Planning Project
kWh	Kilowatt Hour
GPS	Global Positioning System
IDSC	Information and Decision Support Center
PVC	Polyvinyl Chloride
DI	Ductile Iron
EUM	Egyptian Utilities Management
NGO	Non-governmental organizations

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WEIGHTS AND MEASURES

Unit Name	Abbreviation	Description (U.S. Equivalent and/or Metric Equivalent, as applicable)
Length or Distance		
Foot	Ft	Length / distance measure = 12 inches or 0.3048 m
Meter	M	Length / distance measure = 3.28 feet
Kilometer	Km	Distance measure = 1,000 m, 0.621 mi
Mile	Mi	Distance measure = 1.609 km, 5,280 ft
Area Measure		
Square foot	ft^2	144 square inches or 0.0929 m^2
Square meter	m^2	10.76 ft^2
Acre	Ac	43,560 ft^2 or 0.4047 ha
Hectare	Ha	10,000 m^2, 2.47 acres, or 2.38 feddans
Feddan	Fd	4,200 m^2, 0.42 ha, or 1.04 acre
Volume Measure		
Gallon	Gal	Liquid measure = 0.134 ft^3 or 3.785 L
Liter	L	Liquid measure = 0.001 m^3 or 0.264 gal
Milliliter	ML	0.001 L
Cubic meter	m^3	Liquid / dry measure = 35.31 ft^3, or 264.2 gal
Weights		
Ounce	Oz	28.35 g
Gram	G	0.03527 oz
Milligram	Mg	0.001 g
Pound	Lb	453.4 g or 16 oz
Kilogram	Kg	1,000 g or 2.2046 pounds
Metric Ton	T	1,000 kg or 2,205 pounds
U.S. Ton	T	2,000 pounds or 907 kg (not used)

EXECUTIVE SUMMARY AND RECOMMENDATION

Project Description

Harza Environmental Services and its associates Camp, Dresser, McKee International, Environmental Quality International, and Engineering Consulting Group have prepared this Environmental Assessment (EA) for USAID to address impacts associated with construction of five First Stage Investment Program (FSIPs) Projects in Minia Governorate. The projects discussed in this EA were identified for USAID funding under the Middle Egypt Water and Wastewater Master Planning Project (MEMPP). The projects include:

- Expansion of the US Water Treatment Plant (WTP) in Minia City,
- Improvements to the water distribution system in Minia City,
- Improvements to the wastewater pump stations and force mains in Minia City,
- A new slow sand filter (SSF) water treatment facility and force-main to serve Zawiyat Sultan, and
- A new wastewater collection system in the village of Bani Ibayd.

The MEMPP and MEGAWS have identified the need to expand all three of the Minia City WTPs to meet future water demands. The US WTP Expansion Project will be required to meet estimated maximum water demand in 2012.

Extensive residential and institutional development and subsequent increases in water demand are occurring in the northwest portion of Minia City. To serve future water demands in this area, existing water transmission lines must be upgraded to a higher capacity and extended as necessary to provide increased water service to the northwest portion of the city (Area III). Improvements in potable water transmission are also necessary in the southern (Area II) and western (Area I) service areas to:

- Effectively distribute additional water supply resulting from the expansion of the USWTP and;
- Increase pressures in localized low-pressure areas within the distribution network.

Upgrades to the wastewater pump station and force main system in Minia City are required to maintain the current level of service and meet increased future wastewater service demands. The wastewater system currently relies heavily on pump stations PS#6 and PS#2 within the 14 service zones. Currently, these and several other pump stations have insufficient pumping capacity and/or are in poor condition. Results from the MEMPP revealed that nearly all pump stations on the east side of the Ibrahimiya Canal will have to be upgraded by 2022.

The water quality of wells in the village of Sawadah (the water source for the Zawiyat Sultan service area) is poor due to the presence of iron, manganese, bacteria, and/or other contaminants. Replacement of untreated groundwater with treated surface water will address the concerns raised by human health risks associated with groundwater contamination. Construction of the new Zawiyat Sultan WTP will provide sufficient production to phase out

wells that are known to have poor quality. The WTP will be designed to have expansion capacity to meet future demands and support potential development of the area for tourism.

No wastewater collection system currently exists in the village of Bani Ibayd. Recently, NOPWASD began operating a new activated sludge wastewater treatment plant (WWTP) that serves the city of Abu Qurqas and the surrounding area. Excess capacity is available at the WWTP, which is located about four kilometers from Bani Ibayd. Construction of a wastewater collection system will take advantage of the availability of treatment at the nearby WWTP to improve sanitation conditions in the village.

Environmental Setting

Population growth in Minia Governorate is expected to be about 2.2 percent per year. The population served by the Minia City water distribution system is expected to increase from 224,700 in 1999 to267,500 in 2012, and 315,800 by the end of 2022 (i.e., the end of the planning period for the MEMPP). Estimated population size of the Zawiyat Sultan service area will increase from 20,300 in 1999 to 27,200 in 2012, and 33,300 in 2022. Estimates for the Bani Ibayd service area indicate a population increase from 19,300 in 1999 to 25,900 in 2012, and 31,700 in 2022.

The Minia City water distribution system covers nearly 100 percent of the city and serves about 96.5 percent of the population within the Minia City service area in addition to the villages of Damasees and Makwsa. The Minia City wastewater collection system covers 36-percent of the area within the city and serves 65-percent of the population.

Based on data collected from a village near Zawiyat Sultan, approximately 76-percent of the households are connected to the existing distribution system, which provides water access 24-hours per day. Most people who are not served by the local distribution system rely upon public taps or their neighbors for water. Although specific sewer connection data were not available, it is estimated that approximately 75-percent of the rural population within the governorate has access to toilet facilities. Sanitation facilities, when available, include infiltration basins, cesspits and septic systems. Most village houses have electrical connections. Although no data are available for the Project Areas, Minia Markaz ranked second in the Governorate for access to social services units.

In Bani Ibayd, approximately 47-percent of the households in the village are connected to the existing potable water distribution system. Individual infiltration basins are used for the disposal of wastewater in 90-percent of village households. One-percent of population is served by septic tanks, three-percent use latrines, and the remainders possess no sanitary facilities for their wastewater. Septic wastes are ultimately disposed of in a WWTP, sewage collection system, the desert, or illegally in local irrigation canals, drains, and vacant areas.

The climate is arid in the Minia Region. Average annual rainfall is about 5 mm. Surface water in Minia Governorate originates from the Nile and arrives via an extensive irrigation system.

The two primary irrigation canals serving the Minia Region are the:

- Bahr Yusuf at the west edge of the floodplain; and
- Ibrahimiya Canal, which parallels the Nile within a few kilometers

Biological diversity is relatively high despite the lack of natural habitats and the long history of human presence. Within Minia Governorate, the major terrestrial habitats are agricultural land and desert. Wildlife is able to exploit the cultivated and fallow areas and the uncultivated riparian areas along canals and drains. Animals near the project area are likely to be those that are common in agricultural areas throughout Middle Egypt.

Aquatic habitats include freshwater canals, fresh-brackish drains, and the Nile River. The Nile, and larger canals and drains support a variety of fish, amphibians and reptiles, as well as wetland birds and mammals.

Air pollution is mainly a result of agricultural activities, industrial activity and natural phenomena (dust storms). At times, thick smoke is generated from seasonal burning of agricultural fields; some factories (especially brick factories) generate smoke from burning of wood or low-grade fuel oil, and; the months of April through June are known as Khamaseen Season, a period of violent sand and dust storms indicating the beginning of summer.

Water pollution results from agricultural runoff, discharges of partially treated or untreated domestic sewage and septage, industrial effluents, and disposal of solid and animal waste products. The major concern with agricultural runoff is pesticides and other agrochemicals that are known or suspected to be harmful to human and environmental health. Nutrients, and pathogenic organisms are major pollutants associated with treated and untreated wastewater that is discharged to the drainage system. Agricultural processing industries such as those that make up the major industrial base in the Minia region; various mills, slaughterhouses, and tanneries, can produce waste streams that impart large biological and chemical oxygen demands upon receiving waters, and may contain toxic substances.

Historic structures within Minia City include six mosques, an Ottoman period bath and the Coptic Christian cathedral. Most of the sites are located north and west of the new bridge that spans the Nile River. Near Zawiyat Sultan, tombs from the Old Kingdom, and Hebenu, a step pyramid dating back to the Third Dynasty, are located on Kom Ahmar, at the southern end of the service area. Although the Kom Ahmar site is significant, archeological reconnaissance of the construction areas indicated that the sites proposed for construction are archeologically non-sensitive. Archeological reconnaissance conducted in the Beni Ibayd Project Area identified two significant historic structures, Awssia Mosque and the Church of the Archangel Michael within the village. The area around the pump station site and along the routes of the proposed force main appear to be archeologically non-sensitive.

Impact Assessment

With the exception of the new Pump Station # 4 site (0.2 ha located across the street from existing PS#4), the projects in Minia City will occupy existing sites, or will involve buried

pipelines within public right-of-way, resulting in minimal permanent land-use impacts. The rural projects will occupy approximately 3,500 m^2 and as much as 1,600 m^2 of agricultural land at Zawiyat Sultan and Bani Ibayd, respectively. These small tracts of land will be permanently occupied by the proposed structures. Rural roads and urban/village streets along the new force main and gravity sewer line routes will be temporarily affected by construction in all project areas. The facilities sites for the Proposed Projects will occupy government-owned land that has been identified by local governments, and are not in conflict with other planning for regional development.

Issues identified during scoping activities were assessed for impacts associated with the construction and/or operation of the various Proposed Projects. The Proposed FSIP Projects will have substantial positive impacts on public health, domestic hygiene and sanitation. The Proposed Projects were found to have limited positive impacts relative to the following:

- Economic benefits including employment of a small number of local laborers during construction and operation of the WTP;
- Improvements in domestic hygiene and overall public health - due to improved water and wastewater service, and;
- Decreases in poor taste, odor, and staining caused by iron and manganese in the treated water.

No impacts, or negligible negative impacts are expected in the following areas:

- Less than 2,000 m^2 of previously disturbed urban land in Minia City for improvements in pump stations #1, #3, and construction new PS#4 on existing MEGAWS property;
- Air quality effects;
- Surface water quality;
- Climate and groundwater;
- Water demand (slight increase as a result of project construction, population increase, and future development);
- Terrestrial and aquatic ecology; and
- Aesthetic and archaeological resources (assuming appropriate mitigation).

The most significant potential negative impacts identified by this EA include:

- Land use changes associated with permanent occupation of:
  - Approximately 15,000 m^2 of agricultural and previously disturbed land near Zawiyat Sultan owned by the GOE, for the construction of the Zawiyat Sultan WTP, and;

- Approximately 1,050 m^2 of agricultural land near Beni Ibayd Village for the construction of a main wastewater pump station and one sub-station;

- Potential public safety hazards associated with chlorine gas storage for the disinfection systems at the WTPs. Detection equipment and a public warning system should be in place prior to operation to alert people in the potential gas dispersal pathways to move to safer areas in the event of a chlorine gas leak.
- Sampling of raw water near the intake site identified three metals (aluminum, iron, and mercury) that occurred at or above the Egyptian Standards for potable water quality. Treatment is expected to reduce concentrations of these metals to safe levels, however careful surveillance of WTP operations should be conducted to confirm this assessment. Pesticides and other organic compounds were either undetected or present at levels well below the maximum level set by the Egyptian Standards.
- Filter spoils and backwash water are considered an industrial liquid waste under Egyptian Law No. 48. Appropriate treatment will therefore be necessary for filter wastes prior to discharge to surface water bodies.
- Potential impacts to historical buildings in Beni Ibayd during the construction of gravity sewers. Proper precautions to minimize disturbances of historic buildings trenching and installation of gravity sewers.

No major negative impacts on natural, physical or economic resources were identified during this EA. No cross-sectoral or cumulative impacts have been identified. The only irreversible impact will be occupation of a total of less than 18,500 m^2 of various land uses by facilities required by the Proposed Projects. The above-mentioned impacts are relatively minor compared to the previously expected benefits.

Comparison of Alternatives

The No-Action Alternative represents slowly deteriorating sanitation and health conditions in the Project Areas. Over the long term, the average incidence of morbidity due to gastrointestinal infections, paratyphoid and typhoid would be expected to increase due to decreased access to potable water, and increased exposure to wastewater. Table ES-1 summarizes the comparison of alternatives.

Table ES-1
Comparison of Alternatives for Minia FSIP Projects

Alternative / Project	No-Action Alternative	Proposed Project	Feasible Alternative
US WTP Expansion	Insufficient water to meet future demands (2012). Water services may deteriorate, with some areas in city regularly without water during peak hours. Potential that low-quality	Increase average capacity of US WTP by 330 m^3/d (500 m^3/d maximum) at existing site. Water demands in the Minia City service area will be met through 2012. Maintenance/ improvement of current	None identified

Table ES-1
Comparison of Alternatives for Minia FSIP Projects

Alternative / Project	No-Action Alternative	Proposed Project	Feasible Alternative
	water sources (shallow wells) will be used to supplement supply in outlying areas – increased public health risk. No impact on land use; traffic, public safety and other services; physical environment; biological environment; aesthetics; cultural resources.	standards of domestic hygiene. No impact on traffic, public safety, other services; physical environment; biological environment; aesthetics; cultural resources.	
Water Distribution System Improvements	Deteriorating service to high growth areas in north and west parts of city. Potential for use of low-quality water sources to supplement supply in outlying areas. No impact on land use; traffic, public safety and other services; physical environment; biological environment; aesthetics; cultural resources.	Install new mains and replace several smaller mains to serve north and west parts of city. Services to rapidly growing areas in north and west of city will be. Minor, temporary impacts on traffic, public safety, other services. No impact on physical environment; biological environment; aesthetics; cultural resources.	None identified
Wastewater Pump Station / Force Main Improvements Program	Continued reliance on existing system. Potential for backups and overflows increases as existing facilities deteriorate. Potential for broken force mains and or pump station failures/overloads. Public health / sanitation situation expected to deteriorate. No impact on land use; traffic, public safety and other services; physical environment; biological environment; aesthetics; cultural resources.	Upgrade several pump stations, construct new Pump Station # 4, install new force mains to redistribute flows/loads on pump stations, upgrade/replace some existing sewers and force mains. Services improved and deteriorating facilities replaced. Reduced potential for backups and overflows associated with broken force mains and pump station outages/overloads. Major improvement in sanitation. Minor, temporary negative impacts on traffic, public safety, other services. No impact on physical environment; biological environment; aesthetics; Potential for impacts on cultural resources impacts are low as monuments can be avoided and proper precautions to minimize potential impacts will be implemented.	None Identified

Table ES-1
Comparison of Alternatives for Minia FSIP Projects

Alternative / Project	No-Action Alternative	Proposed Project	Feasible Alternative
Zawiyat Sultan Water System Improvements	Continued reliance on poor quality water supply. – increased public health risk. No impact on land use; traffic, public safety and other services; physical environment; biological environment; aesthetics; cultural resources.	Construct SSF WTP just south of the Minia City Bridge. Water quality will meet Egyptian standards. Taste and other aesthetic qualities improved. Land use of 1.2 ha changed from mixed agricultural. Local family using site for cattle sheds and small agricultural plot (0.15 ha) would be displaced. Temporary effects on traffic, possibly other services during construction; public safety issues during construction; no impacts on physical environment; no appreciable effects natural resources and aesthetics, no impact on cultural resources.	Construct a similar SSF WTP west of Hawarta Village. Site size estimated at over 1.1 ha. Area available for significant expansion of facilities – eventual construction of regional WTP. Would require additional 8-9 km of transmission main to reach distribution point (Sawadah) for Zawiyat Sultan Service Area. Budget for additional cost is not available and no alternate guaranteed source of financing has been identified.
Beni Ibayd Wastewater Collection System	Continued reliance on infiltration basins in an area with poor sanitation and population growth. Increased risk of basin backups and overflows results in increased human contact and health risks. Local contamination of groundwater possible. No impact on land use; traffic, public safety and other services; physical environment other than groundwater; biological environment; aesthetics; cultural resources.	Construct primary collectors, trunk mains, pump station and force main to Abu Qurqas WWTP to serve village. Sewer connections allow use of infiltration basins to be discontinued. Fewer backups and overflows. Decreased public health risks. Groundwater contamination potential reduced. Minor, temporary impacts on traffic, public safety, other services. No impact on physical environment. Minor impacts (loss of 0.1 ha agricultural land-marginal habitat) on biological environment. Minor impacts on aesthetics (pump station). No impact on cultural resources with appropriate mitigation.	Alternate pump station site near Nazlet Gueid. Larger plot of land (0.2 ha affected). Feasibility of gravity sewers to pump station not fully investigated. Provides option of future collection system in Nazlet Gueid without need for additional pump station. Otherwise, impacts similar to proposed pump station. Alternate force main alignment. Decreases total force main length by about 2 km. Follows agricultural paths – possible temporary effects on adjacent lands. Otherwise, impacts similar to proposed force main alignment.

Expansion of the US WTP, combined with the Water Distribution System Improvements Project, is required to meet future water demands within Minia City. Water service will be upgraded and extended to serve the growing demand in the northwest (Area III) service area and improve service in low-pressure areas in the south (Area II) and west (Area I) of the city. If no action were taken on either of these projects, service in low pressure and high demand areas of Minia City will continue to decline forcing residents and business owners in these service areas to accept unsatisfactory water service or seek alternative sources of potable water to augment the available municipal supply. Other than the No-Action Alternative, no alternatives were identified for these projects.

The Minia City Wastewater Pumping Station / Force Main Improvements Program will provide needed maintenance and upgrades to the aged and overtaxed wastewater collection and pumping system. If the proposed project is not pursued, risk of pump failure will be greatly increased. Although the incidence of water related diseases in the Project Areas is not known, it may safely be assumed that decreased sanitation service will be accompanied by increased human and environmental risks.

Use of groundwater as a potable water source for the village of Zawiyat Sultan will be replaced by river water treated by slow sand filtration. Groundwater wells that currently serve the area show evidence of contamination. If the groundwater wells to be taken out of service are a contributing factor to disease transmission, improvement in local health can be expected. SSFs are relatively simple to operate and maintain, making this treatment technology a suitable choice for implementation.

An alternative site for the SSF WTP, located north of the project area near the village of Hawarta offers more room for expansion of the WTP and could serve as the site of a regional WTP in the future (around 2022). Budget for additional cost associated with the additional transmission requirements for this option is presently not available, and no alternate guaranteed source of financing presently for the expense could be identified.

The Beni Ibayd Wastewater Collection System should promote improved sanitation and benefit public health by reducing potential human health risks associated with contamination of groundwater associated with improperly constructed on-site wastewater treatment systems. The No Action Alternative would continue reliance on infiltration basins for wastewater disposal. As population density increases, the potential for backups and overflows from basins would increase, as would potential contamination of shallow groundwater. Because a significant percentage of the population relies on handpumps for potable water, this situation would result in deteriorating public health conditions. An alternative site for the pump station and an alternative force main alignment were considered. These project alternatives appear to be equivalent in level of environmental impacts to the Proposed Project. Should the ongoing project design process indicate that the analyzed alternatives are preferable, there would be no environmental objection to their adoption.

No appreciable negative impacts of the Proposed FSIP Projects on water quality, terrestrial and aquatic ecology, aesthetics and cultural resources, and air quality are anticipated. In the absence of significant negligible impact, the Proposed Projects will offer substantial benefits

relative to the No-Action Alternative. Where alternatives exist, the Proposed Projects are preferred to the alternatives.

Management, Mitigation and Monitoring

Mitigation measures should include the following where appropriate:

- Spill prevention, control and cleanup measures for fuel and hazardous chemicals;
- Dust and noise abatement during construction;
- Shoreline stability, siltation / erosion control during construction;
- Diversion, damming, or other mitigation for canal or drains that much be crossed during construction;
- Trench shoring to prevent the undermining of existing structures during construction;
- Management of filter waste during operation;
- Planning to mitigate potential impacts on traffic flow and access to dwellings; and
- Coordination with the SCA to prevent unnecessary disruption of any archaeological resources that may be discovered

Monitoring of the following should be undertaken:

- Raw water quality
- Treated water quality
- Filter backwash
- WTP performance, particularly with regard to aluminum, iron, and mercury
- WTP sludge content prior to disposal or land application

Should monitoring indicate problems with metals concentrations in treated water or failure of filter backwash to meet standards for industrial waste discharges, appropriate modifications to improve treatment should be implemented.

Recommendation

The Proposed Projects should be implemented with appropriate monitoring and mitigation measures.

1 PROJECT DESCRIPTION

The United States Agency for International Development (USAID) and the Government of Egypt, through the Middle Egypt Water and Wastewater Master Planning Project, are developing a Master Plan and capital investment program to meet water and wastewater system needs in the Governorates of Fayoum, Beni Suef and Minia through the year 2022. In cooperation with the Minia Economic and General Authority for Water and Sanitation (MEGAWS), Harza Environmental Services and its associates Camp, Dresser, McKee International, Environmental Quality International, and Engineering Consulting Group (collectively, the Harza Team) prepared a Water and Wastewater Master Plan under USAID Contract Number 263-C-00-99-00008-00. The capital investment program will fund not only selected, first stage investment program (FSIP) projects identified through the master planning process, but also some of the highest priority projects (HPPs) needed before completion of the Master Plan. This Environmental Assessment (EA) addresses five FSIP projects to be constructed in the Governorate of Minia. The FSIP projects include:

- The US WTP Expansion Project in Minia City,
- The Water Distribution System Improvements Project in Minia City,
- The Minia City Pump Station / Force Main Improvement Program Project in Minia City,
- The Zawiyat Sultan Slow Sand Filter (SSF) Water Treatment Plant (WTP) Project, and
- The Bani Ibayd Wastewater Collection System Project.

This EA evaluates early conceptual level designs of the projects. The final design and construction of the FSIP projects will be completed under a design-build contract. Therefore, site- and design-specific information presented herein should be considered preliminary in nature.

These projects were identified by MEGAWS, Minia Governorate authorities and USAID to address current or future problems in the water and wastewater systems. This Environmental Assessment (EA) was prepared to assess impacts associated with construction of the projects in Minia Governorate. These projects will affect Minia City, the villages of Zawiyat Sultan and Bani Ibayd and the surrounding areas.

1.1 PROJECT SETTING

1.1.1 Location

1.1.1.1 General

Minia City and the villages of Zawiyat Sultan and Bani Ibayd are located within the Governorate of Minia (Exhibit 1). The Governorate of Minia is located along the Nile River between about 160 and 290 km south of Cairo and includes areas both east and west of the Nile. It is bordered on the north by the Governorate of Beni Suef, and on the south by the

Governorate of Asyut. It covers a total area of 2,263 km^2 representing 0.22 percent of the total land area of Egypt. Administratively, Minia is divided into nine administrative units called Marakaz, each with a city as its capital. It includes 57 major villages and 1,463 smaller villages and hamlets. The largest city in the Governorate is Minia, which is the local government seat (Information and Decision-Making Support Center 1995).

1.1.1.2 Project Areas

For the purposes of this report, the project areas are defined as the area affected by the proposed projects (Exhibit 1). Therefore, the three projects in Minia City are grouped into the Minia City Project Area, which includes the extent of the urban area served by the municipal water and wastewater systems. The three projects identified in the Minia City Project Area include:

- The US WTP Expansion Project,
- The Minia City Water Distribution System Improvements Project, and
- The Minia City Pump Station / Force Main Improvement Program Project.

Additionally, individual project areas are identified for each of the two rural projects:

- The Zawiyat Sultan SSF WTP Project Area includes the area to be served by a new SSF WTP including the villages of Zawiyat Sultan, Sawadah, Deir Sawadah, Manshat Sawadah, and Ezbat Abu Filibu.

- The Bani Ibayd Wastewater Collection System Project Area is located in Abu Qurqas Markaz and includes the village of Bani Ibayd and the force main route between the village and the Abu Qurqas WWTP.

For each of the five projects, the directly affected area or Site is defined as the land permanently effected by the project including all physical structures (e.g., buildings and process units) and additional lands that will be temporarily disturbed by the project, including routes of buried pipelines.

- The US WTP Site is contained within the existing WTP property. No additional area is likely to be disturbed during construction (Exhibit 2).

- The Minia City Water Distribution System Improvements Site includes the routes of the new and replacement water mains. Because the project consists of approximately 7,300 m of new pipelines with no aboveground structures proposed, no land would be permanently affected (Exhibit 3).

- The Minia City Pump Station / Force Main Improvement Program Site includes the routes of the new and replacement force mains and the new Pump Station No. 4. Approximately 9,300 m of new force mains will be installed. The only area that will be permanently affected is at the location of the new Pump Station No. 4 (Exhibit 4).

- The Zawiyat Sultan WTP Site includes the land occupied by the SSF WTP and the route of the new water transmission line, extending from the WTP to the elevated water tank in Sawadah (Exhibit 5).

- The Bani Ibayd Site includes the village of Bani Ibayd, the new wastewater pump station site, and the route of the force main to the Abu Qurqas WWTP near Ezbat El-Zalem (Exhibit 6).

All the Proposed Projects except for the Zawiyat Sultan WTP will be located west of the Nile River. The US WTP Expansion Project will occupy previously reserved land on the west bank of the Nile River. Both the Minia City Water Distribution System Improvements and Pump Station / Force Main Improvement Program Projects will predominantly encompass city streets within The City Proper. Land proposed for the Zawiyat Sultan WTP Project is located approximately 300 meters south of the Minia City Bridge on the East Bank of The River Nile. The Bani Ibayd Waster Collection System Project will be constructed in the streets of Bani Ibayd Village with the route of the force main traversing within the in-road right of way to connect to the Abu Qurqas WWTP. Sites currently under consideration for the pump station pumping from the village have mixed agricultural and residential use.

1.1.2 Purpose

The proposed projects will meet immediate needs for potable water supply or wastewater service in their respective Project Areas while providing estimated population growth through about 2012.

1.1.2.1 The Minia City Project Area

Minia City lies along the west bank of the Nile River. The city is elongated in the north-south dimension along the river and relatively narrow in its east-west dimension. The Ibrahimiya Canal and a railroad line along the east side of the canal bisect the city along its north-south axis. The older, more densely populated areas of the city lie east of the Ibrahimiya Canal. The canal presents a barrier to interconnection of water and wastewater systems between the east and west sides of the city, as few crossings exist.

Two projects involve improvements to the potable water system in Minia City. Water production facilities serving Minia City are currently operating at capacity, with poor operation and maintenance of water systems common. The end-of-tap water quality within the city is highly variable depending on which WTP serves that portion of the city. The water system improvements are intended to address insufficient water pressure and supply due to decaying and overtaxed infrastructure.

The US WTP Expansion Project will be required to meet future potable water demands. MEGAWS currently has plans to expand all three of the WTPs serving the city to meet future water demands. The expansion of the US WTP will be required to meet estimated maximum water demand in 2012. Although the expansion will be sufficient to meet average water demands in 2022, additional resources may be required to meet the estimated maximum demand.

Extensive residential and institutional development is occurring in the northwest portion of the city. To serve growing water demands in this area, improvements to the existing water transmission system must be made to improve service in the northwest portion of the city just south of the university campus. Additional improvements will also be made in the south and western portions of the distribution system to increase capacity of the transmission system to accommodate increased supply resulting from the USWTP expansion, and improve service in localized low-pressure areas.

The third project in Minia City involves upgrading the wastewater pumping system. Upgrades are required to maintain the current level of service. The wastewater system in Minia City currently relies heavily on one pump station within the 14 service zones. Several of the pump stations have insufficient pumping capacity and/or are in poor condition. Nearly all pump stations on the east side of the Ibrahimiya Canal will require upgrading by 2022.

1.1.2.2 The Zawiyat Sultan Project Area

The population in the Zawiyat Sultan Project Area is served by wells located near the village of Sawadah. Water quality from the existing wells is poor due to presence of iron, manganese, bacteria, and/or other contaminants. Replacement of untreated groundwater with treated surface water of acceptable quality will address the concerns raised by groundwater contamination. Construction of a new WTP with 30 L/s capacity will provide sufficient production to phase out wells that are known to have poor quality. The WTP will have expansion capacity to meet future demands and support potential development of the area for tourism.

1.1.2.3 The Bani Ibayd Project Area

No wastewater collection system currently exists in the village of Bani Ibayd. The National Organization for Potable Water and Sanitary Drainage (NOPWASD) has recently begun operating a new activated sludge WWTP that serves the city of Abu Qurqas and the surrounding area. The WWTP is sized to serve the entire markaz through 2012 and beyond. With a maximum capacity of 40,000 m^3/day and a current operating flow of 5,000 m^3/day, excess capacity is available to expand the current service area. Due to its population size of over 30,000 and its close proximity to the new WWTP, Bani Ibayd was identified during the MEMPP based on a high cost-benefit ratio for connection. MEGAWS has also identified connection of the village as a preferred project.

1.1.3 Stage in the Planning Process

The five projects were identified as "First Stage Investment Projects" by the USAID Middle Egypt Institutional Strengthening, under the Egypt Utilities Management (EUM) No. 263-98-P-012, Water and Wastewater Master Planning Project (or Middle Egypt Master Planning Project – MEMPP). Design and development of specifications for these projects has commenced. Completion of detailed conceptual design and initial issuance of tender documents for design-build construction is expected to begin in summer 2001.

1.1.4 Applicable Environmental Procedures

This Environmental Assessment (EA) was performed in accordance with Title 22 of the US Code of Federal Regulations, Section 216 – Environmental Procedures (22 CFR 216). The projects considered are water and wastewater projects that, taken together, require an environmental assessment as defined by 22 CFR 216.6.

The Government of Egypt requires preparation of an EA for new construction projects. Under Law 4/1994 the Egyptian Environmental Affairs Authority (EEAA) is responsible for reviewing EAs and approving projects.

The Supreme Council of Antiquities (SCA) has jurisdiction over historical-cultural and archaeological resources. Permits must be obtained from the SCA prior to construction of new projects and archaeological discoveries made during construction must be reported to the SCA immediately. Depending on the potential for discovery of archaeological resources, SCA may require presence of an SCA inspector at construction sites.

The Ministry of Irrigation and Water Resources (MIWR) is responsible for issuing permits for shoreline construction and bank stabilization and for discharges into fresh surface water bodies such as the Nile.

1.2 EXISTING FACILITIES AND CONDITIONS

1.2.1 Water Supply and Distribution

The Minia Governorate water system includes 10 WTPs, 39 compact water treatment units and approximately 190 production wells. Total production of potable water is about 260,000 m^3/day. Water distribution in Minia Governorate is accomplished through village systems and small regional systems. Few interconnections among systems exist. At present, water service and quality vary considerably among villages and markaz cities.

Large WTPs are located in Minia City and one each in Mallawi, Beni Mazar, Samalut and Maghagha Marakaz. Compact units and wells serve the remaining markaz cities and villages. Groundwater sources account for about 55 percent of the total governorate-wide production capacity. Generally, water from production wells is not treated prior to distribution. In addition to public water, private wells are in use in a number of villages. Often, these are shallow wells with depths of 10 meters or less. Water is usually withdrawn from these shallow wells by locally available hand-pumps.

1.2.1.1 Minia City

Three WTPs and two compact units currently serve Minia City. The British and Czech WTPs, currently supply half to two-thirds of the potable water for Minia City. The British, Czech, and US WTPs have a treated water production capability of 180, 200, and 330 L/s, respectively, resulting in a total water production capacity of 710 L/s.

The Czech and British WTPs are served by a common raw water intake that is in poor condition. The intake is served by four 200 L/s pumps (two duty and two standby) and two 120 L/s pumps to provide a pumping capacity of 640 L/s. The pumps are old and need to be replaced. Additionally, the equipment room is located at river level and is prone to flooding. A catastrophic failure of this intake due to an electrical short or fire associated with flooding could leave half to two-thirds of the Minia City residents without water. Replacement of the intake is being funded by USAID under the MEMPP as a HPP.

Due to insufficient water pressure to fill existing elevated storage tanks during maximum day demand, insufficient water is available to meet peak hour demands. Hydraulic modeling of the distribution system conducted as part of the MEMPP activities identified inadequate pressures in the northern portions of the city.

The Minia City water service area has a current maximum day water demand of approximately 800 L/s and projected maximum day demands of approximately 1,200 L/s and 1,500 L/s in 2012 and 2022, respectively. To meet water future water demands, expansions of all three WTPs are planned. In addition, NOPWASD has plans to develop a new 400 L/s plant to serve Minia City in the future (Table 1-1).

Table 1-1
Summary of Existing and Proposed Water Treatment Capacity
Minia City

Water Treatment Facility	Design Capacity (L/s)	Current Operating Capacity (L/s)	Proposed Upgrade Capacity (L/s)
Czech WTP	240	180	320
British WTP	200	200	335
US WTP	330	330 [1]	660
Compact Unit #1	25	25	??
Compact Unit #2	25	25	??
New plant	NA	NA	400
TOTAL	820	760	1,715

Notes: NA = Not applicable;
?? = Continued operation of the treatment unit may be limited
1. Average Capacity – Maximum Capacity is 500 L/s.

Minia Czech Water Treatment Plant

The Czech WTP was built in 1960 and currently operates at 200 L/s. The mechanical equipment is nearing the end of its useful life, which increases costs for maintenance. Raw water pumps and finished water pumps are past their service life and need to be replaced. The plant needs a new alum system for flash mixing alum. Safety equipment was not included in plant design or construction. Operation and maintenance practices have created safety considerations.

MEGAWS plans to expand the Czech WTP to 320 L/s within four years. There are 3,778 m^2 of available land on the site, which is sufficient for the required plant expansion however; some of the existing buildings must be demolished to make room for new facilities.

Minia British Water Treatment Plant

The British WTP was built in 1927 and currently operates at 180 L/s. The plant structures are generally in good condition. Some of the equipment is nearing the end of its useful life, which increases costs for maintenance. The circular sedimentation tank was recently rehabilitated to include rapid mixing, flocculation, and sedimentation, with sludge removal piping and plate settlers. The rehabilitation has increased the capacity and improved the process. Safety equipment was not included in plant design or construction.

MEGAWS plans to expand the British WTP to 335 L/s within two years. To reach the stated capacity, the treatment plant will need a new flocculation basin(s) of 4,148-m3/day capacity. This will utilize an area equal to 21 m^2. After putting the three new sand filters into operation, the total sand filter capacity will meet the stated capacity. There are 1,378 m^2 available land on the site, which is sufficient for plant expansion.

Minia U.S. Water Treatment Plant

The US WTP was built in 1993 and currently operates at an average capacity of 330 L/s. The plant is in very good condition. There are 18,730 m^2 available land on the site, which is sufficient for plant expansion. Operations are performed to optimize chemical use and minimize power consumption. Preventative maintenance is performed on equipment. Safety considerations were incorporated into plant design, and safety equipment is available for use.

Expansion of the US WTP has been identified as a FSIP project. Average capacity will be expanded to 660 L/s by 2004.

Storage Facilities

Treated water is either stored in ground storage at the treatment site, or is pumped into elevated tanks located around the system. The British, Czech, and US WTPs have ground storage capacities of 3,650 m^3, 5,000 m^3, and 12,000 m^3 respectively. Additional storage capacity is provided by two compact units (200-m3 capacity each), and three, steel elevated tanks (4,000-m3 capacity each) with an overflow elevation of 52 m.

Elevated storage tanks are in good physical condition, and safety equipment and considerations were incorporated into elevated tank design. However, the current system is incapable of filling the elevated tanks during maximum day demand. As a consequence, the system does not have sufficient supply to meet peak hour demand (which is greater than total water treatment plant capacity and the capacity of the system). According to the Existing Conditions Report (Harza, 2000), the existing facilities do not meet the recommended criteria established for water systems.

Water Transmission and Distribution Systems

The Minia City water supply system serves an area of approximately 857 ha within the existing city boundary and extends beyond the city boundary to serve the villages of

Damarees and Makwsa. In general, the quality of original materials used for the construction of the major components was good.

Water System Modeling

As part of the Existing Conditions Report (Harza Team, 2000), average day, maximum day, and peak hour demand were modeled as 535, 803, and 1205 L/s respectively. Based on modeling results, inadequate pressures are delivered to the northern and southern regions of the city under maximum day demand. A significant portion of the western portion of the City (west of the Aswan-Cairo Agricultural Highway) also receives water at pressures well below the recommended criteria. Other than the aforementioned service areas, most areas of the City receive water at pressure above the recommended minimum pressure criterion of 20 m. Simulation of the peak hour demand however, revealed that, with the exception of the area along the eastern boundary of the city, pressures through most areas in the city are well below the recommended criteria.

Inadequate pressures in affected areas may be a result of these locations being served by long stretches of terminating small diameter pipes, undersized mains, and / or the absence of a significant water transmission main loop. These areas also have the disadvantage of being located further away from a water source or an elevated tank.

The current maximum day demand of 803 L/s can be supplied by the existing water production facilities with a combined maximum treatment capacity estimated at 820 L/s. This capacity however, includes two compact water treatment units that are not reliable, as well the full capacity of the Czech and British Plants which, does not include decreases in production due to routine operation and maintenance.

There are areas of the city where inadequate service pressures occur due to lack of appropriate capacity piping. To meet water needs during maximum day and peak hours, the city has to depend on supply from the available storage at the treatment plants and from the elevated tanks. Evaluation of the storage requirements indicates that the existing facilities are not adequately sized to meet the recommended criteria established for the water system.

Overall, the results of the assessment of the Minia City distribution system indicate that the system is adequate to meet current average water demands at pressures above the recommended standard in most areas. But, during higher demand conditions, areas in the northern and southern boundaries are receiving water at inadequate pressures. The system's ability to maintain these pressures, and in some cases even supply necessary quantities of water, diminishes throughout the city as demands increase to peak hour.

Modeling also identified potential problems that will occur in the near-term as growth and related water demands increase. These primarily stem from the fact that extensive growth is occurring in the northwestern area of the city while the main sources of water are southwest of the urban area. These deficiencies need to be addressed or the current level of water service within Minia City will decline.

1.2.1.2 Zawiyat Sultan Project Area

The Zawiyat Sultan Project Area is currently served by 4 wells located in the village of Sawadah. All existing WTPs and compact units in the Minia Markaz are located on the west side of the Nile River. Therefore, they are not part of the infrastructure that serves the Zawiyat Sultan Project Area. A transmission main connects the villages of Zawiyat Sultan, Sawadah, and Ezbat Abu Filibu. An elevated tank, located in Sawadah, provides the required storage for the system.

Analytical results of samples collected from existing wells located in Sawadah indicated that wells were not in compliance with Egyptian potable water quality standards for at least one of the following parameters on at least one occasion: turbidity, ammonia, nitrates, and iron (Appendix D1 Table D1-1). The production capacity and water quality information for the wells near the Project Area are further described in Section 2.4.5.1.

1.2.1.3 Bani Ibayd Project Area

The Bani Ibayd Project Area is currently served by wells located on the north side of the village. According to MEGAWS representatives, raw water is treated for iron and manganese removal prior to distribution. Analytical results of samples collected from treated water indicated that wells were not in compliance with Egyptian potable water quality standards for at least one of the following parameters on at least one occasion: turbidity, total dissolved solids, conductivity, or manganese (Appendix D1 Table D1-1).

1.2.2 Wastewater Services

1.2.2.1 Minia City Project Area

In spring 2000, a new, 40,000-m3/d capacity WWTP to serve Minia City began operation. The original WWTP that served Minia City, located 2.7 km south of the city, was demolished to make room for the new WWTP. At the edge of the desert west of Minia City NOPWASD is constructing a WWTP that will have a final capacity of 80,000 m^3/d. The first stage of the new NOPWASD plant is nearing completion; however, a force main from the Minia City WWTP to the new NOPWASD plant has yet to be constructed. Once completed, the combination of the NOPWASD WWTP and the recently completed Minia City WWTP will have capacity to serve the wastewater needs of Minia Markaz, including Minia City, through 2022.

Minia City is divided into 14 wastewater service zones. All wastewater from the city is directed to one of two main pumping stations, PS#6 or PS#11 (Exhibit 4). Currently, PS#6 receives 85-percent of the all wastewater flows generated within the city and will soon be overloaded. A number of pumping stations currently have insufficient pumping capacity including PS#1, PS#2, PS#4, PS#5, and PS#13. Upgrades to nearly all of the pumping stations on the east side of Ibrahimiya Canal will be needed by 2022, with upgrades to PS#1, PS#2 and PS#4 required by 2012.

1.2.2.2 Zawiyat Sultan Project Area

The Zawiyat Sultan Project Area is not currently served by municipal wastewater services. Wastewater disposal is typical of smaller villages. Although information specific to the Project Area is not available, human waste is generally disposed of in on-site septage systems, such as infiltration basins. Additional discussion of wastewater disposal as a quality of life indicator is provided in Section 2.3.3.

1.2.2.3 Bani Ibayd Project Area

The Bani Ibayd Project Area is not currently served by municipal wastewater services. Wastewater disposal is typical of smaller villages. A survey conducted in the Project Area indicates that human waste is generally disposed of in on-site septage systems, primarily infiltration basins. Additional discussion of wastewater disposal as a quality of life indicator is provided in Section 2.3.3.

1.3 PROPOSED ACTION

1.3.1 Layout and Description

1.3.1.1 US WTP Expansion

The existing Minia City US WTP is a conventional surface water filtration facility with a average capacity of 330 L/s (Exhibit 2). The facility was placed into service in 1993 and is in excellent physical and operating condition.

The treatment process consists of the following:

- Intake structure
- Bar screens
- Raw water pumping station
- Flocculation basins
- Sedimentation basins
- Rapid sand filters
- Finished water pumping station
- Chlorination system
- Finished water reservoirs, and
- Associated operational and administration support facilities

The existing WTP facilities consume approximately 60-percent of the available site, which leaves room for significant expansion of the plant. The proposed project consists of constructing another 330 L/S conventional WTP module on the available space at the site, yielding a treatment capacity of 660 L/s. The new treatment components are to be similar to the existing units.

Construction of the WTP expansion will include:

- Enlargement of the raw water pumping station and addition of six pumping units
- Two new rectangular flocculation tanks
- Two new rectangular clarifiers
- Five new rapid sand filters
- Associated alum and chlorine storage and feed facilities
- Additional sludge lagoon area
- Two additional rectangular clear water reservoirs, and
- Enlargement of finished water pumping station and addition of four pumping units

1.3.1.2 Minia City Water Distribution System Improvements

The Minia City Water Distribution System Improvements Project will involve the strategic installation and replacement of critical major potable water transmission lines effecting the service of three major service areas of Minia City; the northwest, the west, and the south. (Exhibit 3). The Program is intended to: increase the capacity of the major transmission system to accommodate the increased production resulting from the expansion of the USWTP and improve service to the aforementioned areas, which currently experience low pressure.

1.3.1.3 Minia City Wastewater Improvements

Minia City is divided into 14 service zones currently served by an aged network of pumping stations and force mains that are in fair to poor condition (Exhibit 4). If "no-action" were taken to improve the existing wastewater/ force-main system:

- PS#6 would soon become overloaded due to increased flows from PS#2, PS#3, and PS#5, and;
- PS#5 would soon become overloaded as a result of increased discharges from PS#4.

Data collected during the MEMPP revealed that upgrades to PS#1, PS#2 and PS#4, as well as PS#13 on east side of the Ibrahimiya Canal, will be required by 2012. Upgrades to all remaining pumping stations on east side of the Ibrahimiya Canal will be required by 2022.

The fact that nearly all of the existing pumpstation and forcemain will require upgrading over the master planning period affords the unique opportunity to:

- Change pumping configurations,
- Consolidate pumping, and
- Implement measures to make delivery of wastewater to the WWTP more cost-effective.

Results from the MEMPP revealed that the most cost-effective long-term pumping configuration for the Minia City Wastewater force-main system is to create two separate wastewater streams terminating at the recently completed Minia City Wastewater Treatment

Facility. To meet this end, it is recommended to separate wastewater flows on the east side and west side of the Ibrahimiya Canal. This is to be accomplished by:

- Replacing PS#4 on east side with increased capacity to handle 2022 flow from PS#2 , PS#3 and Zone 4, and
- Routing a new dedicated force main from PS#4 to the WWTP so that flows may be directly discharged to the WWTP.

Based on hydraulic analysis of the city's wastewater collection and pumping systems, components of the Minia City system that need immediate attention under the FSIP project is as follows:

- Main pumping station PS#6 will soon be overloaded. Pump station PS#6 and PS#11 serve as the main pumping stations to transport flow collected in the city to the Minia City WWTP. PS#6 currently handles more than 85-percent of the total city flows. By redirecting flows from PS#4 (which pumps to PS#5, where it is relayed to PS#6) and PS#6 will have adequate capacity through the year 2012.
- PS#5 has insufficient pumping capacity due mainly to increasing discharges from PS#4. To redirect flows, PS#4 will be converted to a main pumping station to relieve the load on PS#6 and alleviate the need to upgrade PS#5.
- A new force main, approximately 4,200 m in length will be installed on the east and west sides of the Ibrahimiya Canal to connect PS#4 to the WWTP.
- Existing PS#13 will be abandoned and replaced with a new gravity line to transfer wastewater from zone 13 to the new PS#4.
- New PS#4 will receive wastewater from PS#2, PS#3 and Zone 4.
- PS#2 has insufficient pumping capacity to meet current demand, and there are plans to increase the service area. The Zone 2 service area that is currently served by PS#2 will be extended further north, and flows from the village of Damarees will be directed to PS#2 via NOPWASD's new pumping station. PS#2 will be upgraded from three 50 L/s capacity pumps to four 120 L/s capacity pumps. Additionally, a new force main, about 3,400 m in length will be installed form PS#2 to the new main pumping station PS#4.
- PS#1 is old and has insufficient capacity. PS#1 will be upgraded from three 25 L/s capacity pumps to three 50 L/s capacity pumps
- The force main from PS#1 to PS#3 is too small and in poor condition. This section has failed many times in the past. About 1,200 m of new, larger force main will be installed from PS#1 to PS#3.

In summary, the following force mains and gravity sewers will be installed:

- 4,200 m of new force main will be installed on the east and west sides of the Ibrahimiya Canal to connect PS#4 to the WWTP;
- 700 m of new force main will be installed from Zone 13 to PS#4;
- 3,400 m of new force main will be installed from PS#2 to the new main pumping station PS#4, and;
- 1,200 m of new force main will be installed from PS#1 to PS#3.

The following pump station improvements are required:

- New PS#4 on east side of Ibrahimiya Canal with structure to handle 2022 flow from PS#2, PS#3, Zone 4, and equipment installed to accept 2012 flows from PS#2 and Zone 4;
- PS#13 will be abandoned and replaced with a gravity line to main pump station PS#4;
- New PS#2 with capacity of 300 l/s, and;
- PS#1 will be upgraded from three 50 L/s capacity pumps to three 100 L/s capacity pumps.

1.3.1.4 Zawiyat Sultan SSF WTP

The proposed water treatment systems will be designed to maximize production from the available land. The initial design discharge for the WTP is 100 m^3/hour with the ability to upgrade to 200 m^3/hour or more in the future, as needed to support potential development of the area for tourism. The raw water will come through an intake structure located on the Nile River adjacent to the plant.

The proposed site is located approximately 300 meters south of the Minia City Bridge crossing the River Nile, on the east bank of the River. Information detailing an alternative site is presented in Section 1.4.2.

The site is a long and narrow (300 x 50meter). The proposed site is gently sloping from the river's edge to the inland boundary some 300 meters from the River. The highest point of the site is approximately 3 m above the River's water level at the time of the site visit in April 2001. Land use on the Site is agricultural composed of annual crops and a recently established perennial orchard. Although owned by the Governorate of Minia, private structures include a brick homestead and several palm thatched livestock shelters.

Although the physical layout of the WTP will be determined as part to the final design, the Slow Sand Filter (SSF) WTP will include the following main components:

- Intake and raw water pump station
- Upflow roughing filter
- Slow sand filter
- Chlorine contact chamber/ ground storage tank
- High Pressure Distribution Pumps
- Transmission Main
- Administration building
- Storage area

<u>Intake and Raw Water Pump Station</u>
The raw water intake pipe for the WTP will be suspended above the high water level from a bridge structure, with the suction dropping vertically into the river near the end of the bridge. Low lift pumps will be installed on-shore at the water intake of the WTP

Up-Flow Roughing Filter

Roughing filters will precede the SSFs in the process train to provide low turbidity influent to the SSFs and prevent rapid clogging of SSF caused by large quantities of suspended solids. Raw water percolates up at a low velocity through a series of coarse gravel layers and a large proportion of the suspended solids is retained. Backwash water will be treated as required under GOE Environmental Law 48 and then discharged to the River Nile.

Slow Sand Filtration (SSF)

Slow sand filtration is filtration at very low filtration rates through a sand bed. A bed of graded sand that overlies several layers of coarser sands and gravels provides the filtration. Water covers the bed to a depth of over one meter. The sand provides physical filtration while a growth of bacteria and other microorganisms that develop in the upper few centimeters of the sand bed (the "schmutzdecke") provides biological filtration.

The schmutzdecke, literally the dirty skin, functions as the primary filter medium. It is the distinguishing feature of a slow sand filter. The schmutzdecke is composed of fine sand that traps sediment and detritus and a large variety of living and dead microorganisms filtered from the water. Because it is a biologically active filter medium, the schmutzdecke is more effective at removing organic materials, microorganisms (coliform bacteria, helminth eggs, giardia cysts, etc.) than an inert filter with a pore size similar to that of the sand bed. The biological activity also promotes removal of organic materials, microorganisms, nutrients and some metals. SSFs are relatively simple to operate and maintain. Maintenance involves draining the filter and removing the upper few centimeters of sand when the filter begins to clog. No chemicals or materials other than clean sand are required for operation.

The design capacity will be approximately 30 L/s (2,600 m^3/day) initially with upgrade capacity to meet future growth should tourism development occur.

Chlorination

Chlorine is used as an effective material for disinfection. The chlorinator injects chlorine gas into the filtered water upstream of the chlorine contact chamber / ground tank. Typically, chlorine contact for 30 minutes or more will kill bacteria that have passed through the filter.

Chlorine Contact Chamber / Ground Tank

A ground tank will be installed at the WTP to store water for an average of 4 hours in the event of the breakdown of the SSF WTP. The ground tank provides sufficient chlorine contact time to achieve disinfection.

High Pressure Distribution Pumps

After treatment, water will be conveyed to the distribution system by high lift pumps, half of which will be operating and half on standby.

Transmission Main

Finished water will be conveyed under pressure from the pump station of the SSF WTP to the elevated water tank in Sawadah village where it will feed the existing water distribution

system for the Project Area. Approximately 2,400 m of new transmission main will be required.

1.3.1.5 Bani Ibayd Wastewater Collection System

NOPWASD recently began operating a new activated sludge WWTP to serve the city of Abu Qurqas and portions of the surrounding area. This facility is located west of the city and has a rated capacity of 40,000 m^3/day. Preliminary performance testing indicate that this plant adequately meets GOE Environmental Law 48 clause 66, which outlines water quality discharge standards into non-fresh water bodies.

The proposed project consists of the installation of a wastewater collection system, pumping station, and force main to serve the village of Bani Ibayd, which lies northwest of the new NOPWASD Abu Qurqas WWTP. Estimated 2012 wastewater flows from this village are approximately 880 m^3/day. Wastewater strength is anticipated to be typical of wastewater generated elsewhere in rural Egypt and presently, contains no significant industrial wastewater fraction. Therefore capacity exists for treatment of Beni Ibayd wastewater at the Abu Qarqas WWTP and no effect on water quality of the Abu Qarqas WWTP is anticipated. Components of the proposed Bani Ibayd wastewater collection system include the following:

- Village local collector sewer system;
- Village wastewater pumping station, and;
- Force main running southward directly to the NOPWASD Abu Qurqas WWTP .

The proposed pump station would be located just east of Beni Ibayd village on land owned by the Local Unit. The area available is about 1,050 m^2. The proposed force main would follow village streets north to a main east-west street, then east to a major north-south roadway, then east to the intersection with the road to Abu Qurqas, then south to the WWTP. Total length of the proposed force main will be about 4,000 m.

1.3.2 Construction Activities

Construction schedules have not been established. All construction under the FSIP is scheduled for completion by 2004.

1.3.2.1 The Minia City Project Area

<u>The US WTP Expansion</u>
The US WTP Expansion Site is part of the existing US WTP Site and has previously been disturbed during construction of the existing WTP. The paved roads surrounding the site provide access for heavy equipment. There is sufficient area on-site for temporary storage of construction materials.

<u>The Water Distribution System and Wastewater Pumping System Improvements</u>
Construction of the Water Distribution System Improvements Project will be located primarily along roadways near the Ibrahimiya Canal. A portion of roadway in Zone 11

(northeastern part of the city) will also be disturbed for water distribution system improvements.

Construction of the Pump Station / Force Main Improvement Program Project may require installation of as much as 9,300 m of pipelines along roadways throughout the city.

Construction will be coordinated to minimize traffic disruptions. The paved roads comprising and surrounding the proposed Sites provide heavy equipment access.

1.3.2.2 The Zawiyat Sultan Project Area

Because the proposed Zawiyat Sultan WTP Site is primarily used for agricultural purposes, no construction access problems are anticipated. Access for heavy equipment is provided along the main paved road to within about 500 m of the site. An unpaved road, which may require minor improvements prior to construction, must be followed for about 500 m to reach the site. Equipment and construction materials may also be transported to the site by river barge. There is sufficient area on-site for temporary storage of construction materials.

1.3.2.3 The Bani Ibayd Project Area

Construction of the Bani Ibayd Wastewater Collection System will affect a number of roads and cart tracks in the village and along the route of the force main to the Abu Qurqas WWTP. Additional roadway will likely be temporarily constricted or blocked by the storage of construction materials. Few paved roads exist in the village; however, several roads are adequate to allow access by heavy equipment. Minor improvements may be needed to accommodate heavy construction equipment access to some parts of the village. In narrow streets, sewer installation will require hand labor for excavation and setting pipes.

1.3.3 Operation and Maintenance

1.3.3.1 Minia City Projects

<u>The US WTP Expansion</u>
Operation and maintenance of the WTP expansion components is expected to be similar to the existing components. Major operation and maintenance items include pumps, replacement of filters, sludge management, and housekeeping and safety practices associated with chlorine storage.

Sludge generated from the sedimentation/ flocculation tanks will be transferred to lagoons for further settling and dewatering. After the supernatant is drawn off and recycled into the process train, sludge management may consist of reuse by land application or disposal by landfilling.

<u>The Water Distribution System and Wastewater Pumping System Improvements</u>
Regular pipe maintenance and inspections will be required to maintain the new water mains. Pumps in the wastewater collection system pump stations will need regular maintenance to assure they maintain their design pumping capacity.

1.3.3.2 The Zawiyat Sultan WTP

The slow sand filtration systems will require relatively little maintenance if properly constructed. Processes involved in SSF technology include filtration and chemical disinfection.

Based on experience with pilot treatment systems operated by Mansoura University, filter cleaning, by scraping off about two to three centimeters of the surface layer of fine sand (initially about 100 cm thick), will be required at 2 to3 month intervals, depending on the particulate load and effectiveness of the roughing filters. To maintain adequate filtration, the depth of fine sand should not be allowed to become less than 60 cm. Additional sand must be added to the filter as necessary.

Scraping and resmoothing of the filter bed will be performed manually. The filter medium must remain moist below the level that is scraped, thus the entire operation should be completed in a period of one or two days. Because the filter modules are relatively small, one or two laborers within the required time frame can complete the cleaning process for one module.

Following cleaning, the water level is carefully restored in the filter and the filter is operated for one to two days to allow reestablishment of its biological "skin" (schmutzdecke). During this "ripening period", the filter is not in production. Water passed through the filter is typically recirculated through the filter or discharged. Thus, total downtime for maintenance of a filter module will be approximately 3 to 5 days.

1.3.3.3 The Bani Ibayd Wastewater Collection System

Pumps will need regular maintenance to assure they maintain their design pumping capacity. Regular pipe maintenance and inspections will be required to maintain the new force mains. Gravity sewer lines may require pigging or jet-rodding as necessary in the event of blockages.

1.3.4 Abandonment Plans

There are no plans for abandonment of the projects during the Master Planning Period. Major rehabilitation of concrete components such as the pipelines and structural concrete components associated with the US WTP and Zawiyat Sultan SSF WTP may be required at 20 to 30 year intervals.

1.4 PROJECT ALTERNATIVES

1.4.1 No-Action Alternative

The No-Action Alternative is to not construct the five projects. The implications of No-Action are presented below, and comparisons to the proposed Projects are discussed in Section 4.1

The Minia City Project Area
If the US WTP is not expanded, insufficient potable water will be available to meet both current and future demand. Insufficient water pressure would continue to be a problem in portions of the city during maximum and peak hour demand.

Elimination of water distribution improvements would leave the growing population in the northwest portion of the city and localized service in south and west service areas of the City with minimal water service.

Without upgrades and repairs to the wastewater collection system, general health and sanitation would gradually decay as overstressed infrastructure reaches the end of its useful life. Wide areas of Minia City would be subject to backups and overflows in the event of a failure at PS#6, which currently handles 85-percent of municipal flows. As systems fail, MEGAWS must replace and repair items on an emergency basis, resulting in higher costs.

The Zawiyat Sultan Project Area
The villages would continue to rely on the Sawadah groundwater wells, which have excessive levels of contaminants including ammonia, nitrate, iron, and manganese. Additionally, existing pumping and water transmission capacity is insufficient to support the eventual development of the area for tourism.

Iron and manganese are of concern for taste and aesthetic reasons. High levels of manganese results in poor tasting water. Poor tasting water may cause residents to seek other sources of better tasting water but of lesser quality (contaminated surface water). Elevated levels of iron in wash water can cause staining of laundry. The presence of ammonia and nitrate in water indicates contamination with septage or agricultural waste streams.

Decaying water quality will affect health and quality of life within the Project Area. MEGAWS will find it necessary to develop new potable water production facilities for Project Area should the proposed projects not go forward.

The Beni Ibayd Project Area
The village currently relies on infiltration basins and cesspits and/or direct discharge to drains for sanitation. In the case of infiltration basins and cesspits, accumulated septage is typically removed by vacuum truck for disposal. Vacuum trucks are required to dispose of septage in desert areas remote from villages; however, the practice of disposing of septage to a drain a few kilometers outside a village is relatively common.

During the site visit, villagers reported that limited areas of the village experience chronic backups or overflows of infiltration basins when groundwater is high. As the population increases in the future, problems with disposal of wastewater would become more common in Beni Ibayd. The result will be potential surface flooding from overflows of cesspits and infiltration basins and more disposal of septage to drains. As such problems increase, the overall level of sanitation and public health would be expected to decrease.

1.4.2 Other Feasible Alternatives

Feasible alternatives for the project include use of different technology, alternative designs or alternative sites. For the Zawiyat Sultan SSF WTP Project, two sites are considered viable. For the Beni Ibayd Wastewater Collection System Project, two alternative sites have been suggested for the pump station location and two alternative arrangements of the force main have been suggested.

1.4.2.1 Minia City

No alternatives have been suggested for the projects that will be undertaken in Minia City. The US WTP Expansion Project will utilize space previously set aside for expansion within the existing US WTP site. No alternatives to this project, other than the No-Action Alternative were considered.

The Water Distribution System Improvements Project and the Wastewater Pump Station / Force Main Improvements Program Project are at an early stage of design. During the design process, more efficient alternative arrangements of the systems may be identified through additional modeling and design activities. Prospective design-build contractors may also identify engineering design alternatives as part of the tender and bidding process for the Proposed Projects. In general, most changes are expected to involve adjustment of pipeline alignments within Minia City either to optimize construction or to avoid environmentally sensitive areas. Thus, because of the early stage of design and the generic nature of expected impacts, no specific alternatives are considered in this EA.

1.4.2.2 Zawiyat Sultan

MEGAWS has indicated interest in upgrading the proposed WTP capacity to 150 L/s to accommodate tourism development in the area. An alternate site located west of the village of Hawarta and approximately 11,500 m^2 in size was identified by MEGAWS. The alternate site would require approximately 13,000 m of transmission main to reach the elevated tank in Sawadah, compared to approximately 2,400 m.

The Master Plan also identified a site in the general vicinity of the Hawarta site for eventual construction of a regional plant with minimum capacity of 120 L/s to meet 2022 demands. The regional plant would serve the same area as the SSF WTP that will be built near Tehna El-Gabal under the HPP phase of the MEMPP. The Tehna El-Gabal SSF WTP site is approximately 4 km north of the Hawarta site. There appears to be enough area at the Hawarta site to accommodate a regional WTP of more than 120 L/s capacity.

1.4.2.3 Bani Ibayd

An alternate pump station site west of the village of Nazlet Awolad Gueid may allow Nazlet Awolad Gueid (1999 population of 8,060) to connect to the Abu Qurqas WWTP at relatively low cost. This alternate site occupies an area of approximately 1,750 m^2. Based on field reconnaissance, it was unclear whether sewage could flow by gravity to either the proposed site or the alternative site, with the potential to flow by gravity to the more remote alternative site being less likely. The well field on the north side of village should be avoided during pump station siting. Due to the preliminary nature of the siting activities to date and design considerations such as high groundwater in the vicinity of Bani Ibayd, it is recommended that all final designs be reviewed by USAID's CMC for compliance with this EA.

The local representatives of MEGAWS also identified a potential alternative to the proposed force main route, which would pass through the village and then follow rights of way of paved roads to the Abu Qurqas WWTP. The alternative route would follow a dirt track through agricultural fields and eventually reach the paved road near Nazlet Awolad Gueid. This route would require a force main about 3,200 meters long, which would be about 800 meters shorter than the proposed force main.

2 ENVIRONMENTAL SETTING

2.1 INTRODUCTION

2.1.1 Field Study Methodology

Field activities involved site visits and consultation with local and governorate authorities (Appendices A and B). The project's senior environmental scientist, environmental engineers ecologist, surveyrs, and archaeologists visited the rural sites on several occasions. The focus of field activities was on the potential archaeological resources in the area surrounding the proposed construction areas. The archaeologists' field reconnaissance reports and site visit notes are included in Appendix D2. The Ecologist's site visit reports for the rural sites are included in Appendix D3. The urban sites received a lower level of scrutiny during field activities because of previous disturbance of the construction areas.

In addition to interviews and site visits, analytical results of river water quality samples collected for the HPPs were reviewed. For the HPPs, four samples were collected from each of following three locations.

- The east shore of the river about 200 m downstream from the Tehna El-Gabal WTP Site (about 13 km downstream of Minia City – Nile River Bridge);
- The west shore of the river near the Zohra WTP site, which is across the Nile River from Tehna El-Gabal (about 10 km downstream of Minia City – Nile River Bridge), and;
- The east shore of the river near the Deir Abu Hennis WTP Site (about 40 km upstream of Minia City – Nile River Bridge).

River water samples were analyzed for physical and chemical parameters including basic water quality parameters such as alkalinity, dissolved oxygen, turbidity, biochemical oxygen demand, and chemical oxygen demand; metals; oil and grease; total organic carbon and nutrients. Analyses for organic pollutants such as agrochemicals and PCBs were conducted for one sample at each site. River water sampling results are presented in Appendix D3 Table D3-1.

2.1.2 Life of the Project

The Proposed Projects are intended to meet water and wastewater demands within their respective Project Areas to varying degrees through the MEMPP planning horizon of 2022. The projects' ability to meet existing and future demands is compared with estimated demands.

2.1.2.1 Potable Water Projects

Projects that address water demand can be compared with projected water demands to assess project life (Table 2-1).

Table 2-1
Estimated Future Water Demand
for the Minia City and Zawiyat Sultan Project Areas
Minia Markaz

Project Area	City or Village Name	Maximum Day Water Demand		
		2007	2012	2022
Minia City	Minia City	1,065	1,122	1,386
	Damarees Village	7	8	13
	Makwsa Village	24	28	40
	Total for Minia City Project Area	**1,096**	**1,158**	**1,439**
Zawiyat Sultan	Zawiyat Sultan	13.5	16.4	22.6
	Sawadah	11.1	13.4	18.5
	Total for Zawiyat Sultan Project Area	**25**	**30**	**41**

Notes: 1) Water demand is expressed in units are in L/s
2) The Zawiyat Sultan WTP will have a maximum operating capacity of 30 L/s and will be expandable to 60 L/s in the future.

The US WTP expansion will provide one critical component to meeting both current and future demands of the city. In order to meet 2022 maximum day demand of approximately 1,500 L/s, expansion of all existing WTPs is required, as discussed in Section 1.2.1.1 (Table 1-1). The Water Distribution System Improvements Project will not increase water supply to the city but will ensure the continued level of serve and extend the service area.

With an initial capacity of 30 L/s, the Zawiyat Sultan SSF WTP will satisfy water demand within the Project Area through 2012. Planned upgrades to 60 L/s will be required prior to 2022 according to projected population. If properly maintained, the WTP will have an operational life through the end of the planning period, and beyond, prior to requiring major rehabilitation. Thus, the WTP has a service life that will extend beyond the end of the planning period.

2.1.2.2 Wastewater Projects

Projects that address wastewater demand can be compared to wastewater projections to assess project life (Table 2-2).

Table 2-2
Estimated Future Wastewater Projections for the Minia City and Bani Ibayd Project Areas and for the Abu Qurqas Markaz WWTP

		Monthly Average Wastewater Projection (L/s)		
Marakaz	**Project Area**	**2007**	**2012**	**2022**
Minia City	Minia City	546	664	955
Abu Qurqas	Bani Ibayd	12.0	15.4	23.5
Abu Qurqas Markaz WWTP				
	Markaz total (m^3/day)	23,371	29,583	44,543
	Markaz total (L/s)	271	342	516

Notes:
1) Wastewater projections are in units are in L/s unless otherwise noted.
2) The design capacity of the Abu Qurqas WWTP is 40,000 m^3/day.
3) Although the villages of Damarees and Makwsa are included in the Minia City water service area, they are not included in the wastewater service area.

The Minia City Pump Station / Force Main Improvements Program Project will not increase existing treatment capacity, but will improve reliability of existing service and reduce the risk of major backups and overflows due to system overloads and failure of deteriorated pumping equipment. The existing Minia City WWTP will become hydraulically overloaded around 2007; however, the NOPWASD regional WWTP and the force main from the Minia City WWTP to the NOPWASD WWTP should be completed by that time. Excess wastewater flows can be treated at the NOPWASD facility after 2007.

The Beni Ibayd Wastewater Collection System Project will convey wastewater to the new Abu Qurqas WWTP. The Abu Qurqas WWTP currently only utilizes approximately 13-percent of its 40,000-m3/day design capacity. The Abu Qurqas WWTP has sufficient capacity to handle projected average wastewater flows of the entire Abu Qurqas markaz until approximately 2022 (assuming all villages are sewered and pump to the WWTP). Therefore, significant excess capacity will remain after inclusion of Bani Ibayd in the service area for additional service connection to surrounding villages in the markaz.

If properly maintained, both the Minia City Pump Station / Force Main Improvements and the Bani Ibayd Wastewater Collection System will have an operational life through the end of the planning period, and beyond, prior to requiring major rehabilitation. Thus, the Projects have a service life that will extend beyond the end of the planning period.

2.1.3 Study Area

The study area includes areas that will be subject to direct and indirect impacts of the project and its alternatives. The area that will be directly impacted by construction and operation of the project includes adjacent land and areas along the right-of-way of existing roads, where the force mains will be constructed. The study areas include but are not limited to the following:

- Minia City: urban streets and buildings adjacent to the pipeline routes.
- Zawiyat Sultan: the bank of the Nile River where the intake will be constructed, agricultural and industrial activities on, or adjacent to, the SSF WTP, and the roads along the proposed transmission line route.
- Bani Ibayd: village streets and buildings adjacent to the proposed pipeline route, agricultural land surrounding the proposed pump station site, and roads along the force main route.

Both direct and indirect impacts of the proposed projects that will affect the Project Area are discussed in Section 3.

2.2 CURRENT LAND USE AND REGIONAL PLANNING

2.2.1 Land Use

The total area of cultivated land of Minia Governorate is 183,472 ha representing 5.58-percent of the total cultivated land area of Egypt. It is estimated that an additional area of 45,380 ha of land can potentially be reclaimed for agriculture if adequate water resources could be obtained. The greater part of the cultivated land is privately owned and cultivated by the owners (Information and Decision Making Support Center [IDSC] 1995).

Minia Governorate is a major agricultural producer, ranking number 5 among the 25 governorates of Egypt in terms of agricultural productivity. Major crop production in Minia includes maize (producing 16.86 percent of the national production), wheat (producing 7.96 percent of the national production) and cotton (producing 9.09 percent of the national production) Animal production totals 39,875 tons of meat annually representing 5.77 percent of the national production (IDSC 1995)

Within the limits of the ancient flood plain of the Nile, soils are mainly Nilotic silt precipitated by Nile water, which periodically flooded the Nile Valley in ancient times. The average thickness of the Nile sediments in the Nile Valley of Middle Egypt is about 9 meters (Abu Al-Ezz 1977, Said 1990). Prior to construction of the Aswan High Dam in the 1960's, the rate of silt precipitation was estimated at an average of 10.3 mm per year in the irrigated land of the Upper Egypt Nile Valley in general (Said 1990). Following the construction of the Aswan High Dam, the silt load of the Nile water diminished to a very low level. Desert land reclaimed for agriculture is mostly located above the river's flood plain. Soils in these areas are mostly sand/clay (Abu Al-Ezz 19 1977).

2.2.2 Regional Planning

There are few regional planning initiatives within Minia Governorate that affect the Project Areas. The three WTPs located in Minia City that were built by the governments of Czechoslovakia (Czech), Britain, and the United States of America (US), are currently in operation. Besides the US WTP Expansion Project presented here, there are plans to expand both the Czech and British WTPs and construction a new 400 L/s WTP.

The MEMPPP made recommendations for regionalization of water systems and/or construction of additional capacity to serve the Project Areas. No other regional planning activities were identified for the Project Areas.

2.3 SOCIO-ECONOMIC CONDITIONS

2.3.1 Demography and Migration Patterns

The population in Minia Governorate is largely rural with about 81 percent of its 3.31 million inhabitants (1996 census) living in rural areas. Minia City is the largest urban center in the governorate with a 1996 population of 201,360. The population growth rate in the governorate between 1986 and 1996 was 2.2 percent per annum, which projects a doubling of the population every 32 years. The population growth rate in rural areas was somewhat higher than the governorate average. Table 2-3 presents projected growth for the governorate and for the Project Areas.

Table 2-3
Population Projections for Minia Governorate and the Project Area from 1996 to 2022

Area	1996	1999	2002	2007	2012	2017	2022
Minia Governorate	3,308,803	3,543,874	3,789,553	4,223,562	4,687,887	5,181,690	5,703,638
Minia Markaz	403,466	433,484	464,952	520,607	580,204	643,608	710,611
Abu Qurqas Markaz	328,491	352,931	378,552	423,864	472,386	524,008	578,560
Minia City Project Area, Minia Markaz							
Minia City	201,360	212,863	224,687	245,444	267,536	290,982	315,796
Damarees Village	5,797	6,228	6,680	7,480	8,336	9,247	10,210
Makwsa Village	15,935	17,121	18,363	20,562	22,915	25,419	28,066
TOTAL	223,092	236,212	249,730	273,486	298,787	325,648	354,072
Zawiyat Sultan Project Area, Minia Markaz							
Zawiyat Sultan	10,401	11,175	11,986	13,421	14,957	16,592	18,319
Sawadah	8,532	9,167	9,832	11,009	12,269	13,610	15,027
TOTAL	18,933	20,342	21,818	24,430	27,227	30,202	33,346
The Bani Ibayd Project Area, Abu Qurqas Markaz							
Bani Ibayd	18,001	19,340	20,744	23,227	25,886	28,715	31,705

Source: Harza. 2000. MEMPP Existing Conditions Report.

2.3.2 Economy and Principal Sources of Employment

Approximately seven percent of the rural population in Minia Governorate is unemployed. This is about half the urban unemployment rate of 14 percent. The urban dependency ratio is 74-percent compared to 76-percent in rural areas.

The largest source of economic activity in Minia Governorate is agriculture. Income from agricultural activities accounts for about 61-percent of the average annual income for rural individuals. Other major sources of income for rural individuals are salaries and wages (23-percent), non-agricultural activities (7-percent) and real estate (4-percent). Fishing and aquaculture in Minia Governorate produce 4,817 tons of fish per year, which represents one percent of the total national fish production.

In urban areas such as Minia City, the major sources of income are salaries and wages (46%), non-agricultural activities (24%) and "other' activities (12%). Average income per income-generating individual in 1996 was about LE 3,000 per year in both urban and rural areas.

Local industries include chemical production, construction, metals, engineering, plastics, textiles, paper, food and miscellaneous other manufacturing operations. Tourism facilities include 12 hotels with 457 rooms and 907 beds, producing in 35,808 tourist-nights per year (IDSC 1997).

2.3.3 Quality of Life Indices

Some indicators such as access to water and wastewater facilities may be used to judge quality of life.

2.3.3.1 Urban Areas: Minia City Project Area

According to the Existing Conditions Report (Harza 2000) 96.5 percent of the population of within the Minia City service area, including Minia City and the villages of Damarees and Makwsa, is served by the distribution system. On the average day, the city accounts for 93 percent of the water consumption while the villages use the remaining seven percent. Water is generally available 24-hours per day throughout the distribution system. The distribution system services Minia City and extends to the fringes of the city service area. Residents within the service area without a connection to the distribution system typically rely on hand pumps or a neighbor's tap.

In the whole markaz, about 86.9-percent of urban residents have a tap inside the home, and 9.6-percent have a tap inside a multiple unit dwelling. The balance of the urban markaz population obtains water from the system by other means such as hand-pumps. Residential connections make up 98-percent of the total number of water service connections within Minia City service area, with institutional connections accounting for the remaining 2-percent. The average water usage within Minia City was estimated to be 161 L/c/d .

The Minia City wastewater collection system covers 36-percent of the area within the city and serves 65-percent of the city population. Of the 35-percent of residents without a sanitary connection, those with connection to water service generally use on-site waste disposal systems. Residents who lack connections to both water supply and sanitary service generally do not have toilet facilities.

2.3.3.2 Rural Project Areas

During the MEMPP village survey, data collected to assess water service access included parameters such as number of household connections, use of hand-pumps, number of public taps, and average water use. Data collected to assess access to wastewater service included access to, and types of, disposal facilities such as infiltration basins and collection systems.

Although specific sewer connection data were not available, about 75-percent of the rural population within the governorate had access to toilet facilities based on information collected for by the MEMPP. Most people voluntarily limit water use to reduce costs of pumping out infiltration basins and other on-site septage storage systems. Human waste is generally disposed of in the on-site septage systems. However, water used for washing purposes (gray water) is often spread on the ground outside dwellings to provide dust control. The rates of evaporation and infiltration limit the amount of gray water that can be disposed of without creating pools or mud holes. To avoid gray water disposal problems, some residents wash cooking and eating utensils and clothing in canals and drains. The quality of such sources of water often fails to meet generally acceptable bacteriological criteria for human contact.

According to the 1996 census, 88-percent of the rural population of Minia Markaz live in village houses. About 16-percent of residents have a tap inside a single family home, and 13-percent have a tap inside a multiple unit dwelling. Eight percent of the rural markaz population obtain water from the system by other means. Approximately 63 percent of the rural population in the markaz use hand-pumps. An estimated 75-percent of the rural markaz population had access to some form of sanitary disposal facility.

<u>The Zawiyat Sultan Project Area</u>
Because the villages within the Project Area where not surveyed, data for the closest village, Nazlet Faragallah, was assumed to be most representative of the Project Area. Based on survey information collected for the village of Nazlet Faragallah as part of the MEMPP, residents currently limit amounts of water use in the home because of limited wastewater disposal options. Approximately 76-percent of the households in the village are hooked up to the existing distribution system, which provides water access 24-hours per day. Because the village does not have a public water tap, residents without a connection use a neighbor's tap or other alternate water source. The average water usage in the Zawiyat Sultan was estimated to be 53 L/c/d or 8 m^3/household/month.

Individual infiltration basins are used for the disposal of wastewater in 90-percent of village households. Two percent of population is served by septic tanks, and two percent discharge wastewater to the ground.

The Bani Ibayd Project Area

Based on survey information collected for the village of Bani Ibayd as part of the MEMPP, residents currently limit amounts of water use in the home because of limited wastewater disposal options. Approximately 47-percent of the houses in the village are hooked up to the existing distribution system, which provides water access 24-hours per day. Approximately 70-percent (by area) of the village is served by the distribution network. Although the village has eight public taps for residents without a connection, none were operating at the time of the village survey. Residents without a connection use handpumps or other water sources. The average water usage was estimated to be 59 L/c/d.

Individual infiltration basins are used for the disposal of wastewater in 90-percent of village households. Septic tanks serve one percent of the population, three percent of the population use latrines, one percent discharge wastewater to the ground, and the remaining population have no facilities

2.3.4 Transportation, Telecommunication and Power Networks and Support

Minia Governorate had 1,217 km of paved roads in 1996. Most streets and all major roads in Minia City are paved. In the Zawiyat Sultan Project area, the main north-south road, along which the transmission line will be laid, is paved. In Beni Ibayd village, many streets are packed earth with few paved roads. The Project Areas are served by telephone and electric service and a post office. Although the number of electric connections within the Project Areas is unknown, Minia Governorate consumes 467,800,000 kWh per year, or 141 kWh per capita annually. The majority of inhabitants in the Project Areas appear to have electrical service. There are 76,605 telephone lines in Minia Governorate, or 2.3 lines per 100 inhabitants. Three hundred eighteen post offices serve the Minia Governorate (IDSC 19 1997).

2.3.5 Education, Health and Social Services

2.3.5.1 Access to Services

Illiteracy levels are higher in the rural areas of Minia Governorate than in urban areas. About 61 percent of the rural population is illiterate, compared to 31 percent of the urban population of Minia Governorate. Statistics are not available to describe education within the three Project Areas.

Public education facilities are available for primary, secondary, and higher education levels. Minia Governorate has a total of 17,437 primary and secondary classrooms, serving 680,355 students for an average of 39 students per classroom. There are eleven institutions for higher education with a total enrollment of 29,395 students (IDSC 1997).

Health services in Egypt are provided by governmental and non-governmental organizations. Governmental services are mainly offered through the Ministry of Health and Population (MOHP) and it's affiliated organizations. The armed forces provide an appreciable medical service, essentially at secondary and tertiary levels. The private sector also makes a

significant contribution with regard to the provision of health services at different levels. Notification of the MOHP is obligatory only for occurrences of certain highly infectious and/or serious diseases. Thus, information relative to the health conditions associated with quality of water supply and exposure to water-borne pathogens is incomplete. In particular, the incidence of gastroenteritis, which is related to contamination of water supplies and, to a lesser extent, food, is not fully reported.

Health services in Minia Governorate include 74 hospitals and local health units with 4,009 beds or about 825 inhabitants per bed. There are 1,350 physicians with about 2,451 inhabitants per physician (IDSC 1997). Access to social services within Minia and Abu Qurqas is as follows:

- Minia Markaz is estimated at 30,244 individuals per social service unit, tying with one other markaz for the secondary ranking within the governorate [ITD22].
- Abu Qurqas Markaz is estimated at 31,531 individuals per social service unit, tying with two other marakaz for the tertiary ranking within the governorate.

2.3.5.2 Occurrence of Waterborne Disease

Statistics collected for the occurrence of six waterborne diseases in Minia Governorate indicate that Typhoid, Hepatitis, Poliomyelitis, Gastroenteritis, and Schistosomiasis are endemic (i.e., diseases present at all times among an appreciable portion of the population). Additionally, cholera has occurred as an epidemic disease in Egypt, with the last outbreak occurring in 1995.

From 1995 to 1998, incidence of Typhoid and Hepatitis in Minia Governorate averaged 23 percent and 10 percent higher, respectively, than incidence rates for all Egypt. It can be concluded that these higher rates are a reflection of the environmental conditions in Minia Governorate, which are worse than the average conditions found in Egypt. Detailed statistics for the marakaz within Minia Governorate were collected for Typhoid and Hepatitis (Table 2-4).

Table 2-4
Waterborne Disease Incidence Rate per 100,000 Persons in Minia Governorate

	1995	1996	1997	1998	1999
Typhoid Fever					
Minia Governorate	21.9	20.1	22.2	19.5	22.2
Minia Markaz	31.6	20	20.8	11.4	10
Abu Qurqas Markaz	4.8	12.2	12.9	12.4	7.7
Viral Hepatitis					
Minia Governorate	NR	11.8	12.7	21.6	21.8
Minia Markaz	NR	36.9	34.9	62.5	63.3
Abu Qurqas Markaz	NR	2.9	4.0	11.4	11.0
Gastroenteritis					
Minia Governorate	NR	6	6.2	4.6	3.3
Minia Markaz	NR	20.8	21.5	12.6	9.8
Abu Qurqas Markaz	NR	1.3	2.6	0.8	0.0

Source: Calculated form figures provided by the Governorate Health Directorate's Preventive Medicine Section

Notes: 1. Estimated based on first quarter statistics.
2. Highlighted values exceed the governorate-wide average incidence rate for the year.
3. NR = Not reported

Incidence of Typhoid in Abu Qurqas Markaz was less than the rate for the governorate. Incidence of Typhoid in Minia markaz occurred most frequently in one city (near Minia City) with a mixed water supply and one village (Tahansha) with a deep water supply.

Minia Markaz showed an incidence of viral Hepatitis three times higher than the rate for Minia Governorate as a whole. No further detail was available regarding locations within the markaz that contributed to higher incidence rates of Hepatitis. The incidence rate of Hepatitis in Abu Qurqas markaz was less than the governorate-wide rate.

Gastroenteritis statistics are difficult to interpret because access to hospitals and criteria for reporting cases affects whether or not mild to moderate cases are reported. Milder cases are often self-limiting; thus, people in rural areas may not go to hospital unless a severe case occurs. In urban areas, residents with relatively mild cases may seek medical attention. In addition, gastroenteritis has many potential causes, but few cases are diagnosed. Finally, there is no requirement that cases be reported unless the case is confirmed to be typhoid or another "reportable" disease. Therefore, comparison with statistics for other governorates is not meaningful. In Minia Governorate, Minia Markaz has experienced a relatively high incidence of reported cases of gastroenteritis, which may reflect better access to fever hospitals in Minia City rather than significantly higher incidence of cases. Abu Qurqas Markaz had a lower-than-average incidence of gastroenteritis from 1996 to 1999.

Incidence rates of Poliomyelitis in Minia Governorate have been from four to ten times the national rate from 1995 to 1998. Low vaccination coverage and/or the use of a low potency vaccine may explain the relatively high incidence of polio in the governorate.

In a survey conducted in 1991 to study the epidemiology of Schistosomiasis in rural Egypt, Minia Governorate was found to have the second highest rate of incidence of the urinary type of all the governorates surveyed.

Although the last epidemic of the classic type of cholera was in 1947, small-scale epidemics of the El-Tor Biotype of Cholera have occurred in 1970, 1983, and 1995. As part of the 1995 outbreak, a total of 20 cases and 29 carriers were detected in Minia Governorate. Detected cases were limited to seven villages within Deir Mawas Markaz. Although no official explanation for the cause of the outbreak was available, MOHP personnel cited the use of canal water from Deermowasia canal, which is used for both agricultural drainage and sewage disposal, as the cause of the outbreak. No information was available regarding primary sources of drinking water at the time of the outbreak (EQI 1999).

In general, Minia Governorate shows a higher incidence and prevalence of waterborne diseases than average Egyptian rates. This may be due either to true increases, resulting from unsanitary environmental conditions, or to better reporting. .

2.3.6 Ethnic Factors

There are no observable ethnic differences among the inhabitants of the Project Areas.

2.4 PHYSICAL ENVIRONMENT

2.4.1 Climate

The climate of Minia is typical of the hyper-arid Sahara; hot and dry with scanty winter rain and bright sunshine throughout the year. Temperatures range from as high as 47.5° C recorded in May to as low as zero °C, recorded in March. December is the coldest month of the year and July is the hottest. Precipitation is very low averaging 5.3 mm annually. Rain may occur any time of the year with the exception of the three summer months of June, July and August. The potential evapotranspiration rate is extremely high throughout the year, averaging 6.9 mm/day (2336 mm/year). High evaporation rates coupled with the scanty precipitation make the area one of the most arid localities in the world. Relative humidity is generally low, averaging 50-percent throughout the year and is highest in December and lowest in May. Winds blow mostly from the north, northeast or northwest. Violent sand and dust storms locally known as Khamseen occur regularly during the spring months.

2.4.2 Geology and Hydrogeology

2.4.2.1 Geology and Landforms

The Governorate of Minia covers an area extending both east and west of the Nile Valley. Throughout the governorate the river flows very close to the eastern limestone ridge of the Mahaza Plateau, sometimes washing the foot of that plateau. The floodplain west of the Nile is very wide if compared to that on the east bank. The width of the Nile's floodplain on the western side of the Nile varies from about 10 km to more than 21 km (Abu Al-Ezz 1977). On the other hand, the band of agricultural land on the eastern bank appears as isolated pockets separated from each other by limestone ridges (where the river brushes the eastern wall of the valley). This is caused by the tendency of the river to take a course inclined toward the east side, which results in a high rate of erosion of the east bank and high deposition on the west bank (Said 1992). Before the river was put under full control after the construction of the Aswan High Dam, the rates of erosion and deposition were so high that tens thousands of hectares of land were either eroded away or deposited every year. The quantity of material eroded by the river in the year 1953 was 10,721 hectares, whereas its deposition was 12,340 hectares (Abu Al-Ezz 1977).

West of the Nile's flood plain, the Governorate of Minia extends into the Western Desert. At the western boundary of the floodplain, a series of low, longitudinal dunes occur. West of this dune belt is the Western Desert, a nearly level limestone plateau covered with a thin layer of sand and desert pavement (Abu Al-Ezz 1977, Said 1962, Said 1990). The pavement results from chipping of the hard limestone bed that forms the undersurface. At several locations within this flat desert plateau, shallow sandy depressions occur. Beneath the sandy surface deposits, these shallow basins are filled with finer sediments, which have been washed into the depression by rain during past fluvial periods (Said 1962). With their finer deposits, these depressions hold more moisture received from the rare rain showers than the surrounding desert, allowing the growth of a relict, open forest of acacia trees (Saleh 1993).

East of the Nile the Governorate of Minia extends into the intensely dissected Eastern Desert, which is characterized by its external drainage system (Abu Al-Ezz 1977). The westward drainage of this desert to the Nile valley mostly coalesces into a relatively small number of great trunk channels, most important of which are wadis Tarfa, Bustan, Saririyah, El-Tahnawy, and Ibadah. These wadis drain the Mahaza Plateau into the Nile. Flash floods occur in the major wadis and occasionally reach the Nile.

The Nile mainstream in Minia is dotted with numerous low islands. Although the local people cultivate some of these islands, most are too low to allow successful cultivation. Shaybah and Al Barsha Islands are the largest of these islands.

2.4.2.2 Hydrogeology

Minia Governorate is characterized by main groundwater systems including the quaternary alluvial and tertiary aquifer systems. Production wells for irrigation and community water supply, and thus most information available on the occurrence of groundwater, are confined almost entirely from the quaternary alluvial deposits of the Nile River. The quaternary

alluvial aquifer system occupies much of the Nile Valley. It has a maximum thickness of about 250 m, and is dominated by sand and gravels.

The Quaternary System is composed of two hydrogeological units: the major hydrogeological system and the old alluvial plains system. The major hydrogeological system is extensive, highly productive, and mainly semi-confined, particularly in the outer fringes occupied by the old alluvial plains. These water-bearing sediments have a wide geographical distribution in the Nile Valley. They are composed mainly of sandstone, sands, gravels and clay, which are related to the Pliocene, Pleistocene and Holocene ages. There are hydraulic connections between this groundwater system and the surface water of the River Nile, irrigation canals and the occasional water runoff of the desert wadis. Therefore, the quantity and quality of the waters are largely affected by the rates of both infiltration and evaporation, which in turn depend on the variations of thickness and facies of aeration zones.

The second hydrogeological unit (i.e., the old alluvial plains system) is composed of mixed gravel with interbeds of clay. The system has a thickness of some 50 m. This unit is of secondary importance as recharge by surface water runoff from wadis occurs only rarely (Abd El-Baky, 1972).

The average vertical hydraulic conductivity of the surface layer is estimated to be in the range 0.01 m/d. The average horizontal hydraulic conductivity of the main aquifer is about 70 m/d and the specific yield when the aquifer is unconfined is in the range of 0.1 to 0.2. Groundwater flow in the main aquifer is generally in a downstream direction (i.e. northerly). Near the river, the water table is relatively low and approximately parallel to the riverbank.

2.4.3 Surface Hydrology

The Nile is the key element of the surface hydrological regime of Minia. It follows a winding, more or less northerly course through the governorate. Water flows from the Nile into the irrigation networks east and west of the river. Two major, west bank irrigation canals, Ibrahimiya Canal, which is situated within one or two kilometers west of the river, and Bahr Yusuf, which follows the western margin of the floodplain, deliver Nile water to an extensive network of smaller irrigation canals and ditches. Bahr Yusuf Canal, which originally was a natural dis-tributary that branched from the Nile, now branches off the Ibrahimiya Canal near the town of Dairut in Asyut Governorate.

The cultivated and inhabited part of Minia Governorate falls almost entirely into the ancient flood plain of the Nile River. Since the Nile was brought under full control by the construction of the Aswan High Dam, a perennial irrigation system has developed. Fields are flood-irrigated by pumping water from the Nile or the irrigation canals. Excess irrigation water flows by gravity into the drainage network. The drainage network discharges eventually in the Ibrahimiya Canal, Bahr Yusuf or the Nile.

2.4.4 Air Quality and Noise

Air quality is variable. Seasonal agricultural activities are major contributors to air pollution in the region. It is customary to burn off stubble from various crops, such as rice. This can

lead to very poor air quality at the end of the rice-growing season (in late September and October). Extensive burning also occurs at other times of the year.

Other evident air pollution is associated with brick factories. The factories may burn wood, heavy fuel oil (mazut) or lighter fuels. Mazut appears to be the most common fuel, which produces plume of black smoke with heavy particulate loads.

Dust is the other major component of air quality. Fine dust from the desert is airborne throughout most of the year. During windy periods, airborne dust may represent a significant annoyance. Areas near the desert margins are subject to heavy airborne dust loads year-round. In March and April, khamseen may produce very dusty conditions. Heavy dust loads are a lesser problem in areas in the interior, such as the Project Area.

2.4.5 Water Supply and Quality

2.4.5.1 Water Supply

The Minia City Project Area is currently served by treated river water. Water treated by the three existing WTPs and two compact units currently have sufficient capacity to meet the demand; however, supply is limited by inadequate pressure during maximum day and peak hour flows. With a virtually unlimited supply of river water, water supply to the city is only limited by the current treatment operating capacity of 760 L/s (Table 1-1).

The Zawiyat Sultan and Bani Ibayd Project Areas are currently served by groundwater wells. Although both these Project Areas have sufficient water quantities to meet current demand, water quality in Zawiyat Sultan is of poor quality as discussed further in Section 2.4.5.2 below.

Although individual well pump data is not available for the wells in Sawadah, which serve the Zawiyat Sultan Project Area, the total pumping capacity for the station is 185 L/s. Four operating wells installed in 1954 are equipped with five pumps. Four pumps have a pumping capacity of 40 L/s at a manometric head of 50 m and one pump has a 25 L/s capacity at 50 m head. The well system operates 12 hours per day in the summer and 8 hours per day in the winter. Available water quality data indicate that the wells do not meet Egyptian Standards for turbidity, iron, nitrite, and/or ammonia.

To the north of the Zawiyat Sultan Project Area, one groundwater station located at the village of Nazlet Abeid serves the future HPP Tehna El-Gabal SSF WTP Project Area. This area may eventually be connected to the Zawiyat Sultan Project Area according to master plan recommendations.

The groundwater station serving the Bani Ibayd Project Area is located on the north side of the village. The two operating wells were installed in 1954. The wells have four pumps with capacities of 40 L/s, 25 L/s (2) and 12 L/s at 55-m, 50-m and 32-m manometric head, respectively. Pumping information was only available for one of the wells. The well operates for an average of 12 hours/day to produce 1080 m^3/day of water in the summer and 10 hours/day to produce 900 m^3/day in the winter. Water is treated for iron and manganese

removal and is generally of good quality according to MEGAWS representatives. However, sampling data for one of the wells indicates that manganese sometimes exceeds standards.

2.4.5.2 Ground Water Quality

The Zawiyat Sultan and Bani Ibayd Project Areas are currently served by groundwater wells. Because the Bani Ibayd Project Area is the focus of wastewater improvements, water quality data will not be discussed but is included in Appendix D1 Table D1-1 for reference.

Groundwater quality data for the wells that currently serve the Zawiyat Sultan Project Area indicate potential aesthetic and/or contamination problems (Table 2-5).

Table 2-5
Water Quality Data for Wells Serving the Zawiyat Sultan Project Area, Minia Markaz

Well Location		**Sawadah**				
Well Name		**Old Deep**	**No.2**	**No. 3**	**Deep**	**Egyptian**
Water Type		**Raw**	**Raw**	**Raw**	**Raw**	**Potable**
Sample Date		**7/27/98**	**7/27/98**	**7/27/98**	**7/27/98**	**Standard**
Samples analyzed by the Health Department						
Turbidity	NTU	1.89	**13.8**	**10**	NA	5
Ammonia	mg/L	**2.8**	NA	1.5	**3**	1.5
Nitrite	mg/L	0.002	0	**0.04**	**0.01**	0.005
Iron	mg/L	0.3	**1.7**	0.8	0.4	1
Manganese	mg/L	0.4	0.4	NA	0.5	0.5
Samples Analyzed by MEGAWS						
Turbidity	NTU	1.27	**12.5**	**5.25**	1.59	5
Nitrite	mg/L	**0.006**	0.004	**0.08**	**0.04**	0.005
Iron	mg/L	0.3	**2**	**2.4**	0.35	1
Manganese	mg/L	0.27	0.17	0.24	0.4	0.5

Notes: Highlighted values exceed the Egyptian potable standard.
NA = Not analyzed

Wells serving the Zawiyat Sultan Project Area exceed the potable standards for turbidity, ammonia, nitrite, and iron. The presence of ammonia and nitrite in groundwater may indicate human and/or agricultural contamination of the aquifer. Without improvements, water quality is likely to continue to deteriorate as population density increases and increased demands are placed on the existing systems.

2.4.5.3 Surface Water Quality

The Nile is the primary surface water source for potable water in Egypt. A summary of select annual sampling data for water quality measured in the Nile at sites upstream and downstream of the proposed WTP Sites is presented in Table 2-6 with complete analyses presented in Appendix D1 Table D1-3. Site NL-21 is located in Mallawi Markaz at

approximately river kilometer 280, about 40 km upstream of the Zawiyat Sultan and US WTP Project Areas, while Site NL-23 is located at about river kilometer 210 in Samalut Markaz, about 30 km downstream of the Project Areas.

With the exception of chemical oxygen demand, water quality in the river generally meets Egyptian standards for fresh water channels that receive industrial liquid wastes. Turbidity, a major factor in operation of SSFs, appears to be low.

Available 1999 daily raw water quality data were also obtained from the US WTP in Minia City. Figure 2-1 presents the data for turbidity. This figure indicates that turbidity values tend to remain in an acceptable range for SSF operation throughout much of the year. Turbidities are generally less than 15 NTU and often less than 10 NTU. Monthly monitoring data is presented in Appendix D1 Table D1-4.

Figure 2-1
Turbidity at US WTP Minia City - 1999

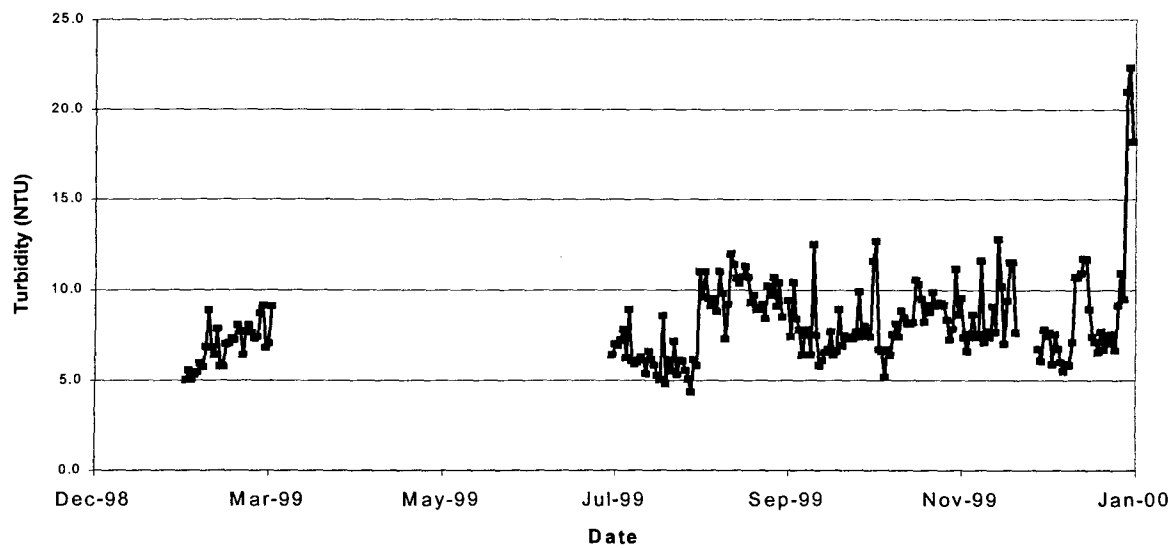


Table 2-6
Annual Water Quality Sampling Information for Selected Parameters from Nile River Upstream and Downstream of the Project Sites

	Egyptian Standard Law No. 48/1982.	Site NL-21 (river km 280) Upstream of the Project Areas								Site NL-23 (river km 210) Downstream of the Project Areas							
Year		**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**
Dissolved Oxygen (mg/L)	**≥ 5.0**	9.3	10.6	12.8		6.4	8.4	8.7	7.4	8.1	9.5	11.4	9.7	6.8	8.5	8.5	7.4
pH	**≤ 8.5 and ≥ 7.0**	7.7	**8.7**	**8.7**		7.8	8.2	7.8	7.6	7.6	8.3	8.5	8.4	7.0	7.9	7.8	7.5
Total Alkalinity (mg/L as $CaCO_3$)	**≤ 150 and ≥ 20**	129	114	138		138	**162**	100	132	127	116	144	150	**160**	142	117	128
Turbidity (NTU)	—	10	32	6		29	27	23	15	15	26	8	34	29	31	26	17
Ammonia (mg/L as NH_3)	**≤ 0.5**	0.01	0.01	0.01		0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.04	0.01	0.01	0.01	0.01
Nitrite (mg/L as NO_2)	—	0.080	0.006	0.010		0.000	0.015	0.006	0.002	0.010	0.028	0.010	0.008	0.004	0.020	0.000	0.002
Nitrate (mg/L as NO_3)	**≤ 45**	1.8	2.4	2.4		1.5	3.6	3.9	3.4	0.9	0.8	2.0	1.7	1.9	2.9	3.9	5.3
Ortho-Phosphate (mg/L as PO_4)	—	0.028	0.080	0.050		0.240	0.100	0.070	0.064	0.034	0.050	0.100	0.280	0.270	0.100	0.050	0.025
Chemical Oxygen Demand (mg/L)	**≤ 10**	**14**	**15**			**13**	**22**	**15**	**16**	**15**	**18**		9	5	**18**	**16**	13
Biochemical Oxygen Demand (mg/L)	**≤ 6**	3.2	3.7	4.9		**7.0**	3.1	5.0	2.8	2.9	4.4	4.7	3.6	4.7	3.8	4.6	2.5
Total Dissolved Solids (mg/L)	**≤ 500**	192	173	180		200	220	198	180	188	190	180	214	195	215	189	197
Total Coliform (MPN/100 mL)	—	1400	1100	1150		540	750	1500	1800	1000	660	800	**3500**[2]	900	1000	2200	700
Fecal Coliform (MPN/100 mL)	—	300	210	600		330	140	700	720	100	100	300	2500	700	400	1000	300

Source: Nile Research Institute (1999). Shaded values exceed the Egyptian Standard for Fresh Surface Water set forth in Clause 60.
Notes: 1: River kilometers are measured as distance upstream from Roda Island (Nilometer) in Cairo.
2: Exceeds Clause 62 Standard for Industrial Wastes

2.4.6 Terrestrial Ecology

The Governorate of Minia encompasses habitats typical of both the mesic Nile Valley and the dry desserts that extend east and west of it. These habitats support diverse plant and animal life. Lists of flora and vertebrate fauna of Minia are presented in Appendix D4, Tables D4-1 through D4-5. Threatened animals and plants that occur in Minia are listed in Appendix D4, Table D4-6. Although information specific to the Project Areas is not available, the major terrestrial habitat type surrounding the rural Project Sites is agricultural land. The Minia City Project Area is typical urban habitat.

The heavily cultivated Nile Valley, with its crop fields, orchards, palm groves, tree-lined Nile and canal banks and human dwellings create a structurally diverse habitat which provide numerous niches for a great variety of plant and animal species (Saleh 1993).

The farmlands of the Nile Valley in Minia provide habitats for a variety plant life along canal and drain banks, roads and railway embankments, and fallow fields. Some of these are exotic species that have been inadvertently introduced but have now become naturalized. These include species such as *Argemone mexicana, Aster squamatus,* and *Ageratum conyzoides* (Zaharan and Willis 1992).

Animal species that can either tolerate human activities or those that exploit habitats created by man occupy suitable microhabitats within this habitat type. Herpetofauna of cultivated areas in Minia include species that are characteristic of the Nile Valley such as the Egyptian and green toads, the Turkish gecko, bean skink, flowered snake, African beauty snake, cat snake, and Egyptian cobra (Saleh 1997).

Characteristic resident bird species include the palm dove, spur-winged plover, cattle egret, little egret, kestrel, black-shouldered kite, moorhen, pied kingfisher, little green bee-eater, Egyptian swallow, graceful warbler, fan-tailed warbler, and Nile house sparrow (Goodman and Meininger 1989).

Mammalian fauna includes species such as the Egyptian hedgehog, Nile rat, jungle cat, African wild cat, red fox, Egyptian jackal and Egyptian mongoose (Osborn and Helmy 1980). This type of habitat is evenly distributed throughout the Nile Valley part of the Governorate.

2.4.6.1 Zawiyat Sultan Project Area

An ecologist conducted reconnaissance of the proposed and alternate sites for SSF to serve the Village of Zawiyat Sultan (Appendix D3-1). Both the proposed and alternate sites (ZS-1 and ZS-2, respectively) had essentially similar biodiversity characteristics.

The ZS-1 site is approximately half barren, with the exception of the grass covered lower riverbank and areas immediately next to the neighboring cultivated fields. And half cultivated with seasonal truck crops and a perennial fruit orchard.

The ZS-2 site is barren with sparse vegetation. Wild vegetation of the ZS-2 site is limited to a few weeds and some marsh vegetation on the lower part of the riverbank and around the small island that fronts the site. Date palm trees are scattered throughout the site. A small field of maize was being cultivated along the west side of the site during the site visit.

Animal life appears to be limited. Adjacent cultivated fields and the adjacent Nile water and red beds probably support considerable wildlife common to the area. Although no wild mammals were observed during this survey, the available habitats indicate that mammals such as the Wolf Jackal *Canis aureaus lupaster*, the Red Fox *Vulpes vulpes*, and the African Wild Cat *Felis silvestris* may at least occasionally utilize the site and adjacent fields. With the Exception of the Wild Cat *Felis silvestris,* which is listed as "Vulnerable" in the IUCN Red Lists, all other mammals that are known or expected to inhabit the area or its immediate surroundings are not among threatened species in Egypt or elsewhere.

The most spectacular element of the wildlife of the area is the bird life. Several bird species were observed on the trees on the site and many more over the Nile and in its water. Many of these species are migrants that pass through the Nile Valley during this time of the year. None of the bird species observed appeared to be specifically restricted to this site nor are they considered locally or regionally threatened.

2.4.6.2 Beni Ibayd Project Area

An ecologist conducted reconnaissance of the proposed and alternate pump station and force main sites near Beni Ibayd (Appendix D3-2). Biodiversity resources of the pump station sites as well as the force main routes (both cross-country and parallel to existing roads) are limited to species typical of cultivated areas of the Nile Valley. Cultivated plants, including occasional trees, and common species of weeds, represent the vegetation. None of these species is unique to the area.

Wild fauna observed at the site was restricted to common bird species that are usually encountered in agricultural land throughout Middle Egypt. These include the Palm Dove *Streptopelia senegalensis*, Kestrel *Falco timunculus*, House Sparrow *Passer domesticus*, hooded crow *Corvus corax* and others. Wild mammal species likely to be found in the area include common species such as the Nile Rat *Arvicanthus niloticus*, the Jackal *Canis aureus*, and the Red Fox *Vulpes vulpes*. The fauna and flora of this site and the force main routes is of little significance both at the local and national levels.

2.4.7 Aquatic Ecology

This habitat type is represented in Minia Governorate by the River Nile and the extensive network of irrigation and drainage canals and ditches. It supports a well-developed aquatic biota of plant and animal species. Several species of aquatic plants are found in this habitat (Appendix D4) and their growth and proliferation are greatly enhanced by the large quantities of chemical fertilizers that wash into these waterways from the agricultural fields. Common hydrophytes include *Elodea canadensis, Marsilea aegyptiaca, Najas armata* and *Eichhorina crassipes* (Kasssas 1993, Zaharan and Willis 1992). Floating islands of the later species,

commonly known as Water Hyacinth, are a common sight in the Nile of Minia and continuous mats of this plant cover the surface of many of the irrigation and drainage canals in the governorate. The extensive proliferation of the species in waterways may cause considerable loss of water by transpiration and sometimes interferes with navigation and operation of barrages and dams.

Freshwater habitat in Minia supports a number of native freshwater fishes (Appendix D4). Most common of these are catfish (*Bagrus docmac*), barbel (*Barbus bynni*), sharptooth catfish (*Claris lazera*), tilapia (*Oreochromis aureus*), Nile tilapia (*O. niloticus*) and others (Bishai and Tawfik 1997). Amphibians include the Egyptian square-marked toad (*Bufo regularis*) and the mascarene frog (*Ptychadena mascarenensis*) (Saleh 1997). Reptiles associated with this habitat include the common water snake (*Natrix tessellata*) and the very rare Nile Monitor, *Varanus niloticus* (Saleh 1997). No amphibious mammals are found in Egypt. However, the Nile rat *Arvicanthus niloticus*, and to a lesser extent, the Egyptian Mongoose *Herpestes ichneumon*, generally appear to favor river and canal bank habitats and often enter water either to escape danger or to search for food (Saleh 1993). Birds associated with this habitat include moorhen (*Gallinula chloropus*), the purple gallinule (*Porphyrio porphyrio*), pied kingfisher (*Alcedo attis*), great reed warbler (*Acrocephalus arundinaceus*) and many others (Appendix D4, Table D4-4) (Goodman and Meininger 1989). This type of habitat appears to be evenly distributed throughout the cultivated part of the Nile Valley in Minia.

2.4.8 Solid and Hazardous Wastes

2.4.8.1 Hazardous Wastes

Historical agrochemical usage information for the specific Project Areas is not available however, pesticides used in Fayoum can be considered typical for the area (Table 2-7). Despite ongoing programs to reduce the amount of chemical usage in agriculture, agrochemicals including pesticides and fertilizers are introduced into agricultural drains by field drainage. This water is often re-used for irrigation a number of times or is subject to human contact. Some chemicals persist unchanged in the environment for years. Others may be transformed by chemical degradation in soils, photodecomposition and/or biological transformations. Transformation may render chemicals harmless or produce other chemicals that may be even more hazardous to the environment. These chemical pollutants flow through the aquatic and terrestrial ecosystems of Minia Governorate and can directly affect the human population by contaminating drinking water, plants, and fishes or other animal food.

Table 2-7
Pesticides used in the Fayoum Governorate since the 1970's.

Endrin	Diamonit	Kalten microgran.
Endosulfan	Dorspan	Sulfur (agricultural)
Ordram	DCFL	Sulfur wetable
Astreptine	RUP	Sulfur micro
Allisan	Deseza 247	Kerathin (powder)
Prythoran	Mineral oil	Kerathin liquid
Bromenal	Sidial K	Copramnit
Bacco oil	Cymosedien	Copper sulfate
Triton B	Superacid	Kalthin dimonit S'
Tamaron	Catrin	Kostran
Grakson	Zinc Phosphide	Coperzan
DDT/Lindane (30/9)	Pholaston	Corakron
Diaten M45	Menazon	Lanit (90%)
Diaten Z78	Captan	Mankozan
Diaten M22	Kalten oil(18.5%)	Malathion
Nolitran	Homay	

Surface water pollution in Minia Governorate is further complicated by organic and microbial pollution resulting from the lack of adequate sewage treatment and disposal facilities, particularly in rural areas. On-site sewage disposal systems using simple infiltration basins ("soakaways") or sanitary trenches are inadequate, and poorly constructed and maintained. Private vacuum trucks frequently empty their contents into drainage channels and sometimes irrigation canals, causing high peak organic loads. This direct organic and microbial pollution poses a major health hazard to human populations in areas where drinking water is sometimes obtained from irrigation canals. Pollution of groundwater is common throughout the governorate, mostly because of the lack of adequate sanitary systems.

According to a 1990 study, industries in Minia Governorate consume a total of 14,130,000 m^3 of water each year. Most of this water is taken directly from the Nile River, and only a small quantity is taken from the municipal network (155,000 m^3 per year mostly for food industries). An annual total of 10,758,000 m^3 of this water is discharged as industrial wastewater. Industrial wastewater discharges consist of 5,478,000 m^3 of industrial process water, 5,005,000 m^3 of cooling water, and 275,000 m^3 of domestic wastewater. Over 96 percent of this water is discharged into the Nile River or the irrigation/drainage network while the remaining volume is discharged into the sewage network or underground diffusion tanks (General Authority for Industrialization 1990)

According to a more recent study conducted as part of the ongoing Middle Egypt project, industrial wastewater output with significant loads of pollutants was estimated at 5,451,275 m^3 annually. Most of the significantly polluted wastewater is discharged either directly into the Nile River or into the irrigation and drainage networks, and most of the direct discharges do not receive pretreatment.

2.4.8.2 Solid Waste

Solid waste disposal is problematic. In the cities and larger villages, trash is collected and taken to the desert for disposal. In smaller rural villages, solid waste often ends up in piles at the edges of canals and drains or in vacant areas. When the quantity of trash accumulates to an offensive level, it is burned. Larger items may be taken to the desert and dumped, out of sight of the city. The Project Areas encompass a city and both large and small villages.

2.5 AESTHETIC AND CULTURAL CONDITIONS

2.5.1 Aesthetic Elements of the Environmental Setting

The Minia City Project Area is currently an urban setting with a higher population density than exists outside the city limits. Streets within the high-density areas are typically narrow with short setbacks to buildings. Recent historic land use appears to have been urban in nature.

The Zawiyat Sultan SSF WTP site is currently used for agriculture. Surrounding land-use is military and agricultural. Recent historic land use appears to be have been agricultural in nature.

The Bani Ibayd Project Area is currently composed of narrow streets within the village, with some streets less than 3 m in width. Buildings typically have minimal to no setback off the streets. The route of the force main to the WWTP will be along paved highway. The pump station site is currently a cultivated agricultural field. Recent historic land use of the pump station site appears to be have been agricultural in nature.

2.5.2 Archaeological and Cultural Resources

Due to the preliminary stage in the planning process, archeological resources within the Project Areas will be discussed with the intent to identify locations to be avoided in the final to selection of Project Sites and pipeline routes.

2.5.2.1 The Minia City Project Area

Archeological assessment of the Minia City Project Area was based on interviews with the Supreme Council of Antiquities (SCA) staff (Appendix D2-4) due to the extent of previously disturbed areas within the city. Eight buildings in the city were identified as sensitive sites due to their archeological, historic and/or cultural significance. Most of the historical sites in Minia City are located in close proximity to each other in certain areas close to the Nile corniche, where the majority of the population of the city lives. Visits were made to the archaeological and historical sites in Minia City, accompanied by an inspector from the Minia SCA office for Coptic and Islamic Monuments, to see if those areas would be affected by the

infrastructure project. No ancient pharaonic sites have been recorded in Minia City, so the sites surveyed were Islamic or Coptic. The sites surveyed were:

1. The Mosque of El-Amrawy, which is on the Nile corniche, opposite the new Minia Bridge. This is also called the 'Farewell' Mosque, as it is used for funeral services before the deceased is taken across the river to the cemetery. It is sometimes referred to as El-Amri Mosque, and sometimes the Hanging Mosque, because it was originally on higher ground than the rest of the city. The mosque was built in 1439 AD, and has been restored several times.

2. The Mosque of El-Lamatty is also on the Nile, north of the new Minia Bridge, east of the Mosque of El-Amrawy, and south of the Mosque of El- Fuli (see item 3). The western facade overlooks El-Horreya Street, the eastern and northern facades face the Nile, and the south facade overlooks the houses of the city and the Youth Organization Club. The mosque was built in 1182 AD by Negm el-Din el-Lamatty, and was restored in 1987. It is also known locally as the Mosque of Sheikh Saad.

3. The Mosque and Mausoleum of El-Fuli is on the Nile next to the police station. It was built in the early 17th century AD by Ali Ibn Mohamed Ibn Ali-el-Masri el-Yemeni (born 1582), who came originally from Yemen. It was later rebuilt into a larger mosque.

4. The Mosque of Odah Bashy is located in Bier Abu Shamia Street, off Sidi Habib Street, to the southwest of the El-Amrawy Mosque. Abwaz Odah Bashy, who was known as el-Miniawi, built the mosque in 1749 AD. On the National Survey maps, this is known as Qadaa Pasha Mosque.

5. The Mosque of El-Kashef is on the same street as the Mosque of Odah Bashy, and to the east of it. There are no records referring to the date of this mosque, which was built by Hassan Kashef, but the style indicates the 18th century AD.

6. The Mosque and Mausoleum of Sheikh Ali El-Masri is next to the police station, and beside the Minia University Hospital, opposite the El-Amrawy Mosque, at the junction of Horreya Street and Mohamed Badawy Street. The exact date of the mosque is not known, but it is Ottoman in style, and is referred to in the "Description d'Egypte," plates 25 and 26. The mosque was completely rebuilt in 1992, when several tombstones were found, which are now in Minia Museum.

7. Ottoman period bath, to the northwest of El-Amrawy Mosque, at the junction of Horreya Street and Mohamed Badawy Street. Most of the bath has gone, apart from the water cistern.

8. The Coptic Orthodox Cathedral of St. Mark. Minia City is the Episcopal See of the Coptic Orthodox bishop of Minia and el-Ashmunein. There are several more

Coptic Orthodox churches in Minia City but none of them are old enough to be considered as historical monuments.

Buildings such as the mosques often were associated with a number of outbuildings and residences. Construction, particularly excavation, in these areas has a high possibility of uncovering new archeological materials. Thus, the areas surrounding the sites identified above should be avoided. If these areas cannot be avoided, then special precautions should be undertaken to assure that archeologically significant finds are reported and properly protected during construction.

2.5.2.2 The Zawiyat Sultan Project Area

Much human activity in ancient times is recorded in the region. The modern village of Tehna El Gabal is adjacent to the ancient city of Akoris that dates to the Greek and Roman periods of Egyptian history. This city was an important regional center in ancient times. South of Tehna El Gabal village are the Old Kingdom tombs known as the Fraser Tombs. The modern village of Sawada contains archaeological sites while modern Zawiyat Sultan Gibli lies directly adjacent to and probably over the ancient Egyptian provincial capital known as Hebenu. Now known as Kom el-Ahmar, the area is a highly significant antiquities zone comprising archaeological remains spanning from the Predynastic (c. 3500 BCE) and Old Kingdom (including a step pyramid) periods through to the New Kingdom and Roman periods (c. 200 CE).

An archeological reconnaissance was conducted to cover two sites that were originally proposed as possible locations of the SSF WTP and the road along which a new transmission line will be laid (Appendix D1-1). The proposed sites included the following:

- An area North of Zawiyat Sultan Bahri (Site ZS-1 on Exhibit 5), which is the proposed site of the SSF WTP, and
- An area near the village of Hawarta, which is the alternative site for the SSF WTP, (Site ZS-2 on Exhibit 5).

At the Hawarta (ZS-2) site, the field archaeologist walked the perimeter of a portion that represented almost one-quarter of the 10-ha site. At the Zawiyat Sultan Bahri (ZS-2) site, the archaeologist walked the site and examined the riverbank.

The archeological reconnaissance of the proposed and alternative sites for the SSF WTP did not identify archeological materials and it was concluded that the sites are archeologically non-sensitive.

2.5.2.3 The Bani Ibayd Project Area

To date scholars have not recorded any evidence of human activity in ancient times in this region located South of Minia City. Nevertheless, new archaeological discoveries in the area

are possible so a reconnaissance of the areas that may be affected by the proposed infrastructure project was conducted.

The reconnaissance involved surveying the following three areas (Appendix D2-2)

- Areas within the village that have historic structures and may be affected by the construction of the collection system,
- An area directly South of the village that is a proposed site for the pump station, and
- An area West of Nazlet Awolad Gueid that is proposed for the pump station and the adjacent unpaved path along which the force main will pass to the paved road leading to the WWTP near Abu Qurqas.

Within the built-up areas of Beni Ibayd village, the archaeologist inspected the streets adjacent to historically and culturally significant structures and looked for other significant buildings. At the proposed pump station sites, the field archaeologist walked the perimeter and through the center of the site looking for evidence of archaeological material on the surface and in furrows and irrigation channels of the fields that border the sites. Cut edges of canals, excavation trenches, agriculture furrows etc., were examined because they often reveal evidence of buried archaeological material, if such material is present in an area. Driving along the paved road that is proposed as a corridor for the force main, the archaeologist examined the sides of the road for archaeological material.

GPS points were recorded for the historic structures and the pump station sites.

Beni Ibayd contains two significant monuments. A minaret of Fatimid style graces El Awssia Mosque (27°57.095' N, 30°46.832' E) suggesting that the mosque is more than 500 years old. Local residents reported that the domed Coptic church dedicated to the Archangel Michael (27°57.095' N, 30°46.832' E) is about 400 years old. Both of these structures are within the built-up area of the village. Although both structures have been substantially renovated, they are classified as monuments according to Egyptian antiquities law, which assigns such a designation to buildings more than 100 years old. While driving through the village the archaeologist noted several houses adorned with decorative cutwork wooden balconies. The age of these structures is unknown but it is estimated that they are almost 100 years old. During the reconnaissance of the Beni Ibayd streets, no evidence of archaeological material was found.

Subsequent inquiries at the SCA regional office in Minia City indicated that no archeological discoveries have been made in Beni Ibayd (Appendix D2-3).

Reconnaissance of the proposed and alternative pump station sites and the alternate force main route uncovered no evidence of archeological materials. With the exception of the Awssia Mosque and Church of the Archangel Michael that were identified in the village, the Project Area is considered archeologically non-sensitive. Construction activities should avoid the mosque and church. If the construction program cannot avoid these areas, special precautions should be taken to avoid damage to the historic structures.

2.6 FUTURE CONDITIONS WITHOUT THE PROJECT

Without the projects, the Project Areas will continue to depend on existing resources for water and wastewater services. As the population grows, demand for reliable clean water and wastewater services will increase, thus increasing the reliance on poor or overtaxed systems currently in use.

2.6.1 The Minia City Project Area

Without the Minia City Projects, the future water demand would quickly outgrow the capacity of the existing WTPs. In the absence of expansions to the US WTP, general health and hygiene would decrease as available water per capita decreases as a result of stretching the existing or decreasing water supply over the increasing population. Without a new water transmission line to serve the northwest portion of the city, this area would likely experience outages more frequently and for longer periods than the rest of the city.

Without upgrades to the wastewater collection system, risk of catastrophic failures of wastewater system components within the city would greatly increase. This would result in backups and overflows of sewage into residential areas. Such occurrences would increase the risk of transmission of diseases such as typhoid and cholera, as well as create aesthetically distasteful conditions.

2.6.2 The Zawiyat Sultan Project Area

Without a new WTP, the residents within the Project Area would be forced to rely on the existing groundwater supply or untreated surface water. Villagers may resort to use of shallow tube wells that may produce what they perceive as better tasting water because it contains lower concentrations of iron and manganese. However, shallow wells are often affected by bacterial contamination and agrochemicals.

Villagers report the existing water quality to be poor, making it more likely that surface water may be the preferred choice. Untreated surface water typically carries pathogens such as *Giardia* and *Cryptosporidium* from fecal material associated with animal presence on the Nile River watershed. In their cyst or oocyst life forms, these pathogens are know to survive for long periods and under extreme conditions. Additionally, industrial facilities typically discharge minimally treated or untreated wastewater to the Nile River or its tributaries.

Other than the proposed projects, there are currently no plans to develop other sources in the area. This situation implies a decrease in public hygiene over time. The result would be deterioration in the public health situation of the area.

2.6.3 The Bani Ibayd Project Area

Without a collection system, the village of Bani Ibayd would continue to rely on existing infiltration basins while excess capacity continues to be unused at the nearby Abu Qurqas WWTP. Due to high groundwater elevations in the area, aquifer contamination from

infiltration basins is more likely. As the village population increases, volumes of domestic wastewater disposed to basins will increase, thereby increasing risk of contamination of shallow groundwater. Because a large percentage of the population of the village depends on handpumps that draw water from shallow wells, public health risks would increase.

3 ENVIRONMENTAL IMPACTS

Significant issues identified during the Scoping Sessions are summarized in Table 3-1. These issues and other potential impacts common to the types of Projects proposed are discussed in the following subsections.

Table 3-1
Summary of Significant Issues
Identified During Minia Scoping Sessions

Issues Identified	Addressed in Section(s)	US WTP Expansion	Water Distribution System Improvements	Wastewater Pump Station / Force Main Improvements	Zawiyat Sultan Water System Improvements	Beni Ibayd Wastewater Collection System
Land use	3.1.1			Yes	Yes	Yes
Construction impacts on residents (i.e., traffic in residential areas, public safety, noise, and service interruptions	3.2.3, 3.3.3, 3.3.5, 3.3.7	Yes	Yes	Yes	Yes	Yes
Construction materials and waste handling practices	3.3.7	Yes	Yes	Yes	Yes	Yes
Maintenance and operation (i.e., odors, traffic, and waste disposal)	3.2.3, 3.3.3, 3.3.5, 3.3.7	Yes	Yes	Yes	Yes	Yes
Water quantity and quality (raw water, treated water, discharges)	3.3.4	Yes	Yes		Yes	
Backups and Overflows	3.2.3			Yes		Yes
Emergency evacuation plan for chlorine leaks	3.3.3, 3.3.7	Yes			Yes	
Antiquities and cultural resources	3.4.2	Yes	Yes	Yes	Yes	Yes
Cumulative Impacts	3.5.3			Yes		

3.1 LAND USE AND REGIONAL PLANNING IMPACTS

3.1.1 Land Use

3.1.1.1 Temporary Effects on Land Use

Effects of construction of wastewater force mains and sewers (Minia City and Beni Ibayd) and water distribution and transmission mains (Minia City and Zawiyat Sultan) will be temporary in both urban and rural project areas. The pipelines will be laid in right-of-ways of existing roads where possible. Installation of pipelines will involve excavating a trench about three times the width of the pipe (trenches would be about 0.6 to 2.0-m wide). Excavated materials from the trench will be temporarily stored adjacent to the trench and used a backfill.

There are also vacant lots scattered throughout the area that could provide temporary storage of construction materials. Productive land uses, other than the use of the roads for transportation, will not be affected. In most areas along the water transmission main and wastewater force main routes, most roads appear wide enough to accommodate construction without affecting structural integrity of buildings adjacent to the roadway. However, in Beni Ibayd Village some streets where sewer lines will be laid are too narrow for heavy equipment. In such instances, hand labor will be necessary to excavate the street and lay the pipe to avoid impacting adjacent buildings. The roadways will be restored following construction, thus they will be returned to their original land use upon completion of the project.

3.1.1.2 Permanent Effects on Land Use

Land use will be permanently affected in several Project Areas; however, the total areas involved are small. In Minia City, the proposed site for Pump Station No. 4 will occupy about 1,000-1,500 m^2 in a lot (presently used for MEGAWS storage) that is surrounded by residential and commercial buildings.

Approximately 15,000 m^2 of land with mixed agricultural use (crops and livestock shelters) will be taken out of service for the Zawiyat Sultan SSF WTP. Land uses adjacent to the site are military and agricultural.

About 1,000 m^2 of land at the edge of the village will be converted from Local Unit equipment storage by the Bani Ibayd wastewater pump station.

3.1.2 Regional Planning

No conflict between the projects and existing regional plans for the area was identified by participants in the Scoping Session (Appendix E). The Middle Egypt Water and Wastewater Master Plan for Minia anticipates eventual construction (around 2022) of a regional WTP to serve Zawiyat Sultan and other areas to the north of the Zawiyat Sultan service area. However, construction of the Zawiyat Sultan Water System Improvements is not seen as a conflict with this plan because of the critical need for improved water quality in the interim. Expansion of the Zawiyat Sultan WTP may be necessary during the period prior to construction of a regional WTP to meet demand from growth of the existing population and tourism development. The Zawiyat Sultan WTP Site can accommodate about double the proposed capacity.

The National Organization for Potable Water and Sanitary Drainage (NOPWASD) has nearly completed construction of a new regional WWTP with a 90,000-m^3/day capacity in the desert west of Minia City. A pipeline will be constructed to connect the new WWTP with Minia City. If the NOPWASD project is implemented as proposed, the new WWTP will be operational by 2007 with sufficient capacity to serve all the larger villages in Minia Markaz as well as Minia City. This is significant because the capacity of the new Minia City WWTP

cannot be expanded appreciably within the existing site. The proposed NOPWASD WWTP has been incorporated in the Master Plan.

3.2 SOCIO-ECONOMIC IMPACTS

3.2.1 Demography and Migration Impacts

Construction of each of the various projects will require a small labor force. Unskilled or semi-skilled laborers will be hired locally. The contractor will likely bring in skilled and some semi-skilled labor. The construction contractor will be responsible for providing accommodations for the labor force. For the rural Projects, this will probably involve rental of quarters in Project Areas and nearby villages.

- Minia City is likely to have sufficient local workers to supply the labor force for the Minia City Projects. If additional workers are needed, lodging and accomodation for the workers exists within the city.

- Because of the proximity of the Zawiyat Sultan WTP Site to Minia City, skilled and semi-skilled workers could commute from lodging in the city. There are also several developments of temporary housing (holiday villages) underway within the Project Area.

- Lodging near the Bani Ibayd Project Area appears to be limited; however, there are properties available for rental within the village. Minia City and Abu Qurqas City are within commuting distance of Beni Ibayd (about 40-60 minutes by car). Skilled and semi-skilled workers may choose to commute from lodging in Minia City or Abu Qurqas City.

Migration impacts during construction appear to be minor. Approximately 30 to 50 percent of the labor forces for the rural projects are expected to require temporary accommodations for the duration of the construction phase of the project, which is expected to be completed in about two years. It is unlikely that skilled laborers will remain in the area after construction of the facility is completed.

No additional permanent workers will be required as a result of the Minia City Projects with the expection of the US WTP Expansion. Up to ten additional workers may be required to operate the US WTP after expansion is completed. Operation of the Zawiyat Sultan WTP will require a staff of about ten persons. Approximately ten additional workers will be required to maintain the Bani Ibayd Wastewater Collection System. The workers in the rural areas will likely reside in the village or commute from Minia City or Abu Qurqas City.

Most of the staff will be classified as "ordinary" workers who will be trained to perform manual labor associated with operation and maintenance of the system. These workers will likely be recruited from the local population. Engineers and technicians will fill less than half of the permanent positions. These workers are likely to be recruited outside of the Project

Area. Depending on the nature of the position and their village or city of origin, these workers may or may not settle within the Project Area. Areas where permanent workers are likely to settle are presented below:

- Minia City Project workers will prodominantly consist of local resisdents.
- Zawiyat Sultan Project workers may commute from Minia City, which is about 30 minutes by public transportation (service taxis).
- Bani Ibayd Project workers may commute from Abu Qurqas City; which is about 30 mintues by public transportation, or from Minia City which is about 40-60 minutes travel time by service taxi.

3.2.2 Economic and Employment Impacts

Construction of each Project will provide a small positive benefit to the local economy. Wages will be paid to local laborers, supplementing their agricultural incomes. In addition, a part of the wages earned by workers that temporarily reside in the Project Areas during construction will be spent on purchasing goods and services.

The Operation and Maintenance of each Project will have a small effect on the local economy. The project will create about ten jobs in each Project Area, some of which will be available to local laborers. Candidates residing within the governorate will probably fill the remaining jobs.

3.2.3 Quality of Life Impact

Quality of life impacts can be short-term or long-term. Short-term impacts are associated with construction activities and will be common to all four projects. Temporary impacts include impacts on traffic, public safety in construction areas, and service disruptions.

3.2.3.1 Traffic

<u>Minia City Project Area</u>
In the areas where construction and rehabilitation of water distribution mains and wastewater force mains will occur, there are several major streets that allow for north-south movement of traffic through the city. Initial plans call for location of the new pipelines along larger streets. The roadways are wide enough to allow traffic to pass the construction area during construction. However, the width of the road may be reduced to one lane, which will delay traffic on the affected segment of road. There are also parallel roads that provide alternative routes for traffic to pass the construction areas.

In the Mahound Abdel area, where sewer mains will be installed, roads will have to be closed to traffic to allow installation of the collection system. In such cases, it will be necessary to identify alternate routes for traffic

Zawiyat Sultan Project Area

The new water transmission main will pass through an easement between two private parcels for about 300 m to the paved main north-south road through the Project Area. The transmission main will then follow the paved road about 2.4 kilometers south where it will tie into to Zawiyat Sultan Elevated Storage Facility. During the brief period required for pipeline installation, measures will be required to keep the site accessible outside of construction hours. The width of the road along the proposed transmission route will be reduced to one lane, which will delay traffic on the affected segment of road and temporary closure of the road may be required throughout the pipeline installation however, observed traffic along the route is relatively light therefore, delays should be minor.

Beni Ibayd Project Area

The plan of the sewer system and force mains had not been determined at the time that this EA was prepared. In general, installation of sewers and mains in the village will have variable effects on traffic, depending on the specific location. There are several main streets in the village along which sewers can be installed without affecting traffic. These streets are wide enough to accommodate large vehicle and an ample construction area. Some secondary streets may be only wide enough for passage of one vehicle; thus, construction will have to be planned to assure that alternate vehicle routes are available and detours are clearly marked. Some smaller streets do not appear to be wide enough for passage of traffic under normal circumstances. Pedestrian access to dwellings may be impaired by construction along such streets. It will be necessary to implement measures to assure access to homes during construction.

3.2.3.2 Effects on Existing Services

Service disruptions may consist of localized short-term disruption of water or wastewater service as existing pipes are tapped or replaced. During construction of the water system improvements in Minia City and, to a minor extent, in Zawiyat Sultan, it may be necessary to shut down water service to specific areas when new lines are connected to the existing system. Planned connections should not require more than 12 hours to complete. Proper planning and prior notification of residents in affected areas will prevent major inconvenience.

Wastewater system improvements in Minia City may affect services and require temporary shutdowns of existing lines as new lines are connected at pump stations. These activities have the potential to cause backups and overflows. Overflows are aesthetically displeasing and represent a potential health hazard from human contact. Construction activities will require careful planning and coordination to avoid negative impacts of backups. Measures to temporarily reduce or divert wastewater flows during interconnection and/or to store wastewater flow should be employed where necessary. In addition, it may be necessary to disrupt water services to specific service areas to reduce wastewater flows. Proper planning and prior notification of residents in affected areas will be necessary to prevent major inconvenience.

Excavation for new lines always presents a potential for disrupting existing utilities by accidentally breaking lines in the construction area (e.g., small water pipes, sewer connections, electrical and telephone lines). Impacts of this sort can be largely avoided by careful coordination with all the utilities providers. In addition, should any accidental breaks occur, the impacts can be minimized by assuring that the contractors either can perform repairs themselves or have notified the utilities and confirmed that repair crews will be available.

3.2.3.3 Downstream Effects

A critical factor in water and wastewater planning is balancing volumes of water supplied to volumes of wastewater disposed. If water supplied exceeds the treatment and disposal capacity, inappropriate discharge practices and pooling of wastewater may result. Therefore, a volume balance was assessed for each Project Area to assess impacts general health and hygiene within the Project Areas as a measure of quality of life.

The Minia City Project Area

After completion of the US WTP Expansion and Water Distribution System Improvements Projects, Minia City residents with connections to the existing distribution system will have access to greater quantities of water at adequate pressure than is currently available through the distribution system. The US WTP Expansion will help to meet future demands posed by the growing population through 2012. Additional water quantities will be provided by planned expansions at other WTPs. The Czech and British WTPs will be expanded within four years and an additional WTP is planned by NOPWASD. The residents currently connected to the distribution system are not expected to change their usage habits, so no change in per capita consumption is expected.

No greater treatment capacity will be gained from the Minia City Pump Station / Force Main Improvements Program Project, but wastewater collection will be optimized for future maintenance and cost efficiency. The new activated sludge Minia City WWTP has a nominal average capacity of 40,000 m^3/day; however, its assessed capacity is about 31,000 m^3/day. Average wastewater generation for Minia City was estimated at about 22,200 m^3/day in 1999. This plant has sufficient treatment capacity to meet growth in wastewater generation due to both population increases and the proportion of the population connected to the collection system (currently 65%). It is anticipated that the WWTP could accommodate the increased water supply and growth through 2012, at which time the NOPWASD project will have been completed.

The Zawiyat Sultan Project Area

The Zawiyat Sultan WTP Project will result in similar quantities of water produced, but the water will be of better quality. The Project will help to meet future demands posed by the growing population through 2012. No significant increase in water demand, and, therefore, the quantity supplied per capita through the distribution system is anticipated (Table 2-1). The WTP will be designed to accommodate expansion from 30 L/s up to 60 L/s, if required prior to completion of the regional WTP.

The residents currently connected to the distribution system are not expected to change their usage habits, and no additional house connections are proposed as part of the projects. Better water quality may prompt some additional residents to connect. However, some residents are believed to be unwilling to connect to the distribution system due to cost or service issues. Additionally, current water use is limited by on-site septage capacity as discussed in Section 2.3.3. Therefore, no significant increase in water demand is expected.

Residents with connections to a water system will have a better quality water supply. This should promote improved personal hygiene (i.e., bathing and laundering of clothes) and housekeeping (i.e., washing food preparation areas). Although activities such as washing cooking and eating utensils in the river may continue due to water disposal issues, the water supply will be more acceptable to the population for activities previously limited due to poor water quality. Taste problems and staining of textiles during washing due to excessive iron and or manganese in the present water supply water will be reduced or eliminated.

3.2.3.4 The Bani Ibayd Project Area

The Bani Ibayd Project will improve overall sanitation and protect the potable water supply from potential contamination by domestic waste. Since no change is proposed for the existing water system in Bani Ibayd and dependence on septic systems within the Project Area will be reduced, no overflow problems are likely. Increased water usage may occur due to the effectively unlimited disposal capacity afforded by municipal service. No negative impact is expected to health and sanitation. Pipelines will be sized for flows typical of similar villages that currently have both wastewater collection systems. High groundwater will be accounted for in the final design to prevent excessive infiltration.

3.3 PHYSICAL ENVIRONMENT

3.3.1 Climate

The Projects will have a negligible effect on climate. Considering the relatively small size of the Projects relative to the area of cropland and open water in the Project Areas and the absence of heated exhaust stacks or discharges, the contribution of moisture to the atmosphere due to evaporation from the projects will be negligible. No temperature changes are expected due to the Projects.

3.3.2 Geology and Hydrogeology

Leakage due to the construction and or operation of the Projects may include the following sources:

- Minia City US WTP Expansion: infiltration associated with the sludge lagoon, and minor leakage from pipelines,
- Minia City Water Distribution System Improvements: pipeline leakage,

- Minia City Wastewater Pump Station / Force Mains Improvement Program: minor force main leakage and gravity sewer infiltration,
- Zawiyat Sultan Water System Improvements: leakage associated with WTP components and new transmission main
- Bani Ibayd Wastewater Collection System: minor force main leakage and gravity sewer infiltration

Minia City Project Area

The US WTP will use the same lagoon for sludge dewatering. The bottom of the sludge lagoon was lined to prevent seepage when the facility was constructed.

Peripheral areas of Minia City currently lose water pressure during peak demand periods, which exposes lines to potential infiltration. Peripheral areas also are more likely to be dependent on wastewater infiltration basins for sanitation. Thus, at present, there may be some potential for contaminated groundwater to infiltrate water lines in peripheral areas. After the Water Distribution System Improvements Project is completed, there will be adequate pressure at all times, which will eliminate potential infiltration. This should improve water quality at the edges of the distribution system.

Leaks in water lines could result in local effects on groundwater and high groundwater problems. New and replacement distribution lines will be less likely to leak, thus reducing potential problems. MEGAWS has been provided with equipment for leak detection and repair under the HPP phase of the MEMPP, thus leakage problems should be reduced as the leak detection and repair program is implemented. Recently implemented programs and the proposed water distribution system improvements should have a beneficial impact in reducing leakage.

The wastewater force main and pump station improvements are expected to reduce potential leakage by replacing deteriorated lines that are known to experience problems with breaks and leaks. Leakage could result in groundwater contamination and pooling of sewage at the surface. With installation of the new force mains, the possibility of significant leakage will be appreciably reduced provided proper construction practices and adequate quality control and inspections are implemented during pipe installation.

The gravity collection mains for the wastewater system expansion into the Mahound Abdel area will likely be affected by minor infiltration of groundwater into the pipes. This is opposite of the effect of the infiltration basins that are currently used for wastewater disposal in the area. Infiltration basins may raise local groundwater levels and contaminate groundwater. Thus, the collection system may reduce groundwater contamination in the area.

Zawiyat Sultan Project Area

The SSF WTP will have drains and sumps to collect water. A small settling basin may be provided to reduce turbidity in roughing filter backwash, if necessary. Generally it is assumed that leakage water quality will essentially be similar to that of the Nile River, the

raw water source for the plant. Because the raw water is considered to have high quality, no adverse water quality effects on groundwater are anticipated.

The new transmission main from the SSF WTP to the elevated tank in Sawadah will have minimal leakage. No effects on groundwater levels or quality are anticipated.

Beni Ibayd Project Area

The wastewater force main and pump station are expected to have minimal potential for leakage. Leakage could result in groundwater contamination and pooling of sewage at the surface. The new force main will be buried and minimal leakage is expected provided proper construction practices and adequate inspection of the force main installation is implemented.

The gravity collection mains for the wastewater system in Beni Ibayd Village will likely be affected by minor infiltration of groundwater into the pipes. This is opposite of the effect of the infiltration basins that are currently used for wastewater disposal in the area. Infiltration basins may raise local groundwater levels and contaminate groundwater. Thus, the collection system may reduce groundwater contamination in the area. This may benefit the public health situation for those parts of the village where handpumps are in use.

3.3.3 Air Quality and Noise

Construction of the Projects will entail a minor increase in dust and noise levels around the three Project Areas. If appropriate precautions are taken both to reduce dust and to confine noise generation to daylight hours, the impacts will be negligible.

The water related projects are limited to aerobic processes and pipeline improvements. Therefore, no offensive odors will likely be generated. Odors are not expected to be a concern. Because the wastewater projects are limited to improvements of pump station and buried pipelines, odor release is expected to be minimal.

3.3.4 Water Supply and Quality

Water supply and quality impacts may occur as part of construction and operation activities. Construction and operational issues related to water quality are presented in Table 3-2 and further discussed in the following sub-sections.

Table 3-2
Summary of Potential Water Quantity and Quality Impacts

Project Area	Minia City			Zawiyat Sultan	Bani Ibayd
Project	US WTP Expansion	Water Distribution System Improvements	Wastewater Pump Station / Force Main Improvements Program	Water System Improvements	Wastewater Collection System
Water supply quantity	Yes	Yes		Yes	Yes
Construction effects on surface water quality			Yes	Yes	Yes
Raw water quality – suitability for treatment	Yes			Yes	
Potable (finished) water compliance with Egyptian Standards	Yes			Yes	
Operational effects on surface water (e.g., backwash)	Yes			Yes	

3.3.4.1 Water Supply

Minia City Project Area

The expansion of the US WTP will increase water supply to Minia City and the connected villages to meet estimated water demands through 2012. Improvements to the water distribution system will alleviate current water shortages during the peak hour flows.

Additional water extraction for the expanded portion of the WTP (330 L/s) from Nile River will be small enough so as not to effect downstream flow and water levels.

Zawiyat Sultan SSF WTP

The Proposed Project will meet projected water demand for the resident population through 2012. Water demand is not expected to significantly increase as a result of the Zawiyat Sultan Project. However, some increase in demand can be expected if the WTP improves the perceived quality of piped water in the Project Area. Some residents who now depend on hand-pumps may choose to connect to the distribution systems. The Project will help to meet increasing demands posed by the growing population in the Zawiyat Sultan Project Area.

If significant development of tourist facilities occurs in the area before the planned regional WTP begins operation sometime after 2012, additional capacity may be required. Such capacity could be provided either by selectively blending groundwater with treated water from the WTP at Sawadah or by increasing the capacity of the SSF WTP. Sufficient area is available at the site for expansion of the Proposed SSF WTP to 60 L/s capacity. The expanded facility would be able to meet all potential demands through 2022.

Water extraction for the initial phase of the Zawiyat Sultan SSF WTP (30 L/s) from Nile River will not affect downstream flow and water levels.

Beni Ibayd Project Area

Construction of a wastewater collection system will remove limitations on water use that are imposed by use of infiltration basins for sanitation. Use will not be limited by the capacity of the basin and the simple economics of limiting the number of times that the basin must be emptied each year. Water use for village houses with existing water connections and new sewer connections can be expected to increase somewhat (less than 25 percent). If all dwellings in the village were eventually connected to both piped water and sewer, the per capita demand in 2022 could be about 25 percent greater than that expected under the No-Action Alternative. Expected increases in demand will be somewhat less than this because not all residents of the village will be connected to piped water and only a portion of those connected to piped water will connect to the sewer system.

The existing wells are equipped with sufficient pumping capacity to meet future water demands in the village through 2012 and beyond if the Proposed Project is implemented. Data collected for the village survey indicates that the two wells have four pumps with capacities of 40, 25, 25, and 12 L/s. Average production was estimated at about 12.5 L/s with about 47 percent of the dwellings in the village connected to the water distribution system. The 2012 population is expected to increase by about 34 percent and house connections could increase also due to factors outside the influence of the Proposed Project. However, this increase would be expected to occur with or without the proposed project. Assuming that 75 percent of the village eventually connects to the water system by 2012, water demand on the production wells would be expected to increase to about 21 L/s. If all water connections also had sewer connections, demand would increase to 26 L/s, or about double the present demand. The anticipated demand increase is well within the existing pumping capacity.

3.3.4.2 Construction Effects on Surface Water Quality

Minia City Project Area

Where pipelines cross drains or canals, impacts on water quality may result during construction. The impacts may be related to increases in suspended sediments and/or accidental releases of chemicals used for construction. Construction of the Water Distribution System Improvements will likely require a crossing of the Ibrahimiya Canal. It is unlikely that construction equipment will have to enter the canal or operate on unprotected banks; thus, it appears that there will be little potential for suspension of sediments during construction. Measures to prevent and control accidental spills will be necessary.

Construction of the some wastewater force mains to the WWTP will require crossing the Ibrahimiya Canal. However, wastewater mains are typically required to cross under canals to prevent leakage from entering the canal. In this case, if the force main leaks, there is potential for contamination of shallow groundwater, but the pressure of fresh water in the canal will prevent infiltration into the canal.

Zawiyat Sultan Project Area

Bank erosion may occur during construction of the intake associated with the Zawiyat Sultan WTP. The Nile River is a sensitive water resource because riparian communities depend on the river as a source of potable water. Measures to prevent sediment suspension or chemical (including fuels) spills into the river should be implemented. Prior to the operation of heavy equipment on the banks of the Nile River, a competent professional should assess bank stability for maximum weight bearing capacity and erosion potential. Implementation of mitigation measures is relatively straightforward and effective. If appropriate work practices and precautions are instituted, impact should be minimal. A permit for shoreline construction and bank stabilization may be required from the MIWR.

Beni Ibayd Project Area

The proposed force main will make two crossings of large canals en route to the Abu Qurqas WWTP. However, wastewater mains are typically required to cross under canals to prevent leakage from entering the canal. In this case, if the force main leaks, there is potential for contamination of shallow groundwater, but the pressure of fresh water in the canal will prevent infiltration into the canal. If the force main crosses over the canal, additional precautions (e.g., placing the conveyance pipe within a casing as a protective measure, daily inspection of the crossing) should be implemented to prevent contamination of irrigation water.

3.3.4.3 Raw Water Quality - Suitability for Treatment

Data on existing river water quality and performance data for operating facilities of similar design can be examined to assess the suitability of river water for treatment by conventional or SSF WTPs. Because there are several WTPs within Middle Egypt that utilize conventional treatment technologies, suitability of source water can readily be assessed by the reviewing the performance of existing facilities. However, slow sand filtration is not widely utilized in Egypt. Therefore, pilot-scale data and recommended influent values found in literature form the basis of the evaluation. Both treatment technologies were compared to river water quality data collected from the Nile River for the HPPs (Table 3-2 and Appendix D3 Table D3-1).

TABLE 3-2
MEMPP Sampling Near the WTP Sites in Minia City and Zawiyat Sultan

Parameter		Maximum Concentration Detected	Average Concentration Detected	Egyptian Potable Standard
General Water Quality Parameters				
Turbidity (field analysis)	NTU	19.9	13.0	**5** [1]
Turbidity (lab analysis)	NTU	4.0	3.2	**5** [1]
Dissolved Oxygen	mg/L	9.19	7.95	**NE**
Color	Pt-Co units	<5	<5	**30**
Microbiological Parameters				
Total Coliform	CFU/100 mL	1,500	733	**3** [2]
Fecal Coliform	CFU/100 mL	480	164	**0**
Plate Count	CFU/mL	5,500	2,144	**50**
Algae Count	Units/mL	7,998	5,890	**0** [3]
Nutrients				
Ortho-Phosphate	mg/L	0.024	0.012	**NE**
Ammonia as N	mg/L	0.201	0.115	**NE**
Hydrocarbon Analysis (Method 413.2\418.1)				
Total Oil & Grease	mg/L	1.97	0.52	**0.1** [4]
Metals				
Aluminum	mg/L	0.44	0.17	**0.2**
Arsenic	ug/L	4.33	2.38	**50**
Chromium	ug/L	2.25	1.44	**50**
Iron	mg/L	0.44	0.21	**0.3** [5]
Manganese	mg/L	0.040	0.030	**0.1** [6]
Mercury	ug/L	2.97	1.19	**2**
Zinc	mg/L	0.28	0.09	**5**

Notes:
1) Egyptian Standard for turbidity = 5 Jackson units for filtered, 10 Jackson units for unfiltered. 1 Jackson unit is approximately equal to 1 NTU.
2) 95% of samples analyzed in a given year should be free of total coliform bacteria
3) Egyptian Standard for bluegreen algae = 0 cells/mL
4) Standard for total hydrocarbons other than benzene = 100 ug/L, Standard for benzene = 10 ug/L. Detection limit = 0.25 mg/L
5) Egyptian Standard for iron in filtered water = 0.3 mg/L, 1.0 mg/L for mixed or groundwater
6) Egyptian Standard for manganese in filtered water = 0.1 mg/L, 0.5 mg/L for mixed or groundwater
= Value exceeds the standard
NA = Not analyzed; NE = Not established
* = Value exceeds the recommended influent limit presented in Table 3-2.

Sampling conducted by Harza during March-May 2000 found that concentrations of most water quality parameters sampled were below the Egyptian Standards for potable water (Minister of Health, Decree No. 108/1995). However, several parameters exceeded the potable standards in at least one sample. Table 3-2 presents the maximum and average sampling result for selected parameters including those with recommended influent values

and those parameters that exceeded the potable standards. Sample analyses were also conducted for organic compounds including pesticides, herbicides, PCBs, and phenols. Few of the organic compounds were present in concentrations above their respective detection limits, and none exceeded the potable water standard (Appendix D3, Table D3-1).

Conventional Treatment, Minia City US WTP Expansion
Although suitability of river water will be assessed as part of final design activities, the widespread employment of conventional treatment in large-scale WTPs within Middle Egypt suggests that river water quality parameters are within acceptable ranges for conventional treatment.

Slow Sand Filtration, Zawiyat Sultan
Filter performance in producing potable water of suitable quality is partially dependent on quality of the source water. With the exception of two parameters, the source water from the Nile River meets the recommended influent limits for SSFs found in literature (Table 3-3). Turbidity and algae exceeded the recommended influent limits in all samples analyzed.

Table 3-3
Recommended Influent Limits for Slow Sand Filters

Parameter	Recommended Limit
Turbidity	5 to 10 NTU
Algae	200,000/L
True Color	15 to 25 Pt Co Units
Trihalomethanes	50 ug/L
Nonpurgeable dissolved organic carbon	2.5 mg/L
UV absorbance	0.080 cm^{-1}
Dissolved Oxygen	> 6 mg/L
Phosphorus (PO_4)	30 ug/L
Ammonia	3 mg/L
Iron	< 1 mg/L
Manganese	< 1 mg/L

Source: Ashe and Desto (1999)

The roughing filter is expected to reduce influent concentrations of turbidity and algae to recommended SSF influent levels. Full-scale SSF plants in operation within Egypt (further discussed in Section 3.3.4.4) have similar influent algae concentrations and have not demonstrated treatment problems. Therefore, water quality in the Nile River appears to be adequate for operation of the SSF WTP.

3.3.4.4 Treated Water Quality

Parameters that exceeded the potable standards (Table 3-2) have been designated "Target Treatment Parameters." The Target Treatment Parameters include turbidity, microbiological

parameters, total oil and grease, aluminum, iron, and mercury. Further discussion of treated water quality will be limited to these parameters since WTPs' performance will likely be judged by their process removal efficiencies for these parameters at a minimum.

Conventional Treatment, Minia City US WTP Expansion

The expansion of US WTP will likely consist of additional units of processes currently in operation. The currently process train consists of the following of the elements:

- Flocculation/sedimentation,
- Rapid sand filtration, and
- Chlorination.

These conventional processes are generally accepted for the treatment of most of the Target Treatment Parameters. A review of acceptable technologies for each of the Target Treatment Parameters is presented in Table 3-4.

Table 3-4
Process Technology Review
for Removal the Target Treatment Parameters

Target Treatment Parameter	Recommended Process Technology	Comments
Turbidity	Coagulation/filtration	
Microorganisms	Coagulation/ sedimentation, filtration, disinfection	A maximum influent concentration of 5,000 coliforms/100 mL has been shown to consistently meet the US standard of 1/100 mL after filtration followed by chlorination. Effective coagulation and sedimentation can remove up to 90 to 95-percent of algae, but the remaining quantity can clog filters.
Total oils and grease	Adsorption, surfactant addition	
Aluminum	Reverse osmosis	
Iron	Oxidation/ filtration	Aeration is generally not useful. Strong oxidants such as permanganate, chlorine or ozone should be used in a narrow pH range ensure formation of ferric hydroxide precipitate prior to filtration.
Mercury	Coagulation/ flocculation/sediment ation, adsorption, Ion exchange	GAC has been shown to achieve greater than 80-percent removal of neutral and monovalent mercury species (USEPA 1989).

Sources: Montgomery 1985. Water treatment Principles and Design

Based on technologies that have been recommended in literature for the Target Treatment Parameters, it appears that aluminum is the only parameter for which conventional treatment is not specifically recommended. It should be noted that aluminum is actually added (as alum) to water as part of the coagulation/sedimentation process. Proper control of aluminum is a major requirement of conventional treatment. Proper control of the alum dosage results in removal of particulate aluminum from raw water. A properly operating conventional WTP, such as the US WTP can readily achieve finished water aluminum levels that meet the Egyptian standard.

Comparison of finished water data for the Minia US WTP with Egyptian potable standards has been limited to turbidity. Finished water typically meets the turbidity requirement. Data for the New Quhafa WTP in Fayoum (Appendix D1, Table D1-5), which is a conventional plant with a similar process design to the Minia US WTP, were reviewed to assess

conventional WTP performance for removal of iron, manganese and bacteria. Although iron and manganese exceeded the potable standards in raw water, all 53 samples examined for iron met the potable water standard and only one of 66 samples examined for manganese slightly exceeded the standard. All samples also passed bacteriological examination. Information on aluminum and mercury were not available.

Slow Sand Filtration, Zawiyat Sultan

Removal efficiency data full-scale SSF plants operating in Egypt (Table 3-5) and literature (Table 3-6) and were reviewed to estimate removal of Target Treatment Parameters. Removal of Target Treatment Parameters will further be discussed by individual parameters.

Table 3-5
Operational Data for Full-Scale, Slow Sand Filter Plants at Toukh El-Aklam and Ezz El-Deen, Egypt

Parameter	Turbidity NTU	Algae mg/m^3	Bacteria Count/L	Total Coliforms Count/L	Fecal Coliforms Count/L
Percent removal from roughing filter	70	57	28	41	40
Percent removal after slow sand filter	93	98	99	99.8	99.7
Final treated effluent (no disinfection)	0.3 – 1.2	12 – 40	90 – 270	0.0 – 2	0.0 – 2

Source: Academy of Scientific Reserch and Technology. April, 2000. Slow sand filtration technical Report, draft report.

Although turbidity and bacteria in the Nile River exceeded the limits set by the Egyptian Standards for potable water, the levels observed for those parameters should be reduced to acceptable levels by the proposed treatment process. Table 3-5 presents performance data from two, full-scale, Egyptian pilot SSF WTPs that are located in Toukh El-Aklam and Ezz El-Deen. The upflow roughing filter is expected to reduce turbidity to levels by about 70-percent, at which point they would be in the effective treatment range for the slow sand filters. The slow sand filters also will remove over 98-percent of the bacteria and microorganisms. Remaining bacteria will be reduced to acceptable levels by chlorination. Although no removal efficiency data were available for removal of aluminum and mercury, greater than 67-percent removal of iron by SSFs has been documented (Ashe and Desto 1999). Thus, the expected level of iron removal should be sufficient to meet standards.

Table 3-6
Slow Sand Filter Performance

Parameter	Demonstrated Removal
Turbidity	< 1 NTU
Coliforms	1 to 3 log units
Enteric viruses	2 to 4 log units
Giardia cysts	2 to 4+ log units
Cryptosporidium oocysts	> 4 log units
Dissolved organic carbon	< 15 to 25 %
Biodegradable dissolved organic carbon	< 50 %
Trihalomethane precursors	< 25 %
Heavy Metals:	
• Zinc, copper, cadmium, lead	> 95 to 99%
• Iron, Manganese	> 67%
• Arsenic	< 47%

Source: Ashe and Desto (1999)

Influent metal concentrations presented in Table 3-2 represent total unfiltered metals, or the sum of dissolved (particles that pass a 0.45 um filter pore size) and suspended metal concentrations (particles that are remained by a 0.45 um filter pore size). Removal of most suspended aluminum and mercury adsorbed to particulates can be expected. In addition, there may be some removal of dissolved metals by the complex chemical-biological interactions in the schmutzdecke. Although confirmatory sampling is recommended, concentrations of aluminum and mercury in treated water are expected to meet potable standards. Filter performance relative to mercury and aluminum removal should be carefully monitored following start-up. Confirmatory sampling and potential mitigation measures that may be implemented in the event that concentrations in treated water exceed standards are discussed in Section 5.1.3.

Although no removal efficiency data were available for total oils and grease, treated water is expected to be sufficient to meet the potable standards. Oils and grease will be primarily removed by adsorption to the filter particles. Additionally, hydrocarbon concentrations may be reduced by aerobic biological activity in the schmutzdecke. Therefore, total oils and grease are not expected to exceed the potable standard in the treated water.

If the removal of Target Treatment Parameters is insufficient, modification of the process can be accomplished without significant significant additional cost or redesign. For example, one study in which a 75- to 200-mm layer of GAC was inserted approximately 100 to 150 mm below the sand surface showed significant reduction of monitored parameters including color, organic carbon, and trihalomethane formation potential. No change in cleaning frequency was required (AWWA 1998). Although metals removal was not monitored during the full-scale tests, GAC has been shown to achieve greater than 80-percent removal of neutral and

monovalent mercury species (USEPA 1989). Thus, effective modification of the filter system, if necessary, may be possible with very little cost and effort.

3.3.4.5 Operation Effects on Water Quality in the Nile River

Backwash may be discharged to the Nile at both the Minia City and the Zawiyat Sultan WTP Sites. Filter backwash should meet the Egyptian Standards for industrial liquid waste detailed in Egyptian Law 48, Clause 61 62, or 66 as applicable, prior to discharge to surface water bodies. Discharge to surface water bodies and agricultural drains requires that total suspended solids be less than 30 mg/L and 60 mg/L, respectively. A permit to discharge to the Nile or other surface water bodies may be required from the MIWR.

Minia City WTP Expansion
The US WTP Expansion Project will include the installation of additional rapid sand filter blocks. Filters will require periodic backwashing to maintain filter performance. Backwash effects of discharges to the river will be addressed during final design. Settling or other, appropriate measures may be necessary to reduce effluent concentrations of suspended solids.

Zawiyat Sultan WTP
Slow sand filter technology requires periodic cleaning and or replacement if the filter media. Filter solids and wash-water may require pretreatment prior to discharge and or disposal.

3.3.5 Terrestrial Ecology

The rural project sites (Zawiyat Sultan SSF WTP site and the Beni Ibayd pump station site) are located on undeveloped agricultural land. Due to the presence of human activity the selected land likely provides foraging habitat only for animals that are adapted to human presence. Some rodents and other small mammals and reptiles may be displaced by construction of the Projects, however similar habitat is available nearby. Overall effects on terrestrial ecology as a result of the projects are expected to be minimal.

A terrestrial ecologist conducted a field reconnaissance of the proposed Zawiyat Sultan SSF WTP site and the Beni Ibayd pump station site(Appendix D3). Wildlife habitat was typical of rural agricultural areas,. Species likely to be found at the site are typical of such areas, common, widely distributed in Egypt, and are thus considered unremarkable (Appendix D4). Construction at both sites will affect less than 0.5 ha of typical agricultural wildlife habitat.

3.3.6 Aquatic Ecology

The Projects will have little effect on aquatic ecology. The WTP intakes will not affect or obstruct downstream flow. Eggs and larvae of certain fish species may become entrained in the intake; however, loss of eggs and larvae will not affect fish populations due to the small proportion of total river flow withdrawn.

3.3.7 Solid, Hazardous, and Toxic Wastes

3.3.7.1 Materials Handling

Potential impacts from construction materials and waste handling practices exist. Improper storage of construction materials or chemicals, unrestricted access to the construction sites, open excavations near public access areas such as sidewalks, and other poor construction practices could pose a threat to public safety. The accumulation of construction wastes can cause an unsafe work area and adversely affect adjacent land through temporary dumping or stockpiling of materials.

These potential negative impacts can be controlled by good construction practice and implementation of safety precautions. Construction materials, particularly potentially hazardous chemicals and petroleum products, should be stored in secure areas and storage areas should have impermeable floors that can contain spills and prevent contamination of surface or groundwater. Construction contractors should have materials and equipment available to clean up spills. Spilled materials and wastes should be properly disposed of. Where construction is occurring in areas accessible to the public, trash and waste materials should be removed promptly and disposed of properly.

3.3.7.2 Sludge Disposal

Sludge currently is generated at the US WTP. After expansions and upgrades to the facilities, sludge production can be expected to roughly double assuming a linear relation between quantity of water treated and volume of sludge produced. Land disposal may be appropriate for WTP sludge.

The thin schmutzdecke layer will be skimmed off the Zawiyat Sultan SSF approximately every 60 days. It will be dried and spread on the land surface within the site boundary. The quantity of material produced will be inappreciable.

3.3.7.3 Potential Chlorine Spills

Chlorine gas will be stored at the US WTP and at the Zawiyat Sultan WTP site for use in the disinfection process. Chlorination is a conventional method for reducing pathogenic bacteria concentrations in potable water. Chlorine gas (the form commonly used for disinfection) is a very reactive chemical that can cause burns on contact with living tissue. Prevention and control of leaks and spills is thus an issue of concern. The gas is heavier than air and "seeks" lower elevations. Dispersal of gas by wind and air currents typically reduces concentrations to safe levels.

People in the immediate vicinity of the WTPs would be at greatest risk in the event of a chlorine spill. The staff of the WTP will thus be most subject to potential personal injury in the event of a spill. Dwellings in the vicinity may also be impacted under certain wind conditions. Prevailing winds are from the north, northwest and northeast. At the US WTP, the nearest ezbat is about 275 m south of the WTP. Individual, or small clusters of dwellings

are located about 175 m north and 275 m southeast of the WTP. The outskirts of Minia City are about 800 m northwest of the site. Based on the prevailing wind direction, the area most at risk would be the ezbat to the south and the buildings to the southeast. The intervening area is agricultural land. The distance to dwellings would allow considerable dispersal of gas prior to potential human contact.

The Zawiyat Sultan WTP site is located about 300 m from the nearest dwellings. Prevailing winds would tend to either blow leaking gas toward the river over agricultural land. There are walled agricultural fields southeast of the site that would tend to disrupt gas movement and promote dissipation. The distance to dwellings would allow considerable dispersal of gas prior to potential human contact.

Effective public protection in the event of a gas spill may consist of 1) early detection of gas leaks; 2) measures to contain gas and control dissipation; 3) audible and visible warnings of the danger that are effective at a distance of several hundred meters; and 4) education of staff and the public on how to avoid contact with the gas. An emergency action plan and a program to educate the plant staff and nearby public about appropriate personal protection measures to take in the event of a spill should be prepared prior to start-up operation of each WTP.

3.4 AESTHETIC AND CULTURAL CONDITIONS

3.4.1 Aesthetic and Amenities

3.4.1.1 The Minia City Project Area

Of the three projects in Minia City, only the US WTP Expansion Project will affect visual impact after project completion. This project will be completed on available land within the site boundaries. The US WTP Expansion Project will effectively double the amount of structures on the existing Site. The WTP is in a remote area and is surrounded by a trees and a wall, which limit the visual impact of additional structures. In addition, since improvements will be limited the existing site boundary and most structures will only one-story high, no major visual impact and no negative aesthetic impact is expected.

3.4.1.2 The Zawiyat Sultan Project Area

The Zawiyat Sultan WTP will most probably be located away from the river; but it will be visible from the river due to its slightly higher relative elevation. The tallest structure will be the building that will house the SSFs and roughing filters, with a maximum elevation of about six meters. The WTP will be surrounded by a wall or fence about two meters high. The low profile of the WTP should not represent a significant negative aesthetic impact.

3.4.1.3 The Bani Ibayd Project Area

The only aboveground structure after project completion will be the pump station. Due to the low profile and small footprint of the pump station, visual impact will be minimal. No negative aesthetic impact is expected.

3.4.2 Archaeological and Cultural Resources

Minia City Project Area

The Minia City Project Area contains eight historically and culturally important monuments (six mosques, an ottoman bath and the Coptic cathedral). Most are located in and near the older parts of the city, close to the Nile River and north and west of the bridge that spans the Nile River (Section 2.5.2.1; Appendix D2-4). According to the preliminary plans for the Water Distribution System Improvements and the Wastewater Pump Station / Force Main Improvement Program (Exhibits 3 and 4, respectively), there is no planned construction of new improvements near the historical sites of Minia City. However, there may be some construction involving replacement of sewers and wastewater force mains. Construction, particularly excavation, in these areas has a high possibility of uncovering new archeological materials. Thus, the areas surrounding the sites identified in Section 2.5.2.1 should be avoided. Final design of any improvement or rehabilitation of the water and wastewater systems should take into consideration that potentially sensitive resources occur in or near Wastewater Zones 3, 13, 14, and 17, and the northern part of Zone 4 of Minia City.

The SCA has the required knowledge of, and responsibility for, historic and culturally sensitive buildings in these areas. The SCA should be consulted prior to finalizing plans for improvements or rehabilitation to determine whether proposed pipeline routes pass too close to sensitive resources and to determine appropriate mitigation measures. As a general rule, sensitive resources should be avoided wherever possible by rerouting planned improvements at least 50 m away from sensitive historic and cultural buildings and the property surrounding them. If resources cannot be avoided, consultation with the SCA should be undertaken to determine the best routing and mitigation measures for proposed improvements, and procedures agreed upon to assure that archeologically significant finds are reported and properly protected during construction.

Zawiyat Sultan Project Area

The Zawiyat Sultan Project Site borders the Nile River and was probably subject to frequent summer flooding prior to construction of the Aswan High Dam. Prior disturbance (i.e., farming) and a history of flooding reduce the chance that any archaeological resources are present. Archeological reconnaissance of the proposed SSF WTP site, the transmission main route and the alternate (Hawarta) site for the SSF WTP (Appendix D2-1) indicated that these areas where construction is planned, or could occur, are archeologically non-sensitive.

Beni Ibayd Project Area

Because the Bani Ibayd construction area consists primarily of village streets, it is likely that previous disturbance during construction of buildings and water infrastructure would have

uncovered any significant archeological material. Reconnaissance of the area and discussions with SCA indicated that no significant archeological finds are associated with the village (Appendices D2-2 and D2-3). Two buildings are considered historical monuments, the Mosque of El-Awssia and the Coptic Church of the Archangel Mikhail [Michael]). Reconnaissance of the proposed and alternate pump station sites and the proposed and alternate force main routes indicated that these areas are not archeologically sensitive.

These two historic buildings may be sensitive to vibration caused by heavy equipment and excavation in their vicinity. Streets around the mosque and church should be avoided during construction. If excavation is required near these buildings, measures should be implemented to protect the buildings by eliminating heavy vibrations (e.g., use of hand labor) and locate properly shored trenches and other excavations as far from the buildings as possible. Construction plans should be reviewed with SCA and their concurrence with the Projects should be obtained prior to construction. If artifacts are uncovered during construction, Egyptian law requires that work will be halted and representatives of the SCA will be notified.

There is an Islamic school located adjacent to the proposed pump station site. Although this building is not considered a historic monument, it is culturally significant to the village residents. Routing of the force main should avoid the school and final location of the pump station should allow as much buffer zone as possible between the pump station and school.

3.5 ASSESSMENT OF OVERALL IMPACTS

3.5.1 Short and Long Term Impacts on Resource and Environmental Productivity

There will be minimal short-term impacts on the populations of the project areas during construction. Such impacts will mainly be in the form of dust generation and brief disruption of water and/or wastewater services during interconnection of new components to existing systems. Temporary disruption of other services may be necessary during construction of projects involving installation of pipelines.

The US WTP Expansion, the Water Distribution System Improvements and Wastewater Pump Station / Force Main Improvements Program Projects will have a long-term positive impact on water supply and quality and sanitation within Minia City. The water system improvements in Zawiyat Sultan should improve potable water quality and provide a basis to support population growth and tourism development in the area. The wastewater collection system proposed for Beni Ibayd will improve the sanitation conditions in the village.

Effects on natural resources and environmental productivity will be minimal. The flora and fauna of the rural construction sites are common and typical of Middle Egypt. The sites offer limited habitat value. Pipeline construction associated with the projects will largely be restricted to existing road rights-of-way in rural areas and city and village streets. The total land area that will be affected by permanent land use changes (conversion to buildings and

water treatment facilities) is about 18,500 m^2 of mixed agricultural/industrial land, about 1,050 m^2 of agricultural land and less than 1,600 m^2 of vacant land in an urban setting.

3.5.2 Cross-sectoral Impacts and Effects on Other Projects

These projects are relatively small. Other than accidental or temporary planned disruptions of other services during construction, no cross-sectoral effects are anticipated..

3.5.3 Cumulative and Irreversible Impacts

The cumulative impact of the projects will be improvement of water and wastewater services in Minia City Project Area; improvement of water services in the Zawiyat Sultan Project Area, and improvement of sanitation in the Beni Ibayd Project Area. The service improvements will support growth in the Project Areas through 2012. Improved water and wastewater services will also promote maintenance of or improvements in the level of public health and domestic hygiene. It should be noted that phasing of the projects is important to achieving the anticipated improvements. The improved wastewater conveyance facilities should be operational prior to completion of water system improvements that may increase wastewater generation.

All proposed projects should have minimal irreversible effects. Permanent changes in land use will affect less than 0.6 ha of open land.

4 COMPARISON OF ALTERNATIVES AND RECOMMENDATION

Mitigation alternatives are compared in this section include the no-action alternative, the proposed projects, alternative sites for the proposed projects, and alternative projects. Major benefits and implication of the proposed Projects and the alternatives, as descibed in Section 1.4, and presented in Table 4-1 and discussed in the following sub-sections.

Table 4-1
Comparison of Alternatives for Minia FSIP Projects

Alternative / Project	No-Action Alternative	Proposed Project	Feasible Alternative
US WTP Expansion	**Insufficient water to meet future demands (2012).** Water services may deteriorate, with some areas in city regularly without water during peak hours. Potential that low-quality water sources (shallow wells) will be used to supplement supply in outlying areas – increased public health risk. No impact on land use; traffic, public safety and other services; physical environment; biological environment; aesthetics; cultural resources.	**Increase average capacity of US WTP by 330 m^3/d (500 m^3/d maximum) at existing site.** Water demands in the Minia City service area will be met through 2012. Maintenance/ improvement of current standards of domestic hygiene. No impact on traffic, public safety, other services; physical environment; biological environment; aesthetics; cultural resources.	None identified
Water Distribution System Improvements	**Deteriorating service to high growth areas in north and west parts of city** Potential for use of low-quality water sources (shallow wells) to supplement supply in outlying areas. No impact on land use; traffic, public safety and other services; physical environment; biological environment; aesthetics; cultural resources.	**Install new mains and replace several smaller mains to serve north and west parts of city –** Services to rapidly growing areas in north and west of city will be improved (distribution system will be able to meet peak demands with adequate pressure through 2012). Minor, temporary impacts on traffic, public safety, other services. No impact on physical environment; biological environment; aesthetics; cultural resources.	None identified

Table 4-1
Comparison of Alternatives for Minia FSIP Projects

Alternative / Project	No-Action Alternative	Proposed Project	Feasible Alternative
Wastewater Pump Station / Force Main Improvements Program	**Continued reliance on existing system.** Potential for backups and overflows increases as existing facilities deteriorate. Potential for broken force mains and or pump station failures/overloads. Public health / sanitation situation expected to deteriorate. No impact on land use; traffic, public safety and other services; physical environment; biological environment; aesthetics; cultural resources.	**Upgrade several pump stations, construct new Pump Station # 4, install new force mains to redistribute flows/loads on pump stations, upgrade/replace some existing sewers and force mains.** Services improved and deteriorating facilities replaced. Reduced potential for backups and overflows associated with broken force mains and pump station outages/overloads. Major improvement in sanitation. Minor, temporary negative impacts on traffic, public safety, other services. No impact on physical environment; biological environment; aesthetics; Potential for cultural resources impacts appears low as monuments can probably be avoided or impacts mitigated.	None Identified
Zawiyat Sultan Water System Improvements	**Continued reliance on poor quality water supply.** Potential that low-quality, but better tasting water sources (shallow wells) will be used to supplement supply areas – increased public health risk. No impact on land use; traffic, public safety and other services; physical environment; biological environment; aesthetics; cultural resources.	**Construct SSF WTP near Minia Bridge.** Water quality will meet Egyptian standards. Taste and other aesthetic qualities improved. Land use changed from mixed agricultural. Local family using site for cattle sheds and small agricultural plot would be displaced. Temporary effects on traffic, possibly other services during construction; public safety issues during construction; no impacts on physical environment; no appreciable effects natural resources and aesthetics, no impact on cultural resources.	**Construct SSF WTP west of Hawarta Village.** Site size estimated at over 1.1 ha. Area available for significant expansion of facilities – eventual construction of regional WTP. Would require additional 8-9 km of transmission main to reach distribution point (Sawadah) for Zawiyat Sultan Service Area. Budget not available; however, MEGAWS proposes funding additional cost. No displacement of local farmers. Otherwise, impacts similar to those for Proposed Project.

Table 4-1
Comparison of Alternatives for Minia FSIP Projects

Alternative / Project	No-Action Alternative	Proposed Project	Feasible Alternative
Beni Ibayd Wastewater Collection System	**Continued reliance on infiltration basins in an area with poor sanitation and population growth.** Increased risk of basin backups and overflows results in increased human contact and health risks. Local contamination of groundwater possible. No impact on land use; traffic, public safety and other services; physical environment other than groundwater; biological environment; aesthetics; cultural resources.	**Construct primary collectors, trunk mains, pump station and force main to Abu Qurqas WWTP to serve village.** Sewer connections allow use of infiltration basins to be discontinued. Fewer backups and overflows. Decreased public health risks. Groundwater contamination potential reduced. Minor, temporary impacts on traffic, public safety, other services. No impact on physical environment. Minor impacts (loss of 0.1 ha agricultural land-marginal habitat) on biological environment. Minor impacts on aesthetics (pump station). No impact on cultural resources with appropriate mitigation.	**Alternate pump station site near Nazlet Gueid.** Larger plot of land (0.2 ha affected). Feasibility of gravity sewers to pump station not fully investigated. Provides option of future collection system in Nazlet Gueid without need for additional pump station. Otherwise, impacts will be similar to proposed pump station. **Alternate force main alignment.** Decreases total force main length by about 2 km. Follows agricultural paths – possible temporary effects on adjacent lands. Otherwise, impacts similar to proposed force main alignment.

4.1 NO-ACTION ALTERNATIVE

The No-Action Alternative for each Project, discussed in Section 1.4.1, represents slowly deteriorating sanitation and health conditions in the Project Areas. It will be difficult to quantify or monitor conditions due to a lack of Project Area specific, baseline data on the incidence of gastrointestinal infections (a common indicator of lack of adequate potable water) and other water-borne diseases. Other diseases that are related to water supply and sanitation, such as paratyphoid, typhoid and cholera, are relatively rare and highly variable from year to year. Over the long term, the average incidence of morbidity due to gastrointestinal infections, paratyphoid and typhoid would be expected to increase due to decreased access to potable water, commensurate with a population increase.

4.2 PROPOSED PROJECT

The Proposed Projects were chosen from among a number of potential FSIPs that were identified during the master planning process. The final list of Proposed Projects was

selected in consultation with Governorate authorities and USAID as being the best mix of urgently needed projects that could be accomplished within available funding. Because detailed design had not been conducted as of the date of this EA, design of some Projects may be modified prior to implementation.

The Water Distribution System Improvements Project is intended serve the growing water demand in the north portion of the city and increase pressures in the south areas of the network.

Two improvement options and the No-Action Alternative were identified for the Minia City Water Improvement Program. Lack of service to this growing area would force residents to rely of lower quality water sources such as hand-pumps. Without an increase in the capacity of mains serving the area, the water supply that can be delivered to this rapidly growing are will be insufficient to accommodate future population growth.

The WWTP Project will provide additional treatment capacity to meet current demand and future demand through 2007. Although treatment of wastewater discharged by downstream villages must be provided before significant improvement of the Beni Bekheit Drain water is achieved, some degree of improvement can be expected from decreasing the amount of wastewater that bypasses the WWTP. Three alternative projects in addition to the No-Action Alternative were identified. Alternatives to the WWTP Project are compared in Section 4.3.

The Minia City Projects

The US WTP Expansion Project is one of three expansions required at the city's WTPs to meet future water demands within Minia City. All three existing WTPs will require expansion, and one new WTP will be constructed in order to meet 2022 estimated water demands. The proposed upgrade of the US WTP will provide sufficient capacity to meet 2012 maximum day demand. No alternatives other than the No-Action Alternative were identified. During periods of water service disruption, residents would rely of lower quality water sources such as hand-pumps.

The Minia City Water Distribution System Improvements Project will serve the growing population in the north and west parts of the city. No alternatives other than the No-Action Alternative were identified. Without an increase in the capacity of mains serving the area, the water supply that can be delivered to this rapidly growing are will be insufficient to accommodate future population growth. Lack of service to this growing area would force residents to rely of lower quality water sources such as hand-pumps.

The Minia City Wastewater Pump Station / Force Main Improvements Program Project will provide needed maintenance and upgrades to the aged and overtaxed wastewater collection and pumping system. No alternatives other than the No-Action Alternative were identified. Although the incidence of water related diseases in the Project Areas is not known, decreases sanitation will generally accompany increased rated of disease.

The Zawiyat Sultan WTP

Groundwater water wells presently serving Zawiyat Sultan will be replaced by a slow sand filter treatment facility drawing surface water from the River Nile. Slow sand filters (SSFs) used in drinking water applications, preceded by roughing filters.

The SSF technology was determined to be the most appropriate and sustainable water treatment technology option for the Project Area. Slow Sand Filter Technology was selected because:

- SSFs are relatively simple to operate and maintain;
- The technology requires minimal mechanical parts, and;
- No chemicals or materials other than clean sand are required for operation.

No other treatment process alternatives were considered for the Zawiayt Sultan WTP project other than the "no-action" alternative. Three alternative locations in addition to the proposed site were considered for the SSF Facility. An alternative site is discussed in Section 4.3.

The Bani Ibayd Wastewater Collection System

The proposed Project will take advantage of available capacity at the new, nearby Abu Qurqas WWTP. Because the WWTP was sized to accommodate wastewater flows from surrounding villages, the initiation of municipal wastewater collection in the village of Bani Ibayd is consistent with regional planning. Due to the proximity of Bani Ibayd to the WWTP, extending service to Bani Ibayd is more cost-effective than constructing a separate WWTP to serve the village. By utilizing the available WWTP capacity, the capital investment required for the construction of WWTP is optimized.

The No-Action Alternative, one alternative site and an alternative force main alignment were identified as alternatives to this project.

4.3 ALTERNATIVE PROJECTS

4.3.1 Zawiyat Sultan

An alternative site about 1.3 km west of the village of Hawarta was identified by MEGAWS for the development of the WTP. The 11,500-m2 site is large enough to accommodate future expansion to well over the 120 L/s capacity of a regional WTP identified by the Middle Egypt Water and Wastewater Master Plan. A large WTP would also support the development of tourism in the area. No alternate guarantee of project funding to subsidize the cost of extra transmission line required to serve the Zawiyat Sultan Project Area could be identified therefore the additional costs of developing this site precluded development of a detailed alternative prior to preparation of this EA.

Reconnaissance of the site indicated that it is similar to the proposed site in terms of natural and cultural resources characteristics, that is, minimal negative impacts would occur if the site were developed. In addition, unlike the Proposed Project, the land at the Hawarta site is

vacant. There would be no impact of displacing the family that is using the Zawiyat Sultan site for housing cattle and farming a small plot.

The site is about 1.3 km from the nearest paved roads, which may entail temporary negative impacts on the margins of surrounding agricultural fields when the roads are improved for use by heavy construction traffic and the transmission main is laid. The cost of road improvements should also be considered. Such impacts would be greater than those anticipated for the proposed site, which is only about 300 m from the nearest paved road.

To serve the Zawiyat Sultan area, a transmission main would have to be constructed from the site to the elevated tank at Sawadah, a distance of about 13 km. The transmission main required by the Proposed Project would be about 2.4-km long. Construction and operation (pumping) costs for the additional length of force main would greatly exceed those for the Proposed Project.

The proposed SSF WTP site has sufficient area to expand capacity to 60 L/s, which would meet demands in the Zawiyat Sultan Service Area through 2022. The anticipated water demand for the resident population in the Zawiyat Sultan service area will be about 41 L/s in 2022 (Table 2-1). Based upon these projections there would be ample capacity to support tourism development if the site is expanded to its full production capacity when necessary.

As stated above, operating costs for the Proposed Project would be less than those for the Hawarta Site Alternative. If considering the additional O&M costs accrued over the planning period , there was a strong need for water from the planned regional WTP. Thus, constructing a WTP at the Hawarta site just because it could eventually be expanded into a regional WTP does not seem reasonable.

4.3.2 Beni Ibayd

An alternative pump station site and an alternative force main alignment were identified for the Beni Ibayd Wastewater Collection System Project. The alternate pump station site is located at Nazlet Awolad Gueid, approximately 1 km southeast of the proposed pump station location. This site would offer the advantage of facilitating future connection of Nazlet Awolad Gueid to the WWTP via the same pump station used for Beni Ibayd.

This alternative requires further analysis. The best location for the pump station will become more apparent with the completion of the preliminary site survey. During final design, a detailed topographic survey will be conducted to determine the appropriate location for the pump station(s). Based on available information, the proposed site and the alternate site appear to be at roughly equal elevations. Therefore, the proposed pump was recommended due to the shorter gravity flow distance from the village.

The environmental impacts of the alternative site appears to be greater than using the proposed site on government-owned land that is under cultivation. The area affected is relatively small and the site is far enough from the village that construction-related impacts will be low. The site would require construction of an additional gravity main to the pump

station. This would involve one canal crossing, which may involve construction of an inverted siphon to pass under the canal (the proposed force main would also have to cross the canal). During construction there may be temporary loss of cultivated area at the edges of agricultural fields bordering the paths along which the gravity main would be laid. Impacts on natural resources are expected to be negligible and no sensitive archeological resources are believed to occur at either site.

The alternative force main arrangement would follow unimproved agricultural paths from the proposed pump station site to the paved road at a point approximately one kilometer southeast of the pump station. This arrangement would shorten the force main length from the proposed pump station site by about 0.8 km. This may entail temporary negative impacts on the margins of surrounding agricultural fields if paths must be improved to allow access by construction vehicles that are involved in laying the force main. The cost of road improvements should also be considered. Such impacts would be greater than those anticipated for the proposed force main, which would follow village streets and paved roads. However, the force main alignment for the Proposed Project would incrementally increase construction-related impacts on the village from dust, noise, and potential service disruptions beyond those that would occur during installation of sewers. Essentially, both alternatives will have similar levels of impact, but will affect different sectors.

From an environmental standpoint, both alternatives appear equivalent. The final force main alignment will likely depend on the restrictions imposed during detailed design of the system and associated costs of each of the alternatives.

4.4 RECOMMENDATION

The proposed Projects should be implemented with all recommended monitoring and mitigation measures.

It will be of particular importance to monitor initial performance of the WTPs relative to reduction of the metals aluminum and mercury. Sufficient funds should be made available to assure adequate monitoring and to allow for process modification, if necessary.

5 MANAGEMENT, MITIGATION AND MONITORING

5.1 MITIGATION AND MONITORING OF PHYSICAL IMPACTS

Many mitigation measures for the various Projects are similar. Potential physical impacts include the following:

- Construction Impacts
  - Potential for spills of fuels and hazardous materials,
  - Dust and noise generation,
  - Shoreline stability and siltation to surface water,
  - Crossing canals and drains, and
  - Undermining of nearby structures.

- Operation and Maintenance Impacts
  - Potential for spills of fuels and hazardous materials,
  - Quality and quantity of available potable water,
  - Surface water quality impacts from backwash,
  - Groundwater contamination from wastewater pipelines and lagoons, and
  - Disposal of solid waste such as WTP sludge or used filter media.

Mitigation measures applicable to each Project are summarized in Table 5-1 with descriptions of each mitigation measure presented in the following subsections.

Table 5-1
Mitigation Measures Applicable to the Proposed Projects

Project Area	Minia City			Zawiyat Sultan	Bani Ibayd
Proposed Project	US WTP Expansion	Water Distribution System Improvements	Wastewater Pump Station / Force Main Improvement Program	Water System Improvements	Wastewater Collection System
Spills of chemicals and fuels	X	X	X	X	X
Dust and noise	X	X	X	X	X
Shoreline construction impacts				X	
Crossing of canals and/or drains		X	X	X	X
Effects on existing structures		X	X	X	X
Finished water quality	X			X	
Surface water contamination			X	X	X
Groundwater contamination	X		X		X
Solid, hazardous and toxic waste management	X	X	X	X	X

5.1.1 Spill Prevention, Control and Cleanup

5.1.1.1 Chemicals and Fuels

Fuels, solvents and similar materials should be stored in locations away from surface water bodies, drains, sewers and wells. Storage areas should be well ventilated and have an impervious floor (i.e., concrete slab construction) with a sump or retaining wall sufficient to contain spills. Materials and equipment should be provided to clean up and properly dispose of spilled materials. Vehicle fueling and maintenance areas should have impervious floors and materials for spill cleanup. When fuels or solvents are required in construction areas, they should be transported in small quantities sufficient to meet immediate needs only. Construction contractors should be required to prepare and follow a Spill Prevention and Management Plan. The Authority and its construction management contractor will be responsible for auditing compliance with the Spill Prevention and Management Plan. The contract documents should include penalties for repeated failure to comply with the plan.

These mitigation measures should be included in construction contractor's tender and contract documents. No additional cost to the Projects is anticipated.

5.1.1.2 Chlorine Leaks

Because chlorine cylinders will be stored at both the WTP and the WWTP, an emergency response plan to address chlorine leaks should be prepared for each Site. The plan should include the following elements:

- Automatic detection of leaks
- Audible and visible warning devices that will activate in the event of a serious leak
- Preparation of an emergency response plan
- Public education activities to inform nearby villages about what to do in the event of a leak
- Training of station personnel

People in the immediate vicinity of the WWTP will be subject to potential personal injury in the event of a spill. People using the Ibrahimiya Canal near the WWTP site would likely be in the path of the gas should a spill escape the site.

Cost of leak detection and warning equipment should be included in the design of facilities where chlorine will be used or stored. The preparation of an emergency response plan, training and public education should be undertaken in close cooperation with MEGAWS.

Cost of leak detection and warning equipment would increase the cost of both the US WTP Expansion and the WWTP Upgrade and Expansion Projects minimally. The cost of preparation of an emergency response plan, training and public education should be assumed by MEGAWS.

5.1.2 Dust and Noise Abatement

At all projects, dust generation should be controlled by measures such as minimizing the area disturbed by construction at any one time, wetting down or using acceptable chemical treatment of unpaved roadways used by construction vehicles (in areas near dwellings), covering or wetting spoil piles adjacent to excavations. Silt fencing should be used when grading activities are near a canal, drain, or river to minimize siltation effects on surface water bodies. Noise abatement should be instituted by limiting construction activities to daylight hours only.

These mitigation measures should be included in construction contractor's tender and contract documents. No additional cost to the projects is anticipated.

5.1.3 Crossing of Canals and Drains

Where pipelines must cross canals or drains, appropriate construction practices should be implemented to limit impacts. Preferred construction practices may include tunneling under the canal or drain or temporarily diverting the flow with the use of irrigation pumps to allow excavation of the channel bed for pipeline installation. In some instances, it may be acceptable to dam the flow or limit water access upstream. Additional practices may be specified by MIWR as part of any permits that may be required for construction.

These mitigation measures should be included in the design construction tender and contract documents.

5.1.4 Undermining of Existing Structures

The foundations of all structures near excavated areas should be assessed to determine structural stability and potential impacts associated with undermining. Excavation in areas near building foundations should employ shoring techniques to preserve the structural integrity of existing structures. Special attention should be given to identified historic buildings both in Minia City as well as in the Village of Beni Ibayd during water and wastewater network improvements and gravity sewer installation respectively.

These mitigation measures should be included in the design construction tender and contract documents.

5.1.5 Water Quality

5.1.5.1 Siltation Impacts to Surface Water Bodies

Appropriate construction practices, such as minimizing the traffic and operation of heavy machinery on or near canals, drains, or riverbanks, should be implemented to limit erosion impact to surface water bodies. Soil erosion and transport may be limited by the installation of silt fencing or hay bails within the construction area. Wet methods similar to those used for dust control may also be used to reduce sediment transport. Loose materials associated

with construction should be secured and/or covered at the end of each working day to prevent transport and deposition by wind or the local traffic.

5.1.5.2 Finished Water for Potable Consumption

Sampling Plan for US WTP Operation

Monthly sampling to establish baseline performance and to help identify problem areas affecting water quality should be conducted for the US WTP. Two or three samples should be collected from the following locations each month:

- Raw Water
- Outflow from sedimentation basins
- Outflow from the sand filters
- Outflow at the outlet distribution pipe after chlorination.

Temperature, DO, conductivity, and pH should be measured in the field at the time of collection using calibrated instruments. Turbidity should be determined using a portable nephelometer.

Water samples should be collected and analyzed by a laboratory for the parameters, and in accordance with the frequencies detailed in Table 5-2. Grab samples should be taken using appropriate sampling devices that minimize potential contamination. Water samples will be placed in containers that have been prepared in accordance with Standard Methods (APHA 1998). Samples will be preserved at 4°C and transported immediately to the analytical laboratory (within 24 hours – preferably within 6-8 hours of collection). All laboratory analyses should be performed in accordance with United States Environmental Protection Agency methods or equivalent methods described in Standard Methods (APHA 1998).

These monitoring measures will have minimal impact on staff requirements. Sample collection and transport to the laboratory should be the responsibility of the laboratory staff at the US WTP. Cost of sample analyses for the WTP is expected to be less than $35,000 in the first year and approximately $25,000/yr thereafter, if performed by a contract laboratory. Cost of the performing the analyses in MEGAWS laboratory could be substantially less.

Table 5-2
Recommended Operational Sampling Plan for US WTP

Parameters	Sample Location		
	Influent from River	Sedimentation Basin Outlet and Sand Filter Outlet	WTP Outlet after Disinfection
General Water Quality Field analysis Laboratory analysis	 Daily Weekly	 Daily, first 3 months Weekly, first 3 months	 Daily Weekly
Total Residual Chlorine			Daily
Nutrients	Ammonia, nitrate, and reactive phosphorus weekly		Weekly
Metals	Quarterly		Monthly
Pollutants			Quarterly
Microbiological Parameters	Weekly		Daily
Phenols			Annually
Total Organic Carbon			Monthly
Hydrocarbons			Quarterly
Chlorinated Phenoxy Acid Herbicides			Annually
EDB and DBCP			Annually
Triazine			Annually
Pesticides and PCBs			Annually
Carbamates			Annually

Note: 1) Analysis should be performed for all metals parameters listed in Appendix D5 Table D5-1 once in the first quarter of operation with the exception of aluminum, iron, and mercury, which should be sampled weekly in the first quarter. If metals concentrations in filtered water do not exceed the Egyptian Standards for potable water in the first quarter (Appendix D5 Table D5-3), then sampling can be limited to quarterly monitoring thereafter.

Zawiyat Sultan SSF WTP

Seasonal (winter/summer) sampling to establish baseline performance and to help identify problem areas affecting water quality should be conducted at each WTP. Two or three samples should be collected from the following locations each season:

- Raw Water (before the upflow roughing filter)
- Overflow from roughing filter to the SSF
- Outflow at the outlet distribution pipe after chlorination.

Temperature, DO, conductivity, and pH should be measured in the field at the time of collection using calibrated instruments. Turbidity should be determined using a portable nephelometer.

Water samples should be collected and analyzed by a laboratory for the parameters, and in accordance with the frequencies detailed in Table 5-1. Grab samples should be taken using appropriate sampling devices that minimize potential contamination. Water samples will be placed in containers that have been prepared in accordance with Standard Methods (APHA 1998). Samples will be preserved at 4°C and transported immediately to the analytical laboratory (within 24 hours – preferably within 6-8 hours of collection). All laboratory analyses should be performed in accordance with United States Environmental Protection Agency methods or equivalent methods described in Standard Methods (APHA 1998).

Table 5-2
Operational Sampling Plan for SSF WTP

Parameters	Sample Location		
	Influent from River	**Roughing Filter Outlet**	**WTP Outlet after Disinfection**
General Water Quality Field analysis Laboratory analysis	 Daily Weekly	 Daily, first 3 months Weekly, first 3 months	 Daily Weekly
Total Residual Chlorine			Daily
Nutrients	Ammonia, nitrate, and reactive phosphorus weekly		All weekly
Metals	Aluminum, iron, and mercury weekly for first 3 months. All metals quarterly[1]		Aluminum, iron, and mercury weekly for first 3 months. All metals quarterly[1]
Pollutants			Quarterly
Microbiological Parameters	Weekly for first 3 months		Weekly
Phenols			Annually
Total Organic Carbon			Monthly
Hydrocarbons			Quarterly
Chlorinated Phenoxy Acid Herbicides			Annually
EDB and DBCP			Annually
Triazine			Annually
Pesticides and PCBs			Annually
Carbamates			Annually

Note: 1) Analysis should be performed for all metals parameters listed in Appendix D5 Table D5-1 once in the first quarter of operation with the exception of iron, copper, and mercury, which should be sampled weekly in the first quarter. If metals concentrations in filtered water do not exceed the Egyptian Standards for potable water in the first quarter (Appendix D5 Table D5-2), then sampling can be limited to quarterly monitoring thereafter.

These monitoring measures will have minimal impact on staff requirements. Sample collection and transport to the laboratory should be the responsibility of the mobile laboratories funded for MEGAWS under the MEMPP High Priority Projects. Cost of sample analyses for each WTP is expected to be less than $25,000 in the first year and approximately $19,000/yr thereafter, if performed by a contract laboratory. Cost of the performing the analyses in MEGAWS laboratory could be substantially less.

5.1.5.3 Compliance with Potable Standards in Treated Water

If removal of Target Treatment Parameters (Section 3.3.4) is insufficient at either of the WTPs, the treatment process should be modified to enhance removal. Process technologies recommended by USEPA (1989) for mercury removal include inorganic-ferric sulfate coagulation at pH 7 to 8, or granular activated carbon (GAC). Other studies have shown that use of GAC has enhanced performance of SSFs for the removal of contaminants that are otherwise unaffected by the filtration process.

MEGAWS will be repronsible for identifying the approprate process modification and incorporating it into the WTP design. Following modification, the initial three-month monitoring program, as identified in Table 5-2, should be repeated to confirm the effectiveness of the modifications.

5.1.5.4 Discharge Impacts to Surface Waters

Discharges to surface water will include filter backwash from the WTP and WWTP effluent discharge. WWTP discharge impacts on Beni Bekheit Drain water quality should be greatly reduced by the elimination of wastewater bypassing the plant.

<u>WTP Filter Backwash</u>
Filter backwash will be generated at the US WTP when the rapid sand filter head loss reaches unacceptable levels to maintain appropriate head or water quality deteriorates to unacceptable levels. Three samples should be collected from each backwash cycle, one at the beginning, middle and end of the cycle. Samples should be analyzed for parameters listed in the Egyptian Standard for industrial treated liquid wastes (Appendix D5 Table D5-3) during the first three backwash cycles. In subsequent backwash cycles, analysis may be limited to only those parameters detected during the previous backwash cycles.

As discussed in Section 3.3.4.5, it is recommended that the WTP design be modified to incorporate an additional treatment process for the filter backwash. If no modification is made, sampling at the US WTP should be sufficient to demonstrate that treatment is not required. MEGAWS will then be responsible for the review of monitoring data and any necessary recommendations for process modification.

<u>SSF Roughing Filter Backwash</u>
Filter backwash will be generated at the Zawiyat Sultan WTP when the roughing filter head reaches unacceptable levels to maintain appropriate water levels in the SSF. Each roughing filter will be back-washed approximately once every two to three months until backwash

water is relatively clear. Three samples should be collected from each backwash cycle, one at the beginning, middle and end of the cycle. Samples should be analyzed for parameters listed in the Egyptian Standard for industrial treated liquid wastes (Appendix D6 Table D6-2) during the first three backwash cycles. In subsequent backwash cycles, analysis may be limited to only those parameter detected during the previous backwash cycles.

As discussed in Section 3.3.4.5, it may be necessary to modify the SSF WTP design to incorporate an additional treatment process (e.g., settling) for the filter backwash. If no modification is made, sampling at the WTP should be sufficient to demonstrate that treatment is not required. MEGAWS will be responsible for the review of monitoring data and any necessary recommendations for process modification.

5.1.5.5 Groundwater Contamination from Wastewater Pipelines and Lagoons

Where pits, ponds, or lagoons are used for processing or storage of wastewater from the WTPs, provisions should be made to install shallow monitoring wells at several locations downslope of the lagoon systems. Monitoring wells should also be installed at points where wastewater force mains cross under or closely parallel irrigation canals. Wells should be monitored quarterly. Water quality samples should be analyzed for BOD, coliform bacteria, and ammonia. Highly elevated concentrations (e.g., BOD > 40, coliform bacteria > $1x10^7$, ammonia > 1.0 mg/L) of any of these constituents should be considered evidence of potential contamination by leakage from the ponds or force main (note that other sources such as nearby infiltration basins or manure piles could also cause high concentrations). Additional sampling and flow monitoring should be undertaken to determine whether leakage from the system is involved.

If significant force main leakage is detected, immediate measures must be taken to locate and repair the leak. Potential leakage should be monitored and measures to protect surface water and groundwater supplies should be instituted as required.

If groundwater impact is suspected, water quality samples should be collected and analyzed for BOD, coliform bacteria, and ammonia. In the event that one of the latter three mentioned are present, a drinking water advisory should be communicated to all downstream well users.

These mitigation measures should be included in the detailed design and the construction tender and contract documents. No additional cost to the project is anticipated.

5.1.6 Solid waste

5.1.6.1 Slow sand filter waste

The small accumulation of sludge from the schmutzdecke will be skimmed off the SSFs at Zawiyat Sultan every 30 to 90 days. The schmutzdecke will potentially contain pathogenic organisms that were filtered from the raw water. The sand that is removed should be dried and stored on-site for a period of six months to one year to assure deactivation of potentially pathogenic organisms.

The volume of material involved is relatively small and can be dried and stored in a small area. This mitigation measure will have no impact on project operation and maintenance costs.

5.1.6.2 WTP sludge

The Minia WTP Expansion will include coagulation/ flocculation in the treatment process train. The sludge generated from the settled floc will be transferred to existing sludge lagoons for further settling and dewatering. Sludge can be used as an organic soil amendment in agriculture or disposed of by landfilling.

5.2 MITIGATION AND MONITORING OF SOCIO-ECONOMIC IMPACTS

Impacts on demography, area economy and education and social services are expected to be small. In general, the impacts will be positive. No mitigation and monitoring measures are proposed for these impacts. Information collected by the next national census should be reviewed and compared with data from the 1996 census to assess any major changes in the local economy.

Benefits from the Projects should accrue in the area of public health and hygiene. However, there is a lack of baseline information and MOHP does not compile statistics at the village level. Due to the lack of adequate baseline information for comparison, and the anticipated difficulty in developing a meaningful assessment of benefits without an adequate baseline, no monitoring is recommended.

Construction in the Project Areas will not significantly disrupt traffic and utilities services (water, electricity, telephone) in the rural Project Areas. Although improvements may be needed to rural unpaved roads, all the Project Construction Sites are accessible by roads large enough to handle construction vehicles. Construction contractors should prepare a plan to mitigate transportation effects resulting from construction of the force main. The plan should be subject to review, modification and approval by MEGAWS and the Local Unit Council. The Authority and its Construction Management Contractor should be responsible for auditing compliance with the construction management plan.

These mitigation measures should be included in construction contractor's tender and contract documents. No additional cost to the projects is anticipated.

5.3 MITIGATION AND MONITORING OF CULTURAL IMPACTS

Egyptian Law No. 117/1983 stipulates that any discovery of antiquities must be reported to the SCA. The law provides penalties for removing damaging or destroying found antiquities. Construction activities involving digging within three kilometers of a known antiquities site require permission from the SCA. To prevent unnecessary disruption of archaeological

resources during construction, construction crews must report to the SCA any archaeological material that may be uncovered during excavation. All work should be implemented in full cooperation with the SCA.

The following measures should be implemented in the Minia City Project Area:

- Final design of any improvement or rehabilitation of the water and wastewater systems should take into consideration that potentially sensitive resources occur in or near Wastewater Zones 3, 13, 14, and 17, and the northern part of Zone 4 of Minia City.

- As a general rule, sensitive resources should be avoided wherever possible by rerouting planned improvements at least 50 m away from sensitive historic and cultural buildings identified in Section 2.5.2.1 and the property surrounding them.

- The SCA has the required knowledge of, and responsibility for, historic and culturally sensitive buildings in these areas. The SCA should be consulted prior to finalizing plans for improvements or rehabilitation to determine whether proposed pipeline routes pass too close to sensitive resources and to determine appropriate mitigation measures.

- If the historic monuments identified in Section 2.5.2.1 cannot be avoided, consultation with the SCA should be undertaken to determine the best routing and mitigation measures for proposed improvements. These would include proper shoring of trenches, avoiding the use of machinery that may cause extensive vibration, and utilizing dewatering equipment as necessary.

- During construction, a SCA inspector should observe all excavation work and alert construction crews and authorities if antiquities are uncovered. The inspector will have authority to implement measures considered necessary to properly protect archeological resources discovered during construction.

- When the proposed infrastructure project is implemented, construction crews must report to the Supreme Council of Antiquities any archaeological material that may be uncovered during excavation regardless of where such material may be discovered.

The following measures should be implemented in the Beni Ibayd Project area:

- If possible, the design of the collection system should avoid the streets immediately adjacent to the Awssia Mosque and the Church of Malek Mikhail (Archangel Michael) . If construction is required near these structures, proper techniques such as the aforementioned should be implemented to minimize negative impacts associated with construction activities.

- All work should be implemented in full cooperation with the Supreme Council of Antiquities (SCA). During construction, a SCA inspector should observe all excavation work and alert construction crews and authorities if antiquities are uncovered.

- When the proposed infrastructure project is implemented, construction crews must report to the Supreme Council of Antiquities any archaeological material that may be uncovered during excavation regardless of where such material may be discovered.

Although the Zawiyat Sultan Project Area is considered archeologically non-sensitive, its proximity to a major archeological site requires that the following measures be implemented:

- All work should be implemented in full cooperation with the Supreme Council of Antiquities (SCA). During construction, a SCA inspector should observe all excavation work and alert construction crews and authorities if antiquities are uncovered.

- When the proposed infrastructure project is implemented, construction crews must report to the Supreme Council of Antiquities any archaeological material that may be uncovered during excavation regardless of where such material may be discovered.

These mitigation measures should be included in construction contractor's tender and contract documents. No additional cost to the project is anticipated.

5.4 MITIGATION AND MONITORING OF CUMULATIVE IMPACTS

No impacts of the project resulting from its interaction with other existing or proposed projects are anticipated. No mitigation and monitoring measures are proposed.

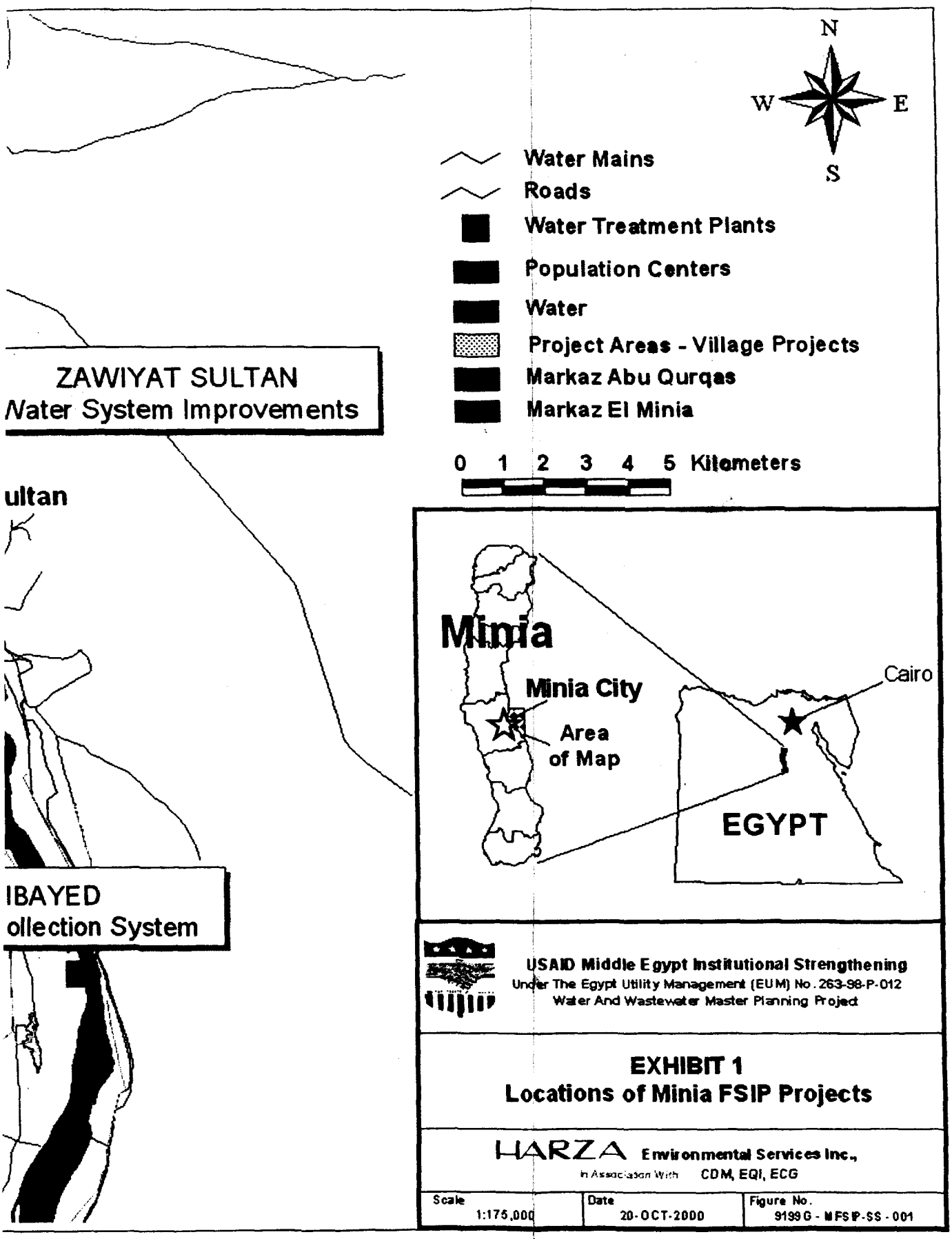
5.5 ENVIRONMENTAL PLAN OF ACTION

The following elements comprise the environmental plan of action for each Project, as applicable:

- Upon Approval of Funding by USAID. Make appropriate modifications to tender and contract documents to inform contractors of their environmental responsibilities for spill prevention and cleanup, dust and noise abatement, minimization of traffic disruption and impaired access to dwellings, and coordination with the SCA.
- Upon Approval of Funding by USAID. Purchase, as a cost to the project, continuous chlorine gas detectors and an alarm system for the chlorination building and chlorine storage area at each WTP.
- Upon Approval of Funding by USAID. Consult with SCA concerning appropriate procedures for review of proposed designs in sensitive areas and for SCA inspection of construction activities.

- Prior to Construction. Contact the local office of the SCA prior to construction and determine the appropriate measures for notification of and participation by the SCA during construction.
- Beginning Prior to Completion of Construction. Purchase appropriate laboratory supplies (if MEGAWS laboratory will perform analyses) and/or contract with a competent laboratory for water quality monitoring at the WTPs.
- Ongoing. Beginning Prior to Completion of Construction. Begin staff training and public education elements of chlorine spill emergency response program.
- Ongoing. Collect and analyze water samples for monitoring of WTP performance.

EXHIBITS

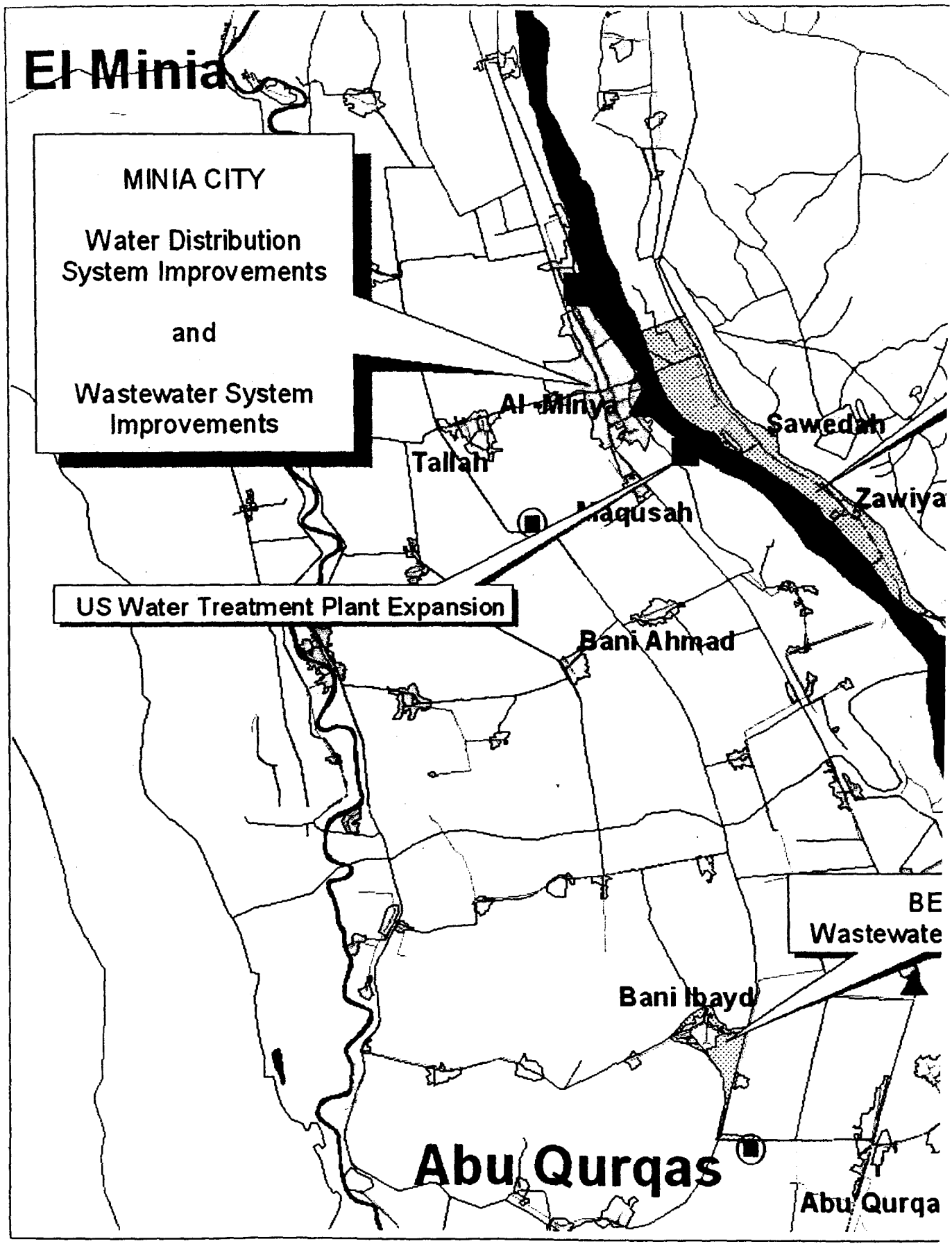


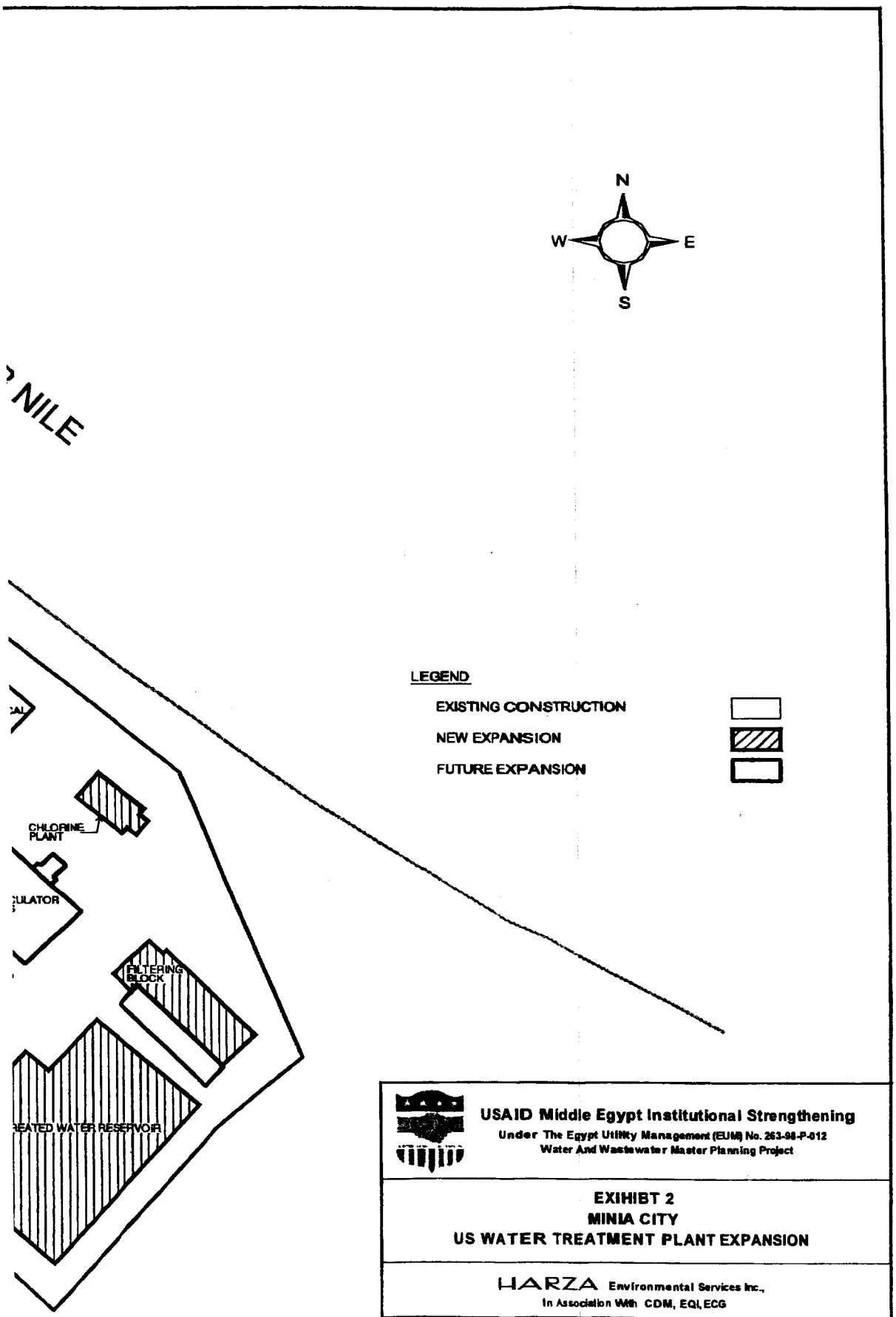
USAID Middle Egypt Institutional Strengthening
Under The Egypt Utility Management (EUM) No. 263-98-P-012
Water And Wastewater Master Planning Project

EXHIBIT 1
Locations of Minia FSIP Projects

HARZA Environmental Services Inc.,
In Association With CDM, EQI, ECG

Scale	Date	Figure No.
1:175,000	20-OCT-2000	9199G - MFSIP-SS - 001


El Minia
MINIA CITY
Water Distribution System Improvements
and
Wastewater System Improvements
Al Minya
Tallah
Sawedah
Zawiya
Maqusah
US Water Treatment Plant Expansion
Bani Ahmad
BE
Wastewate
Bani Ibayd
Abu Qurqas
Abu Qurqa



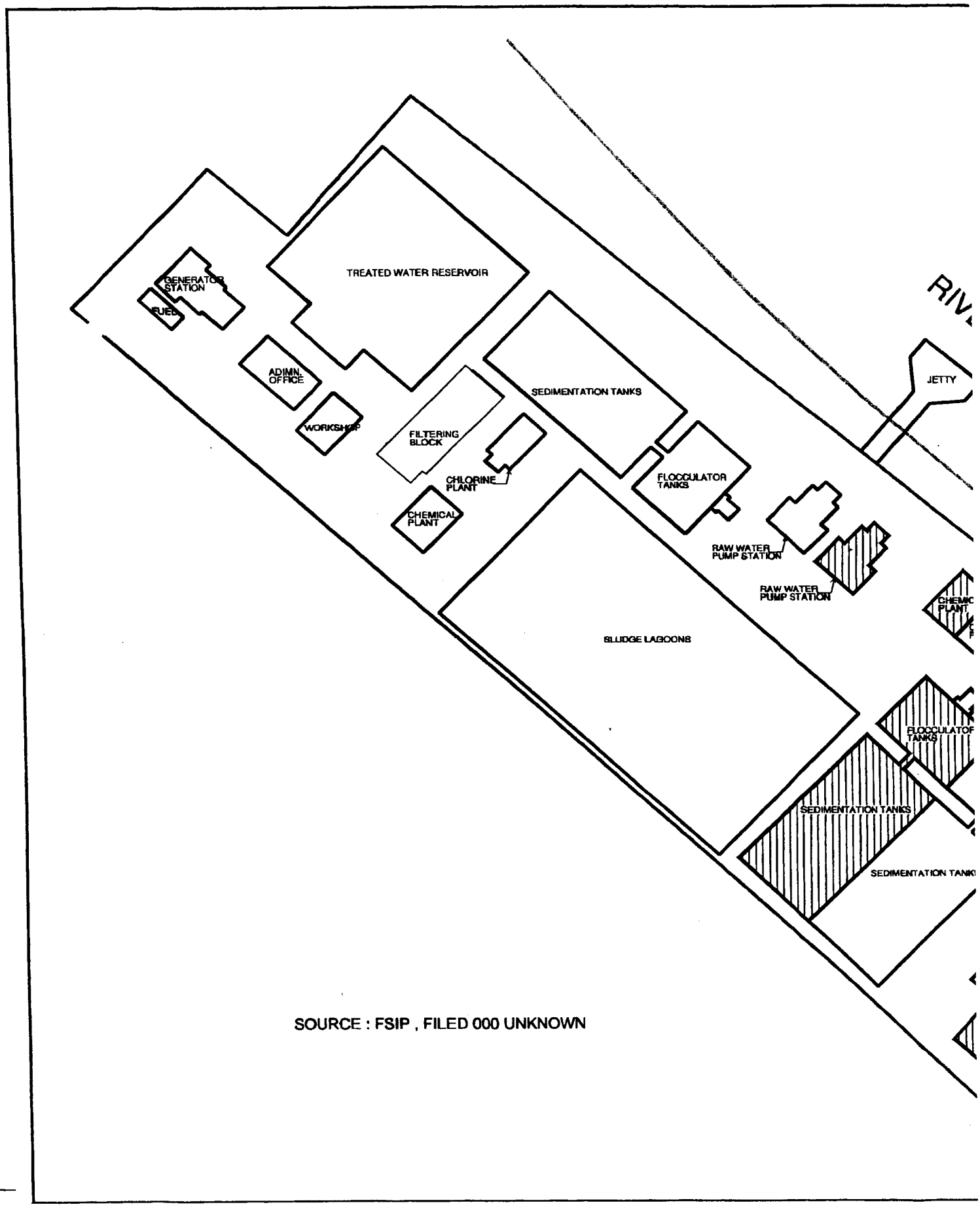
USAID Middle Egypt Institutional Strengthening

Under The Egypt Utility Management (EUM) No. 263-98-P-012
Water And Wastewater Master Planning Project

EXIHIBT 2
MINIA CITY
US WATER TREATMENT PLANT EXPANSION

HARZA Environmental Services Inc.,
In Association With CDM, EQI, ECG

Scale	Date	
NOT TO SCALE	28-08-2000	9199G-MW-001



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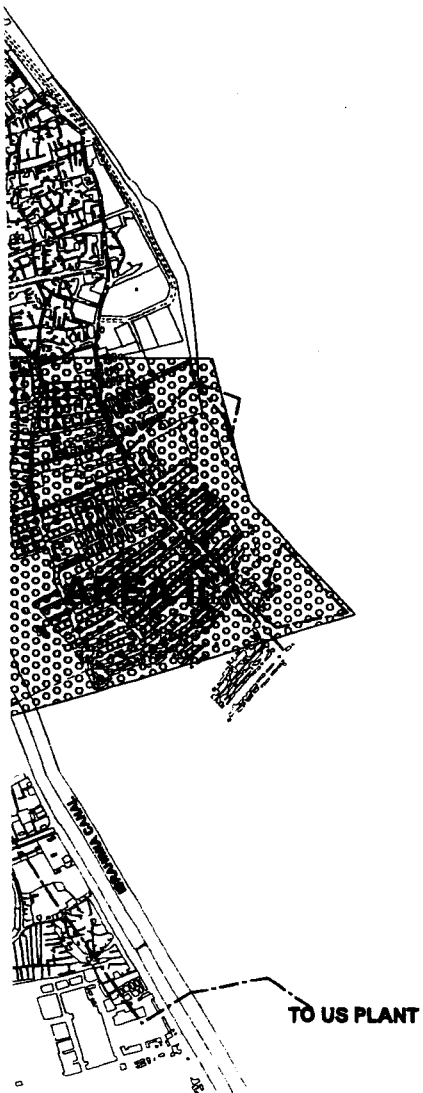

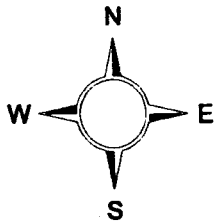

LEGEND

EXISTING PIPELINE	
AREA I	
AREA II	
AREA III	

USAID Middle Egypt Institutional Strengthening

Under The Egypt Utility Management (EUM) No. 263-98-P-012

Water And Wastewater Master Planning Project

EXHIBIT 3

MINIA CITY

WATER DISTRIBUTION SYSTEM AREA TARGETED FOR IMPROVEMENTS

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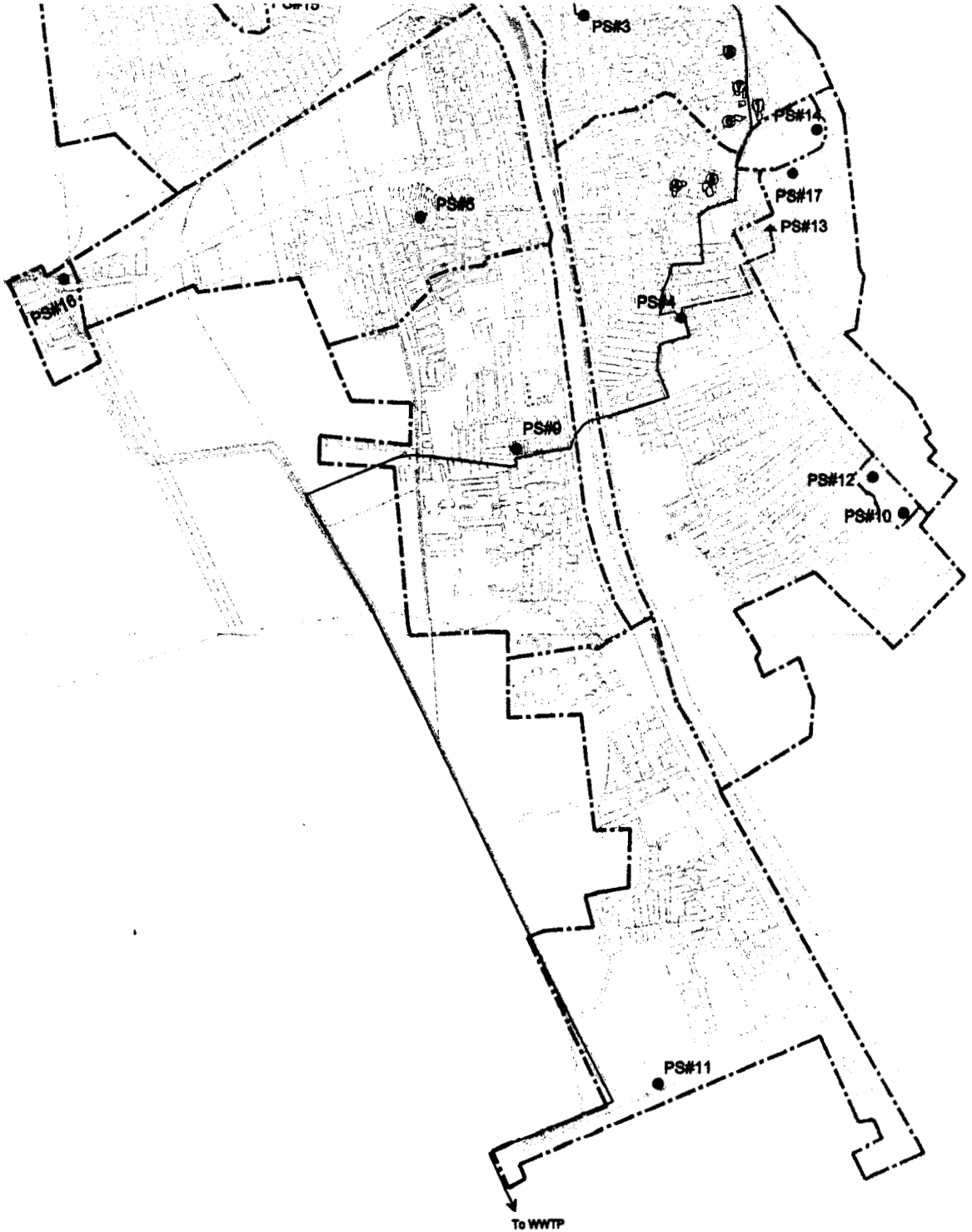


LEGEND

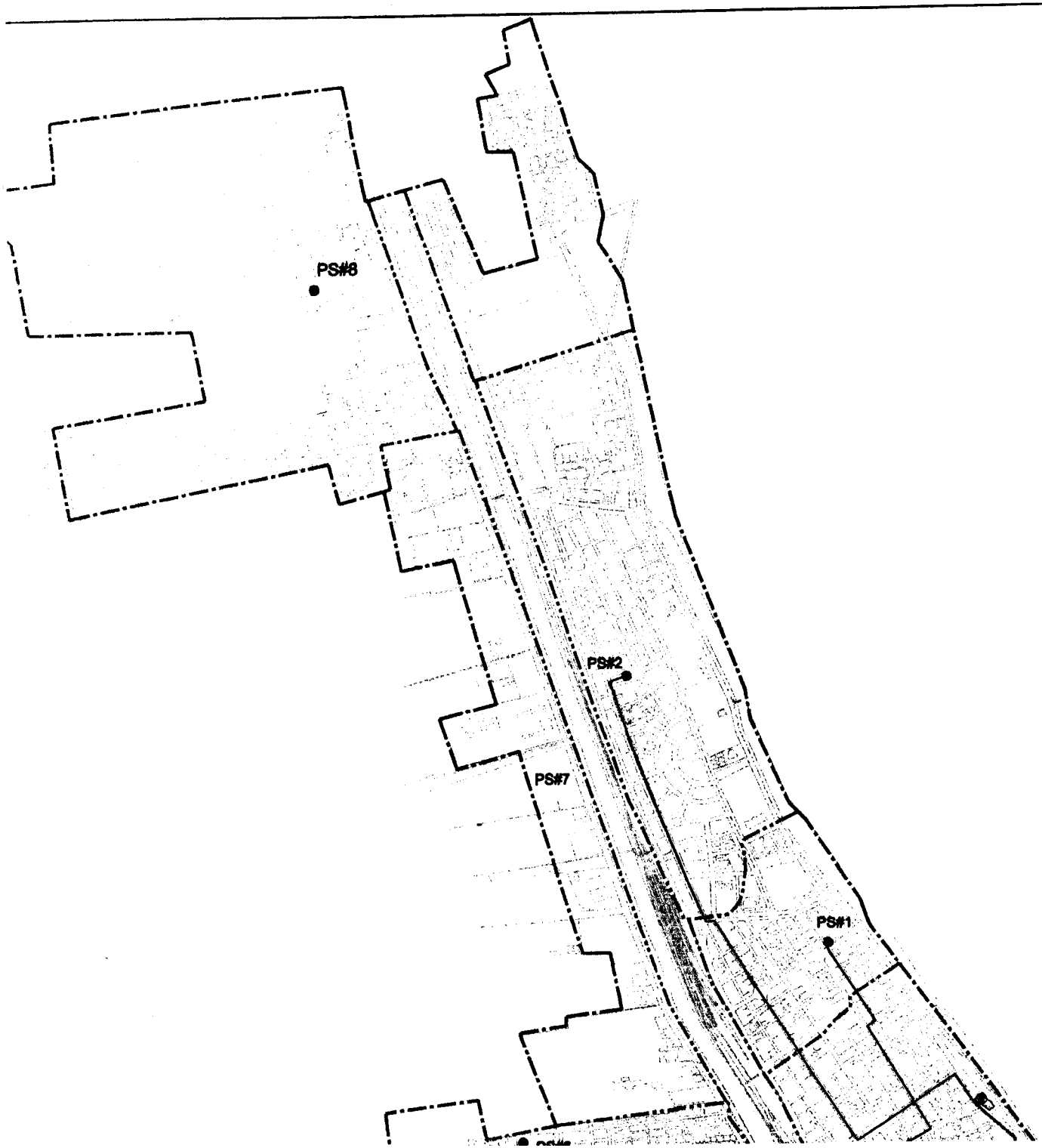
- URBAN BOUNDARY
- SEWER ZONE BOUNDARY
- PROPOSED FORCE MAIN
- PROPOSED MAIN GRAVITY SEWER
- UPGRADED PUMP STATION
- EXISTING PUMP STATION
- ABANDONED PUMP STATION
- HISTORICAL LOCATIONS ②

USAID Middle Egypt Construction Management Contract (CMC)
Under The Egypt Utility Management (EUM)
USAID Result Package No. 263 - 0270.01

EXHIBIT 4
Minia Governorate
El Mina City
WASTEWATER SYSTEM IMPROVEMENTS

HARZA ENGINEERING COMPANY
In Association With CDSI, SOI, SOS

CAIRO, EGYPT	DATE May 2001	DRAWING No. 12345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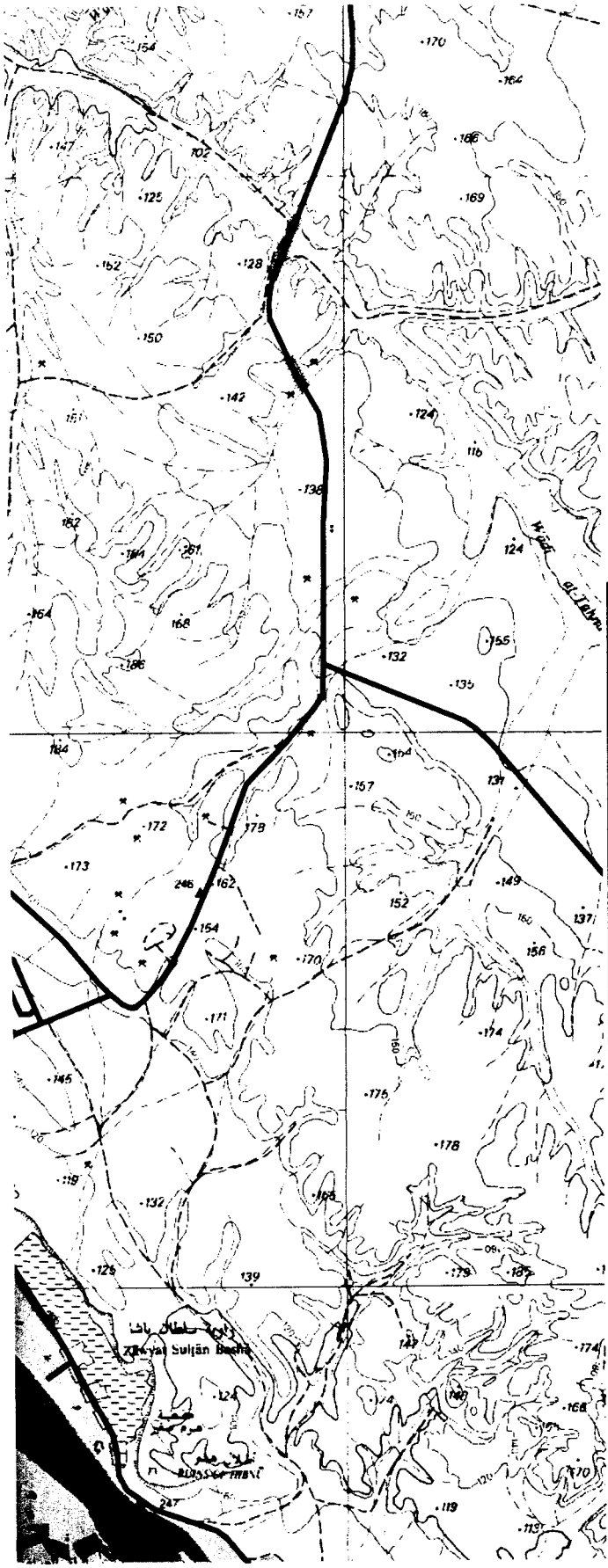
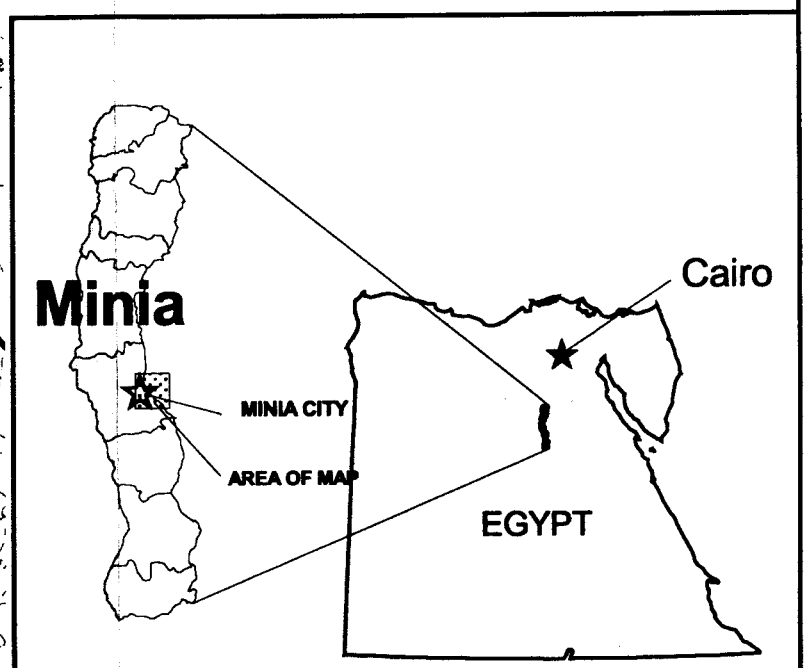


N
W E
S

Roads
Water Main
Proposed WTP Sites
Compact Water Treatment Unit
Wells
Elvated Tank
Water Treatment Plant

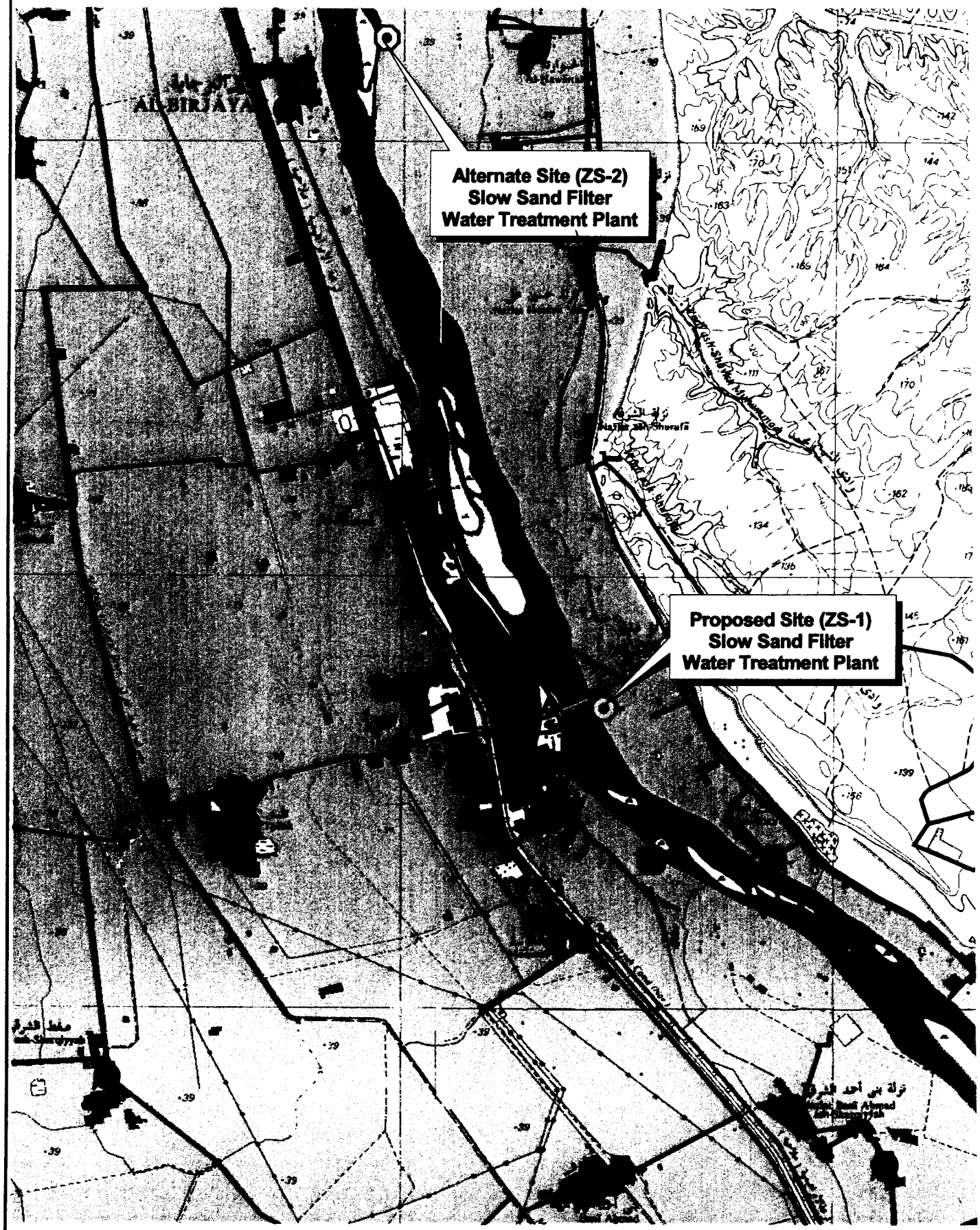


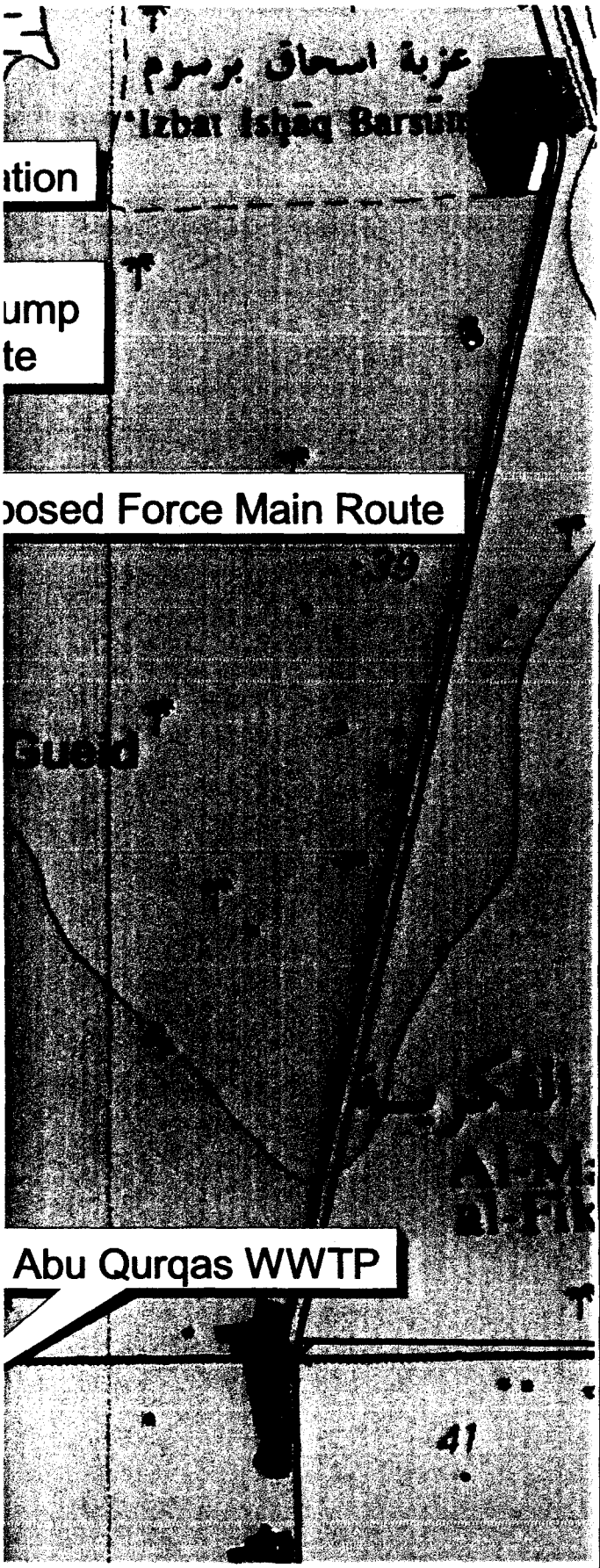
USAID Middle Egypt Institutional Strengthening
Under The Egypt Utility Management (EUM) No. 263-98-P-012
Water And Wastewater Master Planning Project

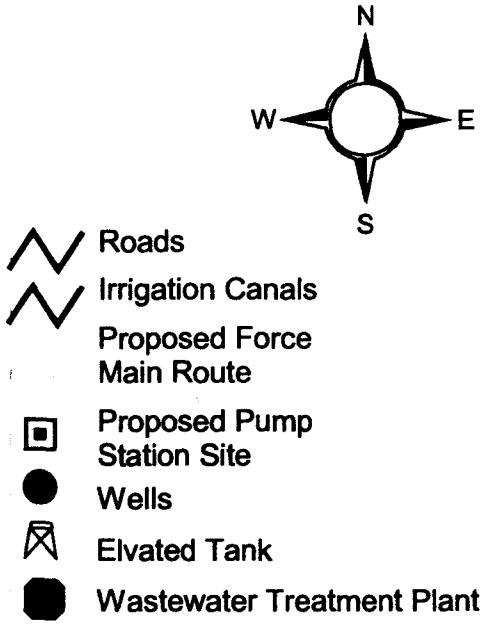
EXHIBIT 5
ZAWIYAT SULTAN WATER TREATMENT PLANT OPTIONS SITES

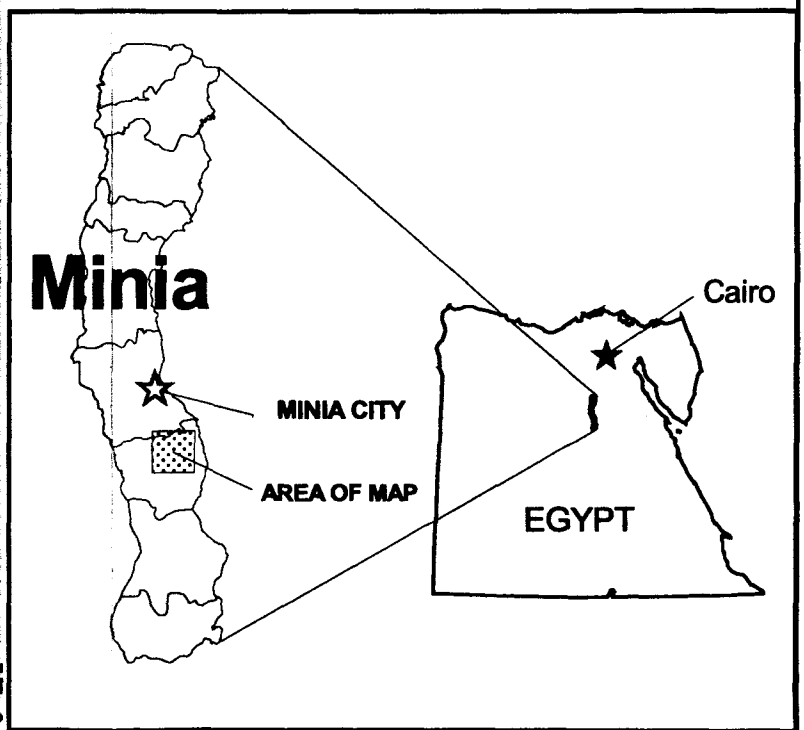
HARZA Environmental Services Inc.,
In Association With CDM, EQI, ECG

Scale	Date	Figure No.
1:60,000	20-SEP-2000	9199G-MFSIP-ARCH-001


Alternate Site (ZS-2)
Slow Sand Filter
Water Treatment Plant
Proposed Site (ZS-1)
Slow Sand Filter
Water Treatment Plant
AL-BIRJAYA
3
0
3
6 Kilometers





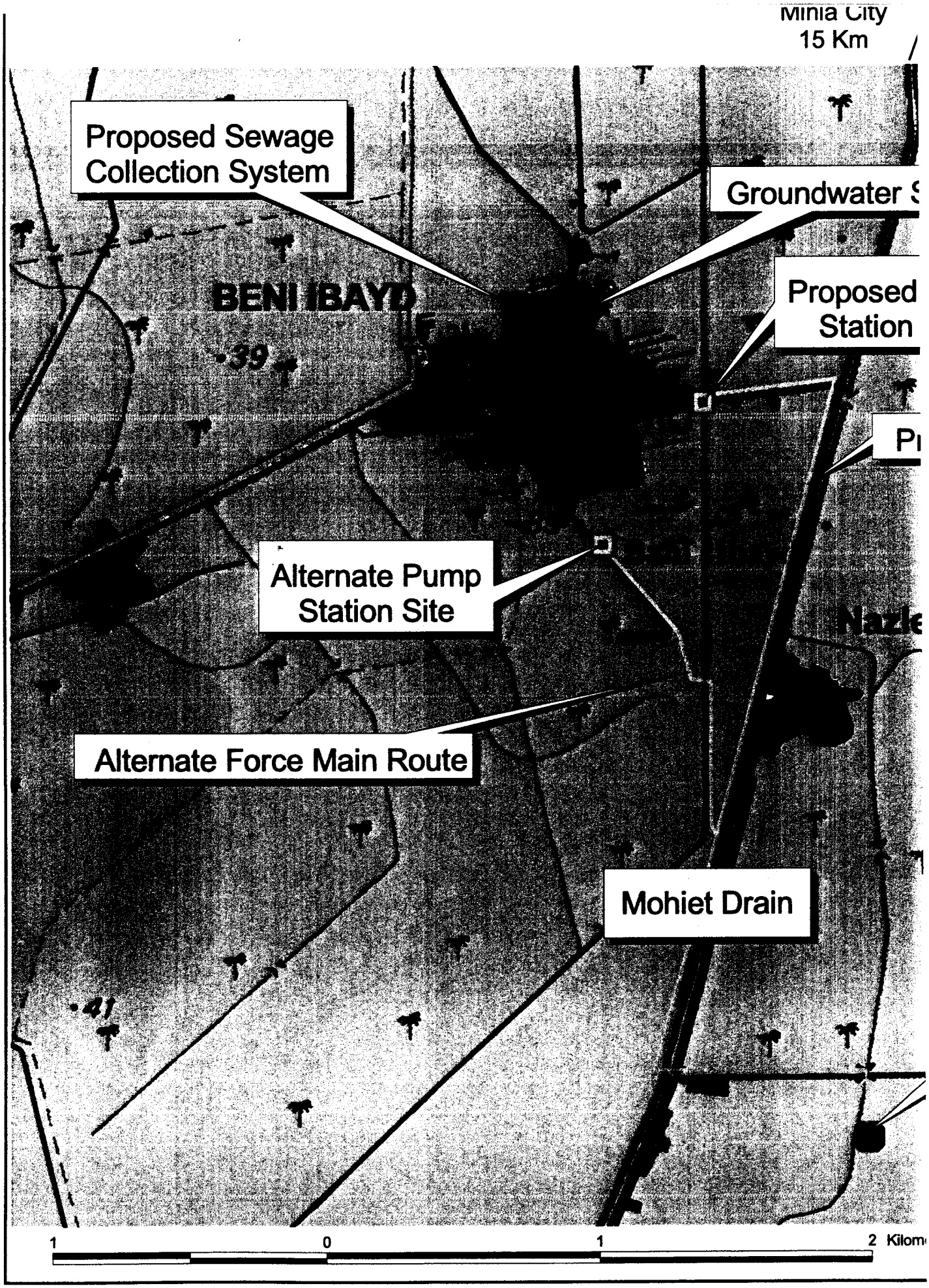


USAID Middle Egypt Institutional Strengthening
Under The Egypt Utility Management (EUM) No. 263-98-P-012
Water And Wastewater Master Planning Project

EXHIBIT 6
BENI IBAYD PROJECT AREA
GENERAL LOCATION MAP

HARZA Environmental Services Inc.,
In Association With **CDM, EQI, ECG**

Scale	Date	Figure No.
1:32,500	20-SEP-2000	9199G-MFSIP-ARCH-003


Minia City
15 Km
Proposed Sewage Collection System
Groundwater S
Proposed Station
Pr
BENI IBAYD
39
Alternate Pump Station Site
Nazle
Alternate Force Main Route
Mohiet Drain
41
1
0
1
2 Kilom

APPENDICES

APPENDIX A

METHODOLOGIES

APPENDIX A

METHODOLOGIES

Information to support the Environmental Assessment has been collected under the present conditions assessment and other activities under the Middle Egypt Water and Wastewater Master Planning Project. Information gathering activities began in February 1999. Analysis of information collected to date was the basis for evaluation of the proposed projects. Limited field reconnaissance studies are proposed to supplement information on antiquities and ecological resources in selected project areas (i.e., those projects involving new construction in semi-urban or rural areas. Site visits were conducted to verify information presently available and to identify mitigation requirements.

The activities involved in addressing issues common to all FSIP projects will be discussed in the following subsection. The anticipated approach to address significant issues related to specific projects is described in the following sections for each of the issues identified.

A. Issues Associated with Multiple Projects

These issues are important and should be addressed during detailed design by the Construction Management Contractor (CMC). At present, there is no information available for construction schedules or project implementation plans to avoid suspension of services. The EA will identify mitigation concerns associated with scheduling project implementation. Guidelines for scheduling of construction of the projects will be described in the Environmental Mitigation and Monitoring Program in the EA document.

Antiquities. Information collected to date by the master planning project does not indicate that known resources occur at the site of the US WTP Expansion Project. Because the site was subject to prior disturbance, assessment of resources is not necessary.

Within Minia City and Beni Ibayd, it was considered unlikely that a field reconnaissance of anticipated work areas for improvements to the water distribution system and/or wastewater force mains and pump stations would be effective. In addition, the precise location of water distribution pipelines and wastewater collection pipes and force mains will not be determined until detailed designs are completed. Therefore, the strategy for archaeological and cultural resources protection was to identify areas that should be avoided by construction. The project archaeologist contacted the responsible local office of the Supreme Council of Antiquities to determine whether that office had any a priori knowledge of the presence of historical or archaeological resources (primarily structures) within the city that should be avoided by construction. In addition, areas where prior permission of the SCA is required prior to construction were identified. The archeologically sensitive areas were located on maps and recommendations for appropriate mitigation measures were developed.

In rural areas outside of Zawiyat Sultan and Beni Ibayd, including the proposed WTP site for Zawiyat Sultan, an archaeologist familiar with the cultural resources of the area conducted a

site reconnaissance. The reconnaissance concentrated on identification of surface evidence of the presence of archaeological resources in open areas.

Disruption of Other Utilities. This issue should be addressed during detailed design by the Construction Management Contractor (CMC). This is largely an issue of coordination with other utilities prior to finalizing location of facilities, particularly within Minia City. The EA has identified mitigation concerns associated with maintaining all services during project implementation. Recommendations for coordination of construction have been prepared.

B. US Water Treatment Plant Expansion

In addition to the applicable analyses described in Section A for issues common to several of the proposed projects, the following issues will be addressed:

Finished Water Quality. The proposed process will be equivalent to the existing treatment process. Performance data for the existing process was reviewed. Available data on Nile River raw water quality were also reviewed. Design criteria for raw water quality were also reviewed and compared to standards for similar systems.

Emergency Action Plan in Case of a Chlorine Leak. The US WTP will continue to disinfect treated water with gaseous chlorine prior to distribution. An assessment of risk to the local population considered distance to nearest areas of human activity and dwellings, probable routes of dissipation of gas and site features affecting gas dissipation.

Surface Water Quality. Current practices for disposal of filter backwash and sludge were reviewed. No information on backwash quality relative to existing discharge standards was found.

C. Improvements to the Water Distribution System in Minia City

In addition to the applicable analyses described in Section A for issues common to several of the proposed projects, the following issues will be addressed:

Measures to Improve Pressure. The goal of this project is to improve pressures throughout the system to adequate levels. The design of the improvements will rely on modeling of the distribution system that will be conducted during final design. For the purposes of the EA, it has been assumed that pressures in the system will be improved to meet standards specified in the Design Criteria established under the MEMPP. No specific assessment was included in this EA.

Design of Pipelines. The proposed size of the pipelines was developed relative to future demand requirements and master planning considerations; this information will be updated during the final design process to assess required pipeline sizes to meet future growth during the master planning period. No specific assessment was undertaken for this EA.

D. Improvement of the Water System in Zawiyat Sultan Village

In addition to the applicable analyses described in Section A for issues common to several of the proposed projects, the following issues will be addressed:

Emergency Action Plan in Case of a Chlorine Leak. The Water Treatment Plant will disinfect filtered water with gaseous chlorine prior to distribution. An assessment of risk to the local population considered distance to nearest areas of human activity and dwellings, probable routes of dissipation of gas and site features affecting gas dissipation.

Adequate Sizing of the Facility. The question of facility sizing was reviewed relative to the expected population of the service area. Consideration was also given to other projects being implemented locally under the HPP phase of the MEMPP.

E. Construction of a Wastewater Collection System for Beni Ibayd Village

In addition to the applicable analyses described in Section Afor issues common to several of the proposed projects, the following issues will be addressed:

Potential for Backups and Overflows. Design features to reduce potential for backups and overflows from the system during operation were reviewed relative to the potential for overflows.

Effluent Quality from Abu Qurqas WWTP. Information on the design and capacity of the Abu Qurqas WWTP, which was collected during the development of the Master Plan, was reviewed.

APPENDIX B

LIST OF CONTACTS

APPENDIX B

LIST OF CONTACTS

The environmental team consulted the following government agencies during scoping and/or project assessment:

- National Institute of Oceanography and Fisheries
  - Office of the President
- Ministry of Irrigation and Water Resources (formerly, Ministry of Public Works and Water Resources)
  - Drainage Research Institute
  - Irrigation Research Institute
  - Groundwater Research Institute
  - National Water Research Institute – Advisory Panel for Water Management
  - Nile Research Institute
- Ministry of Health
- Supreme Council of Antiquities
- Ministry of Agriculture
- Egyptian Environmental Affairs Authority

APPENDIX C

REFERENCES

APPENDIX C

REFERENCES

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APPENDIX D

TECHNICAL INFORMATION

APPENDIX D1

WATER QUALITY DATA

Table D1-1. **Water Quality Data for Wells Serving the Zawiyat Sultan and Beni Ibayd Project Areas**

Table D1-2. **Nile River Water Quality Data, MEMPP Sampling at Proposed WTP Sites**

Table D1-3. **Nile River Water Quality Data, Collected by Nile Research Institute**

Table D1-4. **Nile River Water Quality Data at the US Water Treatment Plant in Minia**

APPENDIX D1. WATER QUALITY DATA

TABLE D1-1

Water Quality Data for Wells Serving the Zawiyat Sultan and Beni Ibayd Project Areas

		Sawadah (Zawiyat Sultan)				Bani Ibayd [1]				
Water Source Water Type Sample Date		Old Deep Well Raw 7/27/98	No.2 Well Raw 7/27/98	No. 3 Well Raw 7/27/98	Deep Well Raw 7/27/98	No. 1 Process Well Raw 5/19/98	No.2 Process Well Raw 5/19/98	Process Treated 5/19/98	Process Network Treated 5/19/98	Egyptian Potable Standard
Samples analyzed by the Health Department										
pH		7.9	8.1	8	7.9	7.9	8.1	8.3	7.9	6.5 to 9.2
Turbidity	NTU	1.89	13.8	10	NA	7.91	0.83	1.12	10.49	5
Conductivity	uS/cm	750	1150	950	1050	1050	1170	850	1150	NE
Hardness	mg/L	250	275	250	240	300	400	300	320	500
TDS	mg/L	500	760	630	700	700	780	566	766	NE
Chloride	mg/L	30	54	48	22	44	86	28	76	500
Ammonia	mg/L	2.8	NA	1.5	[illegible]	0.52	0	0	0.8	1.5
Nitrate	mg/L	0.002	0	0.02	0.01	0.02	0	0	0.001	0.005
Iron	mg/L	0.3	[illegible]	0.8	0.4	0.5	0	0	0.4	1
Manganese	mg/L	0.4	0.4	NA	0.5	1.2	0	0	[illegible]	0.5
Samples Analyzed by MEGAWS										
Temperature	°C	29.3	29.3	29.7	29.6	26.1	27	26.2	26.2	NE
pH		7.8	7.94	7.88	7.81	7.55	7.65	8.01	7.59	6.5 to 9.2
Turbidity	NTU	1.27	[illegible]	5.25	1.59	2.18	9.72	0.38	0.17	5
Conductivity	uS/cm	591	866	709	817	345	630	496	668	NE
Hardness	mg/L	220	260	220	240	260	380	300	410	500
TDS	mg/L	354	519	425	490	345	630	496	668	NE
Chloride	mg/L	70	100	80	110	52	160	70	180	500
Nitrate	mg/L	0.006	0.004	0.03	0.03	NA	NA	NA	NA	0.005
Iron	mg/L	0.3	[illegible]	2.4	0.35	0.4	0.4	0.2	0.1	1
Manganese	mg/L	0.27	0.17	0.24	0.4	0.8	1.01	0	0	0.5

Notes: Highlighted values exceed the Egyptian potable standard.
NA = Not analyzed, NE = Not established

TABLE D1-2

Nile River Water Quality Data, MEMPP Sampling at Proposed WTP Sites

		Zohra				Gabal El Tair and Tehna El Gabal				Deir Abu Hennis				
Sample Site[1]		**ZH1**	**ZH2**	**ZH3**	**BER5**	**DGT1**	**DGT2**	**DGT3**	**TEH5**	**DAH1**	**DAH2**	**DAH3**	**Hen5**	**Egyptian Potable Water Standard**
Sample Date		**22-Mar-00**	**3-Apr-00**	**12-Apr-00**	**7-May-00**	**22-Mar-00**	**3-Apr-00**	**12-Apr-00**	**7-May-00**	**22-Mar-00**	**3-Apr-00**	**12-Apr-00**	**7-May-00**	
Sample Time		**15:45**	**14:40**	**14:45**	**17:45**	**12:37**	**12:20**	**12:25**	**15:45**	**10:05**	**10:00**	**9:50**	**10:30**	
Sample Round	**Units**	**1**	**2**	**3**	**5**	**1**	**2**	**3**	**5**	**1**	**2**	**3**	**4**	
General Water Quality Parameters (field analysis)														
Water Temp	° C	19.3	22.1	23.1	NA	18.8	21.8	22.9	23.8	18.7	21.2	22.3	23.1	
Sample Depth	m	0.7	1	0.5	NA	1.5	1.9	1.5	1.4	0.7	0.3	0.9	1.48	
pH		8.2	8.13	8.08	NA	8.06	8.12	7.93	8.5	8.18	8.09	7.93	8.4	**6.5 - 9.2**
Dissolved Oxygen	mg/L	7.88	8.66			8.21	8.25	7.58	8.96	8.75	8.75	7.67	3.52	
ORP	mV	414	442	447	NA	427	433	425	453	464	413	462	458	
Specific Conductivity	uS/cm	292.8	295.6	296.9	NA	293.7	295.6	297.1	276.1	291.9	295.1	295.1	275.1	
Turbidity	NTU	15.7	[illegible]	[illegible]	NA	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	10.8	7.9	14.3	**5[2]**
Salinity	ppt	0.14	0.14	0.14	NA	0.14	0.14	0.14	0.13	0.14	0.14	0.14	0.13	
TDS	ppt	0.19	0.19	0.19	NA	0.19	0.19	0.19	0.18	0.19	0.19	0.19	0.18	**1.2[3]**
General Water Quality Parameters (laboratory analysis)														
Temp	° C	14.3	13.9	17.2	NA	14.3	14.3	16.5	NA	14.5	14.5	16.0	NA	
Conductivity	uS/cm	287	308	299	NA	290	307	298	NA	285	308	296	NA	
pH		8.55	8.76	8.48	NA	8.60	8.68	8.31	NA	8.54	8.72	8.35	NA	
Odor		Odorless	odorless	odorless	NA	odorless	odorless	odorless	NA	odorless	odorless	odorless	NA	
Color	Pt Co units	<5	<5	<5	NA	<5	<5	<5	NA	<5	<5	<5	NA	
Turbidity	NTU	4	3	3.3	NA	3.30	2.50	3.50	NA	3.50	2.70	3.00	NA	**5[2]**
TDS	mg/L	190	164	184	NA	188	156	184	NA	184	144	182	NA	**1200[3]**
TSS	mg/L	4	2	14	NA	16	4	2	NA	2	8	10	NA	
Total Alkalinity as CaCO3	mg/L	132	130	134	NA	136	136	134	NA	130	136	132	NA	
Total Hardness as CaCO3	mg/L	138	118	110	NA	132	120	108	NA	128	120	110	NA	**500**

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Environmental Quality International,
Engineering Consultants Group

Sample Site[1]		Zohra				Gabal El Tair and Tehna El Gabal				Deir Abu Hennis				
Sample Date		ZH1	ZH2	ZH3	BER5	DGT1	DGT2	DGT3	TEH5	DAH1	DAH2	DAH3	Hen5	Egyptian
Sample Time		22-Mar-00	3-Apr-00	12-Apr-00	7-May-00	22-Mar-00	3-Apr-00	12-Apr-00	7-May-00	22-Mar-00	3-Apr-00	12-Apr-00	7-May-00	Potable
Sample Round	Units	15:45	14:40	14:45	17:45	12:37	12:20	12:25	15:45	10:05	10:00	9:50	10:30	Water
		1	2	3	5	1	2	3	5	1	2	3	4	Standard
Corrosivity	mm/yr	0.13	0.12	0.14	NA	0.18	0.17	0.00	NA	0.28	0.10	-0.09	NA	
Sulfates	mg/L	21	19	19	NA	22	18	19	NA	19	18	17	NA	400
Chlorides	mg/L	12	12	14	NA	12	13	13	NA	12	13	13	NA	500
Fluorides	mg/L	0.48	0.38	0.37	NA	0.47	0.42	0.46	NA	0.48	0.40	0.47	NA	0.8
Calcium Hardness as CaCO3	mg/L	92	72	70	NA	90	72	70	NA	84	68	68	NA	
Calcium as Ca	mg/L	37	29	28	NA	36	29	28	NA	34	27	27	NA	
Magnesium as CaCO3	mg/L	46	46	40	NA	42	48	38	NA	44	52	42	NA	
Magnesium	mg/L	11	11	10	NA	10	12	9	NA	11	12	10	NA	150
Microbiological Parameters														
Total Coliform	CFU/ 100 mL	1000	[illegible]	[illegible]	NA	[illegible]	[illegible]	[illegible]	NA	[illegible]	200	1300	NA	3
Fecal Coliform	CFU/ 100 mL	180	[illegible]	[illegible]	NA	[illegible]	[illegible]	[illegible]	NA	[illegible]	20	180	NA	0
Plate Count	CFU/mL	2450	[illegible]	[illegible]	NA	[illegible]	[illegible]	[illegible]	NA	2600	3200	700	NA	50
Algae Count	Units/ mL	6882	[illegible]	[illegible]	NA	[illegible]	[illegible]	[illegible]	NA	[illegible]	[illegible]	[illegible]	NA	0[4]
Oxygen Demand														
COD	mg/L	9.7	9.9	9.8	NA	19.4	9.9	9.8	NA	19.4	9.9	19.6	NA	
BOD	mg/L	<2	<2	2.4	NA	<2	<2	<2	NA	<2	<2	<2	NA	
Nutrients														
Reactive Phosphate	mg/L	0.0137	<0.01	<0.01	NA	0.0114	<0.01	<0.01	NA	0.0241	<0.01	<0.01	NA	
Ammonia as N	mg/L	0.1503	0.171	0.1303	NA	0.0255	0.1439	0.0640	NA	0.1422	0.2007	<0.01	NA	
Nitrites as N	mg/L	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	NA	0.005
Nitrate as N	mg/L	<0.01	<0.01	<0.01	NA	<0.01	<0.01	<0.01	NA	<0.01	<0.01	<0.01	NA	10
Chlorinated Phenoxy Acid Herbicides (Method 6640 B)														
2,4-D	ug/L	<0.02	NA	NA	NA	<0.02	NA	NA	NA	<0.02	NA	NA	NA	30
2,4,5-TP (Silvex)	ug/L	0.08	NA	NA	NA	0.06	NA	NA	NA	0.06	NA	NA	NA	
2,4,5-T	ug/L	0.05	NA	NA	NA	0.03	NA	NA	NA	0.04	NA	NA	NA	9
Ethylene dibromide and Dibromodichloro-propane (Method 504)														
EDB & DBCP	ug/L	ND	NA	NA	NA	ND	NA	NA	NA	<0.01	NA	NA	NA	1[5]

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Environmental Quality International,
Engineering Consultants Group

Sample Site[1]		Zohra				Gabal El Tair and Tehna El Gabal				Deir Abu Hennis				
Sample Date		ZH1	ZH2	ZH3	BER5	DGT1	DGT2	DGT3	TEH5	DAH1	DAH2	DAH3	Hen5	Egyptian
Sample Time		22-Mar-00	3-Apr-00	12-Apr-00	7-May-00	22-Mar-00	3-Apr-00	12-Apr-00	7-May-00	22-Mar-00	3-Apr-00	12-Apr-00	7-May-00	Potable
Sample Round	Units	15:45	14:40	14:45	17:45	12:37	12:20	12:25	15:45	10:05	10:00	9:50	10:30	Water
		1	2	3	5	1	2	3	5	1	2	3	4	Standard
Triazine Pesticide (Method 619)														
Simazine	ug/L	<0.075	NA	NA	NA	<0.075	NA	NA	NA	<0.075	NA	NA	NA	2
Atrazine	ug/L	<0.13	NA	NA	NA	<0.13	NA	NA	NA	<0.13	NA	NA	NA	2
Prometon	ug/L	<0.30	NA	NA	NA	<0.30	NA	NA	NA	<0.3	NA	NA	NA	
Propazine	ug/L	<0.13	NA	NA	NA	<0.13	NA	NA	NA	<0.13	NA	NA	NA	
Ametryn	ug/L	<2.0	NA	NA	NA	<2.0	NA	NA	NA	<2.0	NA	NA	NA	
Prometryn	ug/L	<0.19	NA	NA	NA	<0.19	NA	NA	NA	<0.19	NA	NA	NA	
Terbutryn	ug/L	<0.25	NA	NA	NA	<0.25	NA	NA	NA	<0.25	NA	NA	NA	
Pesticide (Method 608)														
Alpha BHC	ug/L	<0.035	NA	NA	NA	<0.035	NA	NA	NA	<0.035	NA	NA	NA	
Beta BHC	ug/L	<0.023	NA	NA	NA	<0.023	NA	NA	NA	<0.023	NA	NA	NA	
Gama BHC	ug/L	<0.025	NA	NA	NA	<0.025	NA	NA	NA	<0.025	NA	NA	NA	
Delta BHC	ug/L	<0.024	NA	NA	NA	<0.024	NA	NA	NA	<0.024	NA	NA	NA	
Heptachlor	ug/L	<0.040	NA	NA	NA	<0.040	NA	NA	NA	<0.040	NA	NA	NA	
Aldrin	ug/L	<0.004	NA	NA	NA	<0.004	NA	NA	NA	<0.004	NA	NA	NA	0.03
Heptachlorepoxide	ug/L	<0.032	NA	NA	NA	<0.032	NA	NA	NA	<0.032	NA	NA	NA	
Endosulfan-1	ug/L	<0.03	NA	NA	NA	<0.03	NA	NA	NA	<0.03	NA	NA	NA	
DDE	ug/L	<0.058	NA	NA	NA	<0.058	NA	NA	NA	<0.058	NA	NA	NA	
Dieldrin	ug/L	<0.044	NA	NA	NA	<0.044	NA	NA	NA	<0.044	NA	NA	NA	
Endrin	ug/L	<0.039	NA	NA	NA	<0.039	NA	NA	NA	<0.039	NA	NA	NA	
Endosulfan-2	ug/L	<0.040	NA	NA	NA	<0.040	NA	NA	NA	<0.040	NA	NA	NA	
DDD	ug/L	<0.050	NA	NA	NA	<0.050	NA	NA	NA	<0.050	NA	NA	NA	
Endrinaldehyde	ug/L	<0.05	NA	NA	NA	<0.05	NA	NA	NA	<0.05	NA	NA	NA	
Endosulfansulfate	ug/L	<0.035	NA	NA	NA	<0.035	NA	NA	NA	<0.035	NA	NA	NA	
DDT	ug/L	<0.081	NA	NA	NA	<0.081	NA	NA	NA	<0.081	NA	NA	NA	2
Methoxychlor	ug/L	<0.01	NA	NA	NA	<0.01	NA	NA	NA	<0.01	NA	NA	NA	20
Endrinketon	ug/L	<0.01	NA	NA	NA	<0.01	NA	NA	NA	<0.01	NA	NA	NA	
Toxaphene	ug/L	<0.086	NA	NA	NA	<0.086	NA	NA	NA	<0.086	NA	NA	NA	
Chlordane	ug/L	<0.037	NA	NA	NA	<0.037	NA	NA	NA	<0.037	NA	NA	NA	0.2

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Sample Site[1]		Zohra				Gabal El Tair and Tehna El Gabal				Deir Abu Hennis				
		ZH1	ZH2	ZH3	BER5	DGT1	DGT2	DGT3	TEH5	DAH1	DAH2	DAH3	Hen5	Egyptian
Sample Date		22-Mar-00	3-Apr-00	12-Apr-00	7-May-00	22-Mar-00	3-Apr-00	12-Apr-00	7-May-00	22-Mar-00	3-Apr-00	12-Apr-00	7-May-00	Potable
Sample Time		15:45	14:40	14:45	17:45	12:37	12:20	12:25	15:45	10:05	10:00	9:50	10:30	Water
Sample Round	Units	1	2	3	5	1	2	3	5	1	2	3	4	Standard
Polychlorinated Biphenyl Compounds (Method 608)														
PCB-1221	ug/L	ND	NA	NA	NA	ND	NA	NA	NA	ND	NA	NA	NA	
PCB-1016	ug/L	<0.086	NA	NA	NA	<0.086	NA	NA	NA	<0.086	NA	NA	NA	
PCB-1232	ug/L	<0.054	NA	NA	NA	<0.054	NA	NA	NA	<0.054	NA	NA	NA	
PCB-1242	ug/L	ND	NA	NA	NA	ND	NA	NA	NA	ND	NA	NA	NA	
PCB-1254	ug/L	ND	NA	NA	NA	ND	NA	NA	NA	ND	NA	NA	NA	
PCB-1248	ug/L	ND	NA	NA	NA	ND	NA	NA	NA	ND	NA	NA	NA	
PCB-1260	ug/L	<0.90	NA	NA	NA	<0.90	NA	NA	NA	<0.90	NA	NA	NA	
Carbamates (Method 531.1)														
Aldicarsulfon	ug/L	<0.5 to 4.0	NA	NA	NA	<0.5 to 4.0	NA	NA	NA	<0.5 to 4.0	NA	NA	NA	
Oxamyl	ug/L	<0.5 to 4.0	NA	NA	NA	<0.5 to 4.0	NA	NA	NA	<0.5 to 4.0	NA	NA	NA	
Methiomyl	ug/L	<0.5 to 4.0	NA	NA	NA	<0.5 to 4.0	NA	NA	NA	<0.5 to 4.0	NA	NA	NA	
3Hydroxcarfuran	ug/L	<0.5 to 4.0	NA	NA	NA	<0.5 to 4.0	NA	NA	NA	<0.5 to 4.0	NA	NA	NA	
Aldicarb	ug/L	<0.5 to 4.0	NA	NA	NA	<0.5 to 4.0	NA	NA	NA	<0.5 to 4.0	NA	NA	NA	10
Propoxur	ug/L	<0.5 to 4.0	NA	NA	NA	<0.5 to 4.0	NA	NA	NA	<0.5 to 4.0	NA	NA	NA	
Carbfuran	ug/L	<0.5 to 4.0	NA	NA	NA	<0.5 to 4.0	NA	NA	NA	<0.5 to 4.0	NA	NA	NA	5
Carbaryl	ug/L	<0.5 to 4.0	NA	NA	NA	<0.5 to 4.0	NA	NA	NA	<0.5 to 4.0	NA	NA	NA	
Methiocarb	ug/L	<0.5 to 4.0	NA	NA	NA	<0.5 to 4.0	NA	NA	NA	<0.5 to 4.0	NA	NA	NA	
Phenols (Method 604)														
2 Chlorophenol	ug/L	<0.31	<0.31	<0.31	<0.31	<0.31	<0.31	<0.31	<0.31	<0.31	<0.31	<0.31	<0.31	
Phenol	ug/L	<0.14	<0.14	<0.14	<0.14	<0.14	<0.14	<0.14	<0.14	<0.14	<0.14	<0.14	<0.14	2
2 Nitrophenol	ug/L	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	
2,4 Dimethlphenol	ug/L	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32	
2,4 Dichlorophenol	ug/L	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39	
4-Chloro3-methylphenol	ug/L	<0.36	<0.36	<0.36	<0.36	<0.36	<0.36	<0.36	<0.36	<0.36	<0.36	<0.36	<0.36	
2,4,6 Trichlorophenol	ug/L	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64	200
2,4 Dinitrophenol	ug/L	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	
4-Nitrophenol	ug/L	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	
2-Methyl 4,6-dinitrophenol	ug/L	<16	<16	<16	<16	<16	<16	<16	<16	<16	<16	<16	<16	
Pentachlorophenol	ug/L	<7.4	<7.4	<7.4	<7.4	<7.4	<7.4	<7.4	<7.4	<7.4	<7.4	<7.4	<7.4	9

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		Zohra				Gabal El Tair and Tehna El Gabal				Deir Abu Hennis				
Sample Site[1]		**ZH1**	**ZH2**	**ZH3**	**BER5**	**DGT1**	**DGT2**	**DGT3**	**TEH5**	**DAH1**	**DAH2**	**DAH3**	**Hen5**	**Egyptian**
Sample Date		**22-Mar-00**	**3-Apr-00**	**12-Apr-00**	**7-May-00**	**22-Mar-00**	**3-Apr-00**	**12-Apr-00**	**7-May-00**	**22-Mar-00**	**3-Apr-00**	**12-Apr-00**	**7-May-00**	**Potable**
Sample Time		**15:45**	**14:40**	**14:45**	**17:45**	**12:37**	**12:20**	**12:25**	**15:45**	**10:05**	**10:00**	**9:50**	**10:30**	**Water**
Sample Round	**Units**	**1**	**2**	**3**	**5**	**1**	**2**	**3**	**5**	**1**	**2**	**3**	**4**	**Standard**
Organic Carbon														
Total Organic Carbon	mg/L	3.54	3.23	3.31	3.61	3.58	3.28	3.4	3.79	3.71	3.1	3.57	3.69	
Hydrocarbon Analysis (Method 413.2\418.1)														
Total Oil & Grease	mg/L	<0.25	NA	<0.25	<0.25	<0.25	NA	[redacted]	<0.25	<0.25	NA	[redacted]	<0.25	**0.1[6]**
Pollutants														
Total Cyanides	mg/L	<0.1	<0.1	<0.1	NA	<0.1	<0.1	<0.1	NA	<0.1	<0.1	<0.1	NA	**0.07[7]**
Metals														
Aluminum	mg/L	0.02	<0.02	0.04	NA	0.090	<0.02	0.310	NA	0.150	[redacted]	[redacted]	NA	**0.2**
Arsenic	ug/L	2.3	1.42	2.88	NA	0.920	1.090	1.080	NA	4.330	3.800	3.600	NA	**50**
Chromium	ug/L	1.4	0.67	1.76	NA	2.220	1.470	2.250	NA	1.640	0.720	0.860	NA	**50**
Copper	mg/L	0.007	0.002	<0.002	NA	0.009	<0.002	0.006	NA	0.007	0.004	<0.002	NA	**1**
Iron	mg/L	0.096	0.153	0.261	NA	0.085	0.132	[redacted]	NA	0.085	[redacted]	[redacted]	NA	**0.3[8]**
Manganese	mg/L	<0.03	<0.03	0.03	NA	<0.03	<0.03	0.040	NA	<0.03	0.010	0.040	NA	**0.1[9]**
Mercury	ug/L	0.25	0.7	[redacted]	NA	0.300	[redacted]	[redacted]	NA	0.160	0.370	[redacted]	NA	**1**
Sodium	mg/L	22.62	21.43	22.14	NA	22.830	21.540	22.110	NA	22.030	21.900	21.320	NA	
Potassium	mg/L	5	5.02	5.25	NA	5.220	4.930	5.100	NA	5.030	5.110	5.130	NA	
Zinc	mg/L	0.07	0.049	0.051	NA	0.056	0.044	0.076	NA	0.281	0.109	0.053	NA	**5**

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Notes:

1) Samples were collected from the following location according to WGS84 coordinates:
   - Zohra samples were collected from approximately 28 degrees 11 minutes North, 30 degrees 44 minutes East (approximately 10 km downstream of Minia City-Nile R. Bridge)
   - Deir Gabal El-Teir and Tehna El-Gabal samples were collected from approximately 28 degrees 13 minutes North, 30 degrees 46 minutes East (approximately 13 km downstream of Minia City)
   - Deir Abu Hennis samples were collected from approximately 27 degrees 37 minutes North, 30 degrees 54 minutes East (approximately 40 km upstream of Minia City)
2) Egyptian Standard for turbidity = 5 Jackson units for filtered, 10 Jackson units for unfiltered. 1 Jackson unit is approximately equal to 1 NTU.
3) Egyptian Standard for TDS = 1200 ppm (1.2 ppt) measured at 120°C
4) Egyptian Standard for Bluegreen algae = 0 cells/mL
5) In absence of a standard for the combined concentrations of EDB and DBCP, results were compared to the Egyptian Standard for 1,2-dibromo-3-chloropropane = 1 ug/L
6) Standard for total hydrocarbons other than benzene = 100 ug/L, Standard for benzene = 10 ug/L. Detection limit = 0.25 mg/L
7) In absence of a standard for total cyanides, results were compared to the Egyptian Standard for cyanogen chloride = 70 ug/L
8) Egyptian Standard for iron in filtered water = 0.3, 1.0 mg/L for mixed or groundwater
9) Egyptian Standard for manganese in filtered water = 0.1 mg/L, 0.5 for mixed or groundwater

NA = Not analyzed; NE = Not established; ND = Value below detection limit. However, detection limit is unknown.

= Value exceeds the standard

TABLE D1-3

Nile River Water Quality Data, Collected by Nile Research Institute

	Sample Site 21 at River Kilometer 280[1]							Sampling Site 23 at River Kilometer 210							
Year	**1991**	**1992**	**1993**	**1995**	**1996**	**1997**	**1998**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**
DO (mg/L)	9.3	10.6	12.8	6.4	8.4	8.7	7.4	8.1	9.5	11.4	9.7	6.8	8.5	8.5	7.4
Conductivity (uS/cm)	300	270	300	310	330	320	302	308	266	300	300	325	320	318	310
pH	7.7	8.7	8.7	7.8	8.2	7.8	7.6	7.6	8.3	8.5	8.4	7.0	7.9	7.8	7.5
Total alkalinity (mg/L as $CaCO_3$)	129	114	138	138	162	100	132	127	116	144	150	160	142	117	128
Turbidity (NTU)	10	32	6	29	27	23	15	15	26	8	34	29	31	26	17
NH3 (mg/L)	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.04	0.01	0.01	0.01	0.01
NO2 (mg/L)	0.080	0.006	0.010	0.000	0.015	0.006	0.002	0.010	0.028	0.010	0.008	0.004	0.020	0.000	0.002
NO3 (mg/L)	1.8	2.4	2.4	1.5	3.6	3.9	3.4	0.9	0.8	2.0	1.7	1.9	2.9	3.9	5.3
Ortho PO_4 (mg/L)	0.028	0.080	0.050	0.240	0.100	0.070	0.064	0.034	0.050	0.100	0.280	0.270	0.100	0.050	0.025
COD (mg/L)	14	15		13	22	15	16	15	18		9	5	18	16	13
BOD (mg/L)	3.2	3.7	4.9	7.0	3.1	5.0	2.8	2.9	4.4	4.7	3.6	4.7	3.8	4.6	2.5
TSS (mg/L)	12	47	5	22	18	20	20	24	20	1	44	30	21	28	20
Oil& Grease (mg/L)	2.6	2.3	3.5	2.4	2.9	2.9	1.2	2.6	2.5	2.2	3.9	2.0	2.9	2.3	2.4
TDS (mg/L)	192	173	180	200	220	198	180	188	190	180	214	195	215	189	197
Cl^- (mg/L)	7.8	7.7	18.3	12.9	6.7	18.4	7.6	7.8	7.7	18.3	21.2	12.9	7.2	17.4	8.1
SO_4 (mg/L)	14.0	15.0	25.7	37.0	50.0	30.0	16.5	11.3	11.5	26.0	65.0	35.0	42.0	20.0	18.5
CO_3 (mg/L)	0	4	0	0	0	0	0	0	0	0	10	0	0	0	0
HCO_3 (mg/L)	125	110	138	138	154	100	132	122	116	143	140	160	132	117	128

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	Sample Site 21 at River Kilometer 280[1]							Sampling Site 23 at River Kilometer 210							
Year	**1991**	**1992**	**1993**	**1995**	**1996**	**1997**	**1998**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**
Total Hardness (mg/L as $CaCO_3$)	109	114	138	126	186	160	110	109	112	126	136	132	196	156	112
Ca (mg/L)	24.0	30.4	28.8	30.4	49.6	40.8	24.0	23.2	30.4	31.2	29.6	31.2	50.4	51.2	2604.0
Mg (mg/L)	12.0	9.1	15.8	13.0	14.9	13.9	12.0	12.5	8.6	11.5	14.9	13.0	16.8	6.7	11.0
Na (mg/L)	31.6	18.0	28.0	18.0	21.0	31.0	16.0	28.8	17.0	30.0	30.0	18.0	23.0	32.0	16.0
K (mg/L)	5.5	6.0	18.0	4.5	3.6	4.8	4.2	6.6	5.5	18.0	4.7	4.5	3.6	5.1	5.6
Total Coliform MPN/100 ml	1400	1100	1150	540	750	1500	1800	1000	660	800	3500	900	1000	2200	700
Fecal Coliform MPN/100ml	300	210	600	330	140	700	720	100	100	300	2500	700	400	1000	300

Note: 1. Minia City is located approximately at river kilometer 240 (Nile River Bridge in Minia City is at km 241).

TABLE D1-4a

Nile River Water Quality Data at the US Water Treatment Plant in Minia

February, 1999

Date	Raw Water						Settled Water		
	Turbidity NTU	Alkalinity mg/L	Hardness mg/L	Conductivity uS/cm	pH Unit	Temperature Degree C	Turbidity NTU	pH Unit	Chlorine mg/L
1	5.0	133	110	281	8.11	27.8	0.44	7.34	0.78
2	5.6	130	108	285	8.12	27.9	0.54	7.38	0.77
3	5.0	132	104	315	8.14	27.9	0.41	7.40	0.64
4	5.3	131	106	277	8.05	27.8	0.50	7.35	0.63
5	5.4	136	106	291	8.05	27.9	0.57	7.38	0.69
6	5.9	131	102	287	8.15	28.3	0.48	7.42	0.76
7	5.7	131	102	290	8.13	28.5	0.55	7.37	0.39
8	6.8	133	108	323	8.02	28.3	0.52	7.40	0.64
9	8.9	137	106	302	8.05	28.4	0.50	7.39	0.57
10	6.8	133	108	292	8.02	28.2	0.50	7.45	0.40
11	6.4	135	108	291	8.00	28.2	0.54	7.35	0.69
12	7.8	138	112	293	8.14	28.3	0.51	7.44	0.60
13	5.8	135	110	313	8.08	28.1	0.48	7.33	0.65
14	5.8	137	114	315	8.07	28.0	0.53	7.35	0.56
15	7.0	131	104	255	8.04	27.8	0.49	7.37	0.75
16	7.0	135	110	265	8.07	27.2	0.57	7.31	0.75
17	7.3	134	110	285	8.21	27.0	0.61	7.35	0.64
18	7.2	131	108	264	8.00	27.2	0.65	7.30	0.86
19	8.1	134	106	303	8.03	27.0	0.60	7.30	0.80
20	7.7	136	106	291	8.01	26.7	0.50	7.30	0.82
21	6.4	134	106	278	8.06	26.3	0.58	7.32	0.70
22	7.7	139	114	285	8.02	26.3	0.66	7.44	0.78
23	8.0	135	110	300	8.04	26.4	0.54	7.44	0.65
24	7.6	137	110	297	8.01	26.3	0.70	7.42	0.96
25	7.3	135	108	295	7.98	26.2	0.78	7.37	0.82
26	7.4	137	106	291	8.05	26.4	0.72	7.36	0.79
27	8.7	133	104	297	8.08	26.6	0.50	7.33	0.81
28	9.1	134	106	292	8.08	27.5	0.61	7.32	0.73
29	6.8	149	106	292	7.94	26.9	0.51	7.21	0.79
30	7.1	150	112	302	8.03	26.8	0.69	7.21	1.03
31	9.1	146	106	298	7.96	27.1	0.65	7.17	0.85
MAX	9.1	150	114	323	8.21	28.5	0.78	7.45	1.03
MIN	5.0	130	102	255	7.94	26.2	0.41	7.17	0.39
AVG	7.0	136	108	292	8.06	27.4	0.56	7.35	0.72

TABLE D1-4b

Nile River Water Quality Data at the US Water Treatment Plant in Minia

July, 1999

	Raw Water							Settled Water		
Date	Turbidity NTU	Alkalinity mg/L	Hardness mg/L	Conductivity uS/cm	pH Unit	Temp Degree C	Chloride mg/L	Turbidity NTU	pH Unit	Chlorine mg/L
1	6.4	125	104	290	8.33	25.0		0.62	7.59	0.80
2	7.0	129	106	271	8.27	25.5		0.61	7.60	0.63
3	6.9	129	104	275	8.28	26.8		0.61	7.57	0.94
4	7.2	126	106	290	8.29	25.9		0.63	7.51	0.60
5	7.8	128	105	290	8.21	26.9		0.67	7.46	0.61
6	6.3	127	106	296	8.22	27.3		0.57	7.39	0.79
7	8.9	127	110	279	8.23	26.7		0.62	7.44	0.73
8	6.1	129	112	271	8.21	26.4		0.56	7.42	7.79
9	5.9	129	108	268	8.09	26.0		0.59	7.35	0.72
10	6.0	129	108	271	8.25	27.1	25	0.48	7.40	0.47
11	6.3	130	108	303	8.15	26.7		0.58	7.37	0.81
12	6.1	127	110	281	8.06	26.5		0.60	7.26	0.73
13	5.4	131	106	290	8.09	26.7		0.61	7.25	0.64
14	6.6	129	106	284	8.09	26.5		0.56	7.27	0.81
15	6.2	130	108	294	8.05	26.1		0.62	7.20	0.71
16	5.8	128	110	291	8.07	26.7		0.55	7.20	0.67
17	5.3	128	114	284	7.98	26.9		0.58	7.13	0.56
18	5.0	131	104	289	7.95	27.2		0.55	7.10	0.62
19	8.6	129	102	292	8.26	27.8		0.60	7.52	0.66
20	4.8	133	106	277	8.30	27.8		0.53	7.55	0.69
21	6.1	132	100	244	8.27	27.1		0.52	7.51	0.71
22	5.5	132	104	273	8.33	26.8		0.81	7.57	0.78
23	7.2	131	104	237	8.36	27.2		0.63	7.57	0.53
24	5.3	130	104	225	8.30	27.1		0.49	7.62	0.52
25	6.1	130	108	250	8.27	27.8		0.57	7.62	0.72
26	6.1	130	104	285	8.32	27.7	30	0.63	7.59	0.49
27	5.5	132	104	285	8.32	27.2		0.55	7.61	0.69
28	5.1	129	106	300	8.29	27.2		0.56	7.66	0.48
29	4.4	130	102	285	8.29	27.6		0.50	7.61	0.69
30	6.1	129	104	294	8.26	27.8		0.45	7.60	0.64
31	5.8	129	104	258	8.32	27.8		0.47	7.57	0.64
MAX	8.9	133	114	303	8.36	27.8	30.0	0.81	7.66	7.79
MIN	4.4	126	100	225	7.95	25.5	25.0	0.45	7.10	0.47
AVG	6.2	129	106	278	8.21	27.0	27.5	0.58	7.45	0.90

TABLE D1-4c

Nile River Water Quality Data at the US Water Treatment Plant in Minia

August, 1999

Date	Raw Water						Settled Water		
	Turbidity NTU	Alkalinity mg/L	Hardness mg/L	Conductivity uS/cm	pH Unit	Temp Degree C	Turbidity NTU	pH Unit	Chlorine mg/L
1	11.0	153	112	305	7.89	27.2	0.91	7.18	0.80
2	9.6	153	110	305	7.88	27.4	0.90	7.24	1.12
3	11.0	151	106	311	7.95	26.8	0.79	7.17	0.69
4	9.5	151	106	310	7.85	27.0	0.69	7.16	0.34
5	9.1	150	112	306	7.89	26.5	0.77	7.19	0.73
6	9.5	156	112	311	7.92	26.6	0.88	7.06	0.79
7	8.8	155	112	315	7.87	26.9	1.00	7.07	0.75
8	11.0	157	110	312	7.87	27.3	1.16	7.10	0.75
9	9.8	145	104	309	7.95	27.7	1.06	7.08	1.12
10	7.3	141	112	308	7.77	27.4	0.49	7.02	1.05
11	9.2	141	114	310	7.83	27.5	0.47	7.07	0.96
12	12.0	135	106	313	8.13	28.2	0.78	7.41	0.98
13	11.4	135	106	335	8.14	27.7	0.79	7.41	1.23
14	10.7	138	105	332	8.14	27.9	0.92	7.40	1.30
15	10.4	136	102	284	8.11	27.5	0.95	7.49	1.14
16	10.7	136	104	276	8.13	27.4	0.88	7.49	1.17
17	11.3	134	110	275	8.10	27.0	0.78	7.51	1.66
18	10.7	131	110	272	8.10	27.0	0.85	7.43	1.02
19	9.3	132	110	284	8.11	26.2	0.77	7.41	1.25
20	9.7	133	110	283	8.17	26.6	0.61	7.50	1.23
21	8.9	133	110	285	8.18	25.1	0.89	7.38	1.04
22	8.9	134	106	282	8.10	25.7	0.86	7.49	1.33
23	9.2	131	106	282	8.10	25.2	0.69	7.42	1.18
24	8.4	132	102	287	8.06	25.2	0.57	7.50	1.56
25	10.2	131	102	288	8.08	25.4	0.62	7.55	1.16
26	9.7	140	104	282	8.14	25.2	0.65	7.37	1.14
27	10.7	137	108	282	8.29	24.6	0.85	7.31	1.45
28	9.1	137	102	283	8.32	25.1	0.70	7.43	1.40
29	10.4	137	102	287	8.31	24.3	0.80	7.50	1.52
30	8.5	140	102	290	8.17	24.8	0.96	7.38	1.23
31									
MAX	12.0	157	114	335	8.32	28.2	1.16	7.55	1.66
MIN	7.3	131	102	272	7.77	24.3	0.47	7.02	0.34
AVG	9.9	141	107	297	8.05	26.5	0.80	7.32	1.10

TABLE D1-4d

Nile River Water Quality Data at the US Water Treatment Plant in Minia

September, 1999

Date	Raw Water						Settled Water		
	Turbidity NTU	Alkalinity mg/L	Hardness mg/L	Conductivity uS/cm	pH Unit	Temp Degree C	Turbidity NTU	pH Unit	Chlorine mg/L
1	9.4	123	104	272	7.94	26.1	0.57	7.80	1.13
2	7.4	119	104	271	7.86	26.5	0.48	7.17	1.21
3	10.4	119	108	275	7.87	26.9	0.46	7.14	0.79
4	8.4	121	106	285	7.88	26.6	0.52	7.35	1.23
5	7.8	123	102	273	7.82	26.3	0.53	7.15	1.35
6	6.4	118	104	275	7.91	25.8	0.49	7.49	1.30
7	7.5	119	2	274	8.12	25.8	0.61	7.43	1.28
8	7.8	121	104	275	8.90	25.8	0.39	7.52	1.33
9	6.4	121	106	278	7.92	25.9	0.34	7.39	1.15
10	12.5	121	106	276	7.94	26.3	0.36	7.54	1.17
11	7.5	121	102	278	7.91	26.3	0.43	7.66	1.19
12	5.8	121	106	277	7.89	26.3	0.36	7.44	1.27
13	6.1	121	106	273	7.98	26.7	0.39	7.62	1.09
14	6.55	121	106	277	7.99	26.6	0.42	7.48	1.07
15	6.7	121	108	277	7.91	26.4	0.43	7.34	0.92
16	7.7	123	110	276	7.89	26.5	0.46	7.48	1.20
17	6.4	122	106	277	7.87	26.2	0.39	7.42	1.03
18	6.6	121	106	280	7.84	26.1	0.45	7.46	1.08
19	8.9	123	106	282	7.81	26.2	0.40	7.52	1.23
20	6.9	123	104	280	7.90	26.4	0.46	7.68	1.25
21	7.5	122	110	278	7.89	26.0	0.52	7.48	1.48
22	7.3	122	110	281	7.90	26.2	0.46	7.40	1.06
23	7.4	125	110	282	7.96	25.9	0.44	7.48	1.29
24	7.3	124	108	280	7.93	26.0	0.47	7.41	1.34
25	7.7	125	112	270	7.82	26.2	0.52	7.50	1.25
26	9.9	123	112	277	8.05	25.8	0.46	7.53	1.18
27	7.4	122	108	276	8.02	25.8	0.46	7.34	1.67
28	8	122	110	274	7.92	26.1	0.50	7.38	1.56
29	7.7	125	114	276	7.97	26.1	0.45	7.60	1.15
30	7.4	124	114	274	7.89	26.4	0.48	7.55	1.22
MAX	12.5	125	114	285	8.90	26.9	0.61	7.80	1.67
MIN	5.8	118	2	270	7.81	25.8	0.34	7.14	0.79
AVG	7.7	122	104	277	7.95	26.2	0.46	7.46	1.22

TABLE D1-4e

Nile River Water Quality Data at the US Water Treatment Plant in Minia

October, 1999

Date	Raw Water						Settled Water
	Turbidity NTU	Alkalinity mg/L	Hardness mg/L	Conductivity uS/cm	pH Unit	Temp Degree C	Turbidity NTU
1	11.6	138	102	279	8.28	24.5	0.65
2	12.7	138	106	277	8.24	25.8	0.55
3	6.7	140	116	286	8.20	25.4	0.55
4	6.6	143	118	285	8.13	25.5	0.47
5	5.16	141	108	290	8.12	24.8	0.48
6	6.68	145	110	285	8.09	25.0	0.51
7	6.38	143	104	276	8.11	24.6	0.51
8	7.51	141	108	273	8.14	25.0	0.52
9	8.12	136	110	275	8.15	25.8	0.52
10	7.39	134	108	285	8.27	25.3	0.65
11	8.84	131	108	284	8.16	25.4	0.54
12	8.46	131	102	282	8.08	25.8	0.54
13	8.14	132	104	273	8.13	25.7	0.56
14	8.1	134	104	283	8.01	25.8	0.57
15	8.2	135	106	279	7.94	26.0	0.81
16	10.55	138	108	282	8.13	25.9	0.52
17	10.32	145	100	283	8.07	24.4	0.65
18	9.5	135	110	288	8.10	23.7	0.66
19	8.23	135	102	290	8.04	23.3	0.64
20	9.16	133	108	283	8.02	23.0	0.74
21	8.75	130	108	294	8.03	23.2	0.75
22	9.87	135	108	297	7.96	23.3	0.61
23	9.19	129	108	295	8.10	24.1	0.53
24	9.11	131	110	289	7.97	23.1	0.74
25	9.28	137	104	290	7.99	22.8	0.77
26	9.16	131	106	290	8.03	22.9	0.61
27	8.33	130	110	285	7.90	23.0	0.54
28	7.25	134	106	296	7.93	23.2	0.67
29	7.81	129	110	295	7.95	22.3	0.61
30	11.15	129	110	294	7.88	22.3	0.55
31	8.6	129	110	292	7.95	22.1	0.62
MAX	12.7	145	118	297	8.28	26.0	0.81
MIN	5.2	129	100	273	7.88	22.1	0.47
AVG	8.6	135	107	286	8.07	24.3	0.60

TABLE D1-4f

Nile River Water Quality Data at the US Water Treatment Plant in Minia

November, 1999

Date	Raw Water						Settled Water		
	Turbidity NTU	Alkalinity mg/L	Hardness mg/L	Conductivity uS/cm	PH Unit	Temp Degree C	Turbidity NTU	pH Unit	Chlorine mg/L
1	9.5	133	110	297	7.92	21.7	0.54	7.18	1.09
2	7.35	130	110	300	7.92	21.8	0.55	7.14	0.73
3	6.6	129	110	298	7.95	21.9	0.55	7.12	0.98
4	7.58	130	108	291	7.94	21.7	0.64	7.22	1.10
5	8.63	127	110	289	7.89	21.2	0.63	7.20	0.87
6	7.37	127	108	285	7.91	18.7	0.50	7.14	0.93
7	7.52	125	108	290	7.94	21.9	0.68	7.44	0.64
8	11.6	125	108	296	8.06	21.9	0.54	7.33	1.02
9	7.08	127	110	295	8.08	21.8	0.55	7.41	0.99
10	7.67	128	104	299	8.03	21.5	0.58	7.24	0.79
11	7.36	127	104	300	7.94	21.4	0.59	7.26	0.82
12	9.07	129	110	308	7.82	21.2	0.53	7.41	1.01
13	7.66	128	110	306	8.02	21.3	0.54		0.99
14	12.8	131	108	305	7.97		0.57		
15	10.2	129	116	309	7.94		0.48		
16	7	134	114	306	8.02		0.50		
17	9.38	131	110	303	8.08		0.62		
18	11.5	130	112	305	8.20		0.65		
19	11.5	131	112	308	8.08		0.73		
20	7.61	131	110	309	8.01		0.60		
21		129	120	310	8.01				
22		131	120	318	8.03				
23		129	120	315	8.06				
24		131	116	315	8.03				
25		129	106	322	8.01				
26		132	112	317	8.14				
27		125	110	309	7.99		0.74	7.25	1.87
28	6.7	128	122	318	8.08		0.58	7.34	1.80
29	6.06	128	116	312	8.07		0.55	7.19	1.60
30	7.8	130	110	318	8.03				
MAX	12.8	134	122	322	8.20	21.9	0.74	7.44	1.87
MIN	6.1	125	104	285	7.82	18.7	0.48	7.12	0.64
AVG	8.5	129	111	305	8.01	21.4	0.58	7.26	1.08

TABLE D1-4g

Nile River Water Quality Data at the US Water Treatment Plant in Minia

December, 1999

Date	Raw Water						Settled Water		
	Turbidity NTU	Alkalinity mg/L	Hardness mg/L	Conductivity uS/cm	pH Unit	Temp Degree C	Turbidity NTU	pH Unit	Chlorine mg/L
1	7.4	128	114	308	8.11	19.3	0.68	7.28	1.97
2	7.61	131	120	304	8.03	19.1	0.76	7.37	2.06
3	5.88	128	114	305	8.04	19.0	0.75	7.37	1.38
4	7.53	128	110	316	7.97	19.9	0.72	7.52	1.49
5	6.72	127	112	312	8.00	19.4	0.74	7.35	1.46
6	5.98	131	120	310	8.02	18.8	0.68	7.32	1.49
7	5.48	132	118	317	8.00	18.9	0.65	7.29	1.53
8	5.89	131	118	320	7.97	19.9	0.72	7.46	1.57
9	5.83	133	116	332	8.00	19.7	0.63	7.38	1.25
10	7.1	135	116	212	7.84	19.9	0.85	7.27	1.61
11	10.73	134	116	320	7.96	19.2	0.82	7.27	1.48
12	10.67	138	122	343	8.01	18.3	0.90	7.44	1.71
13	10.9	146	122	350	8.04	17.3	1.03	7.59	1.74
14	11.71	146	124	362	8.06	17.5	0.83	7.54	0.65
15	11.68	144	120	350	8.04	17.7	0.97	7.35	1.29
16	8.9	142	120	345	8.11	17.5	0.90	7.31	0.84
17	7.41	137	140	343	8.17	17.4	0.95	7.37	1.08
18	7.12	136	138	340	8.10	18.1	0.90	7.34	1.90
19	6.54	140	138	353	8.21	18.0	0.83	7.30	1.43
20	7.67	140	144	348	8.13	17.4	0.90	7.39	0.60
21	6.64	142	140	346	8.10	17.3	1.03	7.39	1.30
22	7.5	142	136	350	8.10	17.1	0.97	7.39	1.18
23	7	134	140	355	8.11	17.0	0.97	7.38	0.62
24	7.52	141	140	343	8.20	18.3	0.86	7.41	1.23
25	6.64	140	136	350	8.23	16.9	0.88	7.39	0.99
26	9.14	140	140	357	8.27	16.5	0.91	7.40	1.30
27	10.91	140	136	356	8.16	16.3	0.75	7.35	1.29
28	9.48	141	138	351	8.16	15.7	0.93	7.48	1.23
29	20.97	141	140	350	8.15	16.3	0.92	7.35	1.28
30	22.34	143	140	367	8.15	15.8	1.02	7.48	1.36
31	18.18	143	142	360	8.10	16.2	1.00	7.46	1.14
MAX	22.3	146	144	367	8.27	19.9	1.03	7.59	2.06
MIN	5.5	127	110	212	7.84	15.7	0.63	7.27	0.60
AVG	9.2	137	128	335	8.08	17.9	0.85	7.39	1.34

APPENDIX D2

ARCHEOLOGICAL REPORTS

APPENDIX D2-1

PRELIMINARY ARCHAEOLOGICAL RECONNAISSANCE OF ZAWYAT SULTAN AND SAWADA (ZS-1)

Prepared by Dr. Said Gohary

The USAID Middle Egypt Institutional Strengthening - Water and Wastewater Master Planning Project identifies Zawyat Sultan, a village on the east side of the Nile in Minia Governorate, as a site for a High Priority Project. The proposed project comprises two elements: a pump station beside the Nile, and a pipeline connecting it with the storage towers (tanks).

Before implementation of the master plan, an environmental assessment is required. A component of the assessment is an archaeological reconnaissance of the area in and around Zawyat Sultan and Sawada. The purpose of the reconnaissance is to identify surface evidence of archaeological and historically significant cultural resources, that might be encountered during implementation of the infrastructure project.

Archaeological finds are known in the region. Approximately 2 km south of the proposed site is the well-known Coptic monastery and church of Apa Hor at Sawada, dating to the 15th century. Further south is Zawyat el-Mayteen, dating to the Archaic Period and Old Kingdom, approximately 2700 BC. Sheikh Said, the rock-cut tombs of Beni Hasan, and the rock-cut shrine at Stabl Antar, are some 15 km to the south, and are all of great historical value.

This report documents the archaeological reconnaissance of Zawyat Sultan and Sawada. It describes the methodology used to conduct the archaeological reconnaissance, presents the findings of the investigation, and proposes recommendations for proceeding with the implementation of the proposed project. Illustrating the report is a map supplied by Harza Environmental Services (Harza), and photographs documenting the areas surveyed and findings.

METHODOLOGY

The objective of the archaeological reconnaissance was to identify any archaeological or historically significant structure in and near both sites of Zawyat Sultan and Sawada, and the route along which the pipeline will extend.

To accomplish this objective, site visits to these areas were conducted on April 30, 2001, by the archaeological expert, Dr. Said Gohary, Vice-dean, Faculty of Archaeology, Cairo University, and member of the Permanent Committee of the Supreme Council of Antiquities. He was accompanied by Mr. Moneer Fayez and Mr. Sameh Atef from the Harza office in Minia.

Four areas were surveyed:

1. the site for the pump station on the east bank of the Nile and surrounding areas
2. the unpaved road to the east of the site and of the village
3. the paved road along which the pipeline will extend, leading to Sawada
4. Sawada and adjacent areas.

The archaeological expert looked for evidence of archaeological material in and around the site, especially in the village streets and houses under construction, as it is common practice to dig a hole 2-3 m deep before laying the foundations. The archaeologist also looked for historically significant buildings. He then examined the banks of the irrigation canals and the sides of the road, and areas where *sebakheen* are working. These areas were surveyed on foot to have clear visibility of the ground.

The archaeological expert noted that the site proposed for the pump station is agricultural land, which belongs to the government. The soil is of soft mud and sand, and the area would have been covered with water during the annual inundation of the Nile. No potsherds or other archaeological evidence were found, but a lot of shells.

REMARKS AND FINDINGS

1. It was necessary to walk in the fields east of the paved road. On the banks of the fields near the mountain, potsherds were noted in large quantities, probably dating to the Islamic, or even Coptic period, but these represent no archaeological importance. They were probably moved by the locals from other places.

To the north of the proposed site several modern buildings can be seen, a 3-star hotel, military club, bungalows and villas.

2. A large number of houses in the village to the east of the site are being built from concrete, consist of 2-4 floors, and have running water from the towers in Sawada, but no sewerage system. The archaeological expert noted also that most of these houses have electricity. Some of the houses are between 30- 60 years old. When the locals were questioned about their construction, they said nothing of archaeological importance had been found in the last few decades.

3. The sides of the paved road close to the proposed site for the pump station contain potsherds and sometimes fired bricks, but these are of no historical value. The government lights some parts of this road.

4. The sites of Zawyat Sultan and Sawada and the surrounding areas were examined by the archaeological expert, and no evidence of any standing, or fallen, ancient structure was found. On the contrary, when the archaeologist asked the villagers, and the government officials in the municipality, they informed him that the authorities plan to build a school and medical center there.

CONCLUSIONS

As a component of an environmental assessment, an archaeological reconnaissance was conducted of areas 1 to 4 for the proposed location of the pump station and the distribution towers. Based on the Remarks and Findings presented above, the following conclusions are deduced:

The existence of potsherds around the site for the pump station, about 1 km to the east.

The discovery of several burial sites a few kilometers to the south, (Zawyat Mayteen and others).

The ancient monastery and church at Sawada, 2 km south-east of the site. These buildings are not threatened by the project, because they are far from the site, and new discoveries are unlikely, as these are areas which have been surveyed by Supreme Council of Antiquities experts, and they are not marked on their maps as potential archaeological areas.

RECOMMENDATIONS

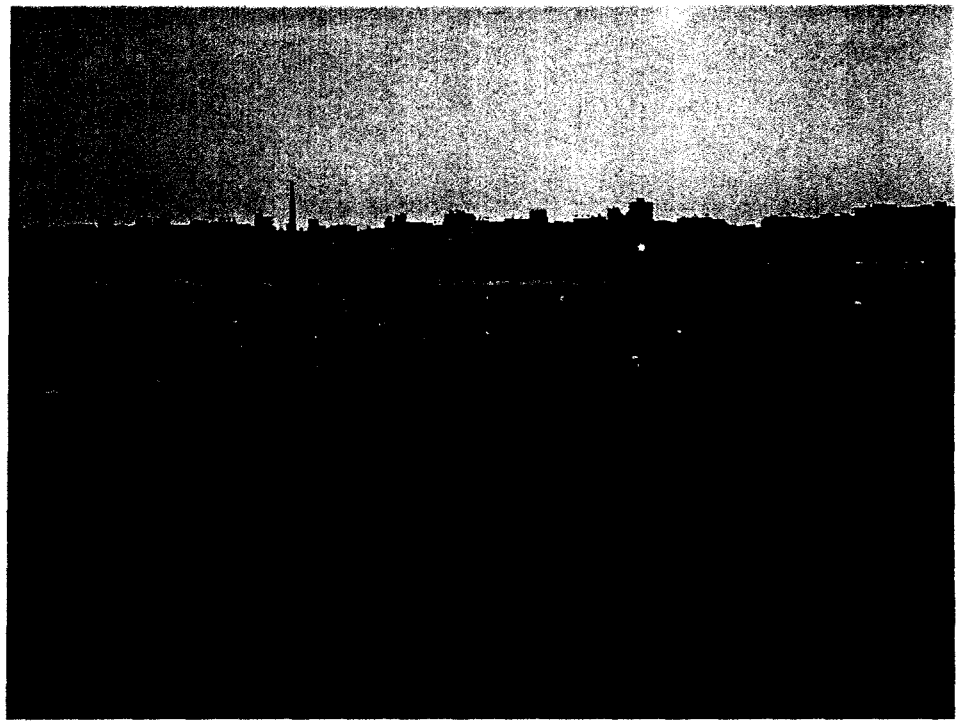
1. All work on both sites, i.e. the pump station and distribution towers, should be carried out in full cooperation with the Supreme Council of Antiquities.

2. The extension of pipes underground between the two sites should not be deeper than 1.5 meters.

3. It is preferable to extend the pipeline from the pump station in a straight line, east then south, rather than north, then east then south.

Photo Documentation

PHOTO 1. View Of Proposed WTP Site Near Zawiyet Sultan (ZS-1).



PRELIMINARY ARCHAEOLOGICAL RECONNAISSANCE OF ZAWIYAT SULTAN (ZS-2)

Prepared by Ms. Shari Saunders

Introduction

The USAID Middle Egypt Institutional Strengthening – Water and Wastewater Master Planning Project identifies Zawiyet Sultan, a village in Minya Markaz of Minya Governorate, as a site for a First Stage Investment Program Project. The project, located on the east bank of the Nile River, will benefit the village of Zawiyet Sultan. The proposed project comprises two elements: a slow sand filter water treatment plant (WTP), and a potable water transmission main. Before implementation of the master plan, an environmental assessment is required. A component of the assessment is an archaeological reconnaissance of the areas of the proposed site of the WTP and along the pathway of the proposed potable water transmission line. The purpose of the reconnaissance is to identify surface evidence of archaeological and historically significant cultural resources that might be encountered during implementation of the infrastructure project.

Much human activity in ancient times is recorded in the region. The modern village of Tihna El Gabal is adjacent to the ancient city of Akoris that dates to the Greek and Roman periods of Egyptian history. This city was an important regional center in ancient times. South of Tihna El Gabal village are the Old Kingdom tombs known as the Fraser Tombs. The modern village of Sawada contains archaeological sites while modern Zawiyet Sultan Gibli lies directly adjacent to and probably over the ancient Egyptian provincial capital known as Hebenu. Now known as Kom el-Ahmar, the area is a highly significant antiquities zone comprising archaeological remains spanning from the Predynastic (c. 3500 BCE) and Old Kingdom (including a step pyramid) periods through to the New Kingdom and Roman periods (c. 200 CE). The vast history of human activity in the region suggests a potential for new archaeological discoveries in the area. This potential necessitates a careful survey of the areas that may be affected by the proposed project.

This report documents the archaeological reconnaissance of the Zawiyet Sultan area: it describes the methodology used to conduct the archaeological reconnaissance, presents the findings of the investigation, and proposes recommendations for proceeding with the implementation of the water project. Illustrating the report are photographs that document the areas surveyed.

Methodology

The objective of the archaeological reconnaissance is to identify any archaeological and culturally significant resources in the region of Zawiyet Sultan that might be affected by the proposed infrastructure project.

To accomplish this objective, site visits to the region were conducted on September 3 and 4, 2000. Engineer Mohamed Sanad and Engineer Sabat Amin Hamad of MEGAWS, and Engineer Godba of the Land Use Department accompanied the field archaeologist for the

visit to proposed WTP site near Hawarta. On the following day, Engineer Sanad and Peter Saunders, Senior Environmental Scientist of the Master Planning Project, guided the reconnaissance. Archaeology Expert Dr. Said Gohary participated on both days.

The proposed site area north of Zawiyet Sultan Bahri was surveyed. In examining the proposed site, the archaeologist looked for evidence on the surface of archaeological material, in particular sherds of ancient pottery. The bank of the Nile was examined thoroughly because evidence of buried archaeological material is often visible in such cuts if such material is present in the area. Driving along the paved road that is proposed as a corridor for the transmission main, the archaeologist examined the sides of the road and looked for historically significant buildings.

Findings

The archaeological reconnaissance of the Zawiyet Sultan area examined the site proposed for the WTP. The path of the transmission main was inspected in a drive-by assessment.

ZAWIYET SULTAN BAHRI (NORTH) (ZS-2)

The option for the Zawiyet Sultan WTP is located North of Zawiyet Sultan Bahri. A lime crushing operation works on the north side of the site, while much of the site is being used to shelter farm animals. The area is composed of hard packed clay. Several layers of clay mixed with stones are clearly visible in the river's bank. The site is located about 6m above the water. The field archaeologist examined this expanse closely and found no archaeological material. Bricks were noted near the site's southwest corner, at the river's edge. Very probably these are remains of a modern structure. An embankment on the east side of the site was examined also. During the reconnaissance of the riverbank and across the site, no archaeological material was evident.

PATH OF THE TRANSMISSION MAIN

The path of the potable water transmission main to the village of Zawiyet Sultan Gibli follows the paved highway. This area has been disturbed by the construction of the highway and of modern structures on both sides of the thoroughfare. A drive-by reconnaissance identified no archaeological material and no historically significant buildings.

Conclusions - Recommendations

As a component of the environmental assessment, an archaeological reconnaissance of Zawiyet Sultan (Minya Markaz) assesses the archaeological sensitivity of areas that will be disturbed by the implementation of a proposed infrastructure project. Based on the findings presented above, the following conclusions are deduced.

The reconnaissance focused on the site proposed for the WTP and the potable water transmission main. As the archaeologist walked the area, no archaeological material was detected. Furthermore, no evidence of archaeological material was found along the pathway of the proposed potable water transmission line.

The region around Zawiyet Sultan bears witness to a long history of human activity. Although the archaeologist found no surface evidence to suggest the presence of archaeological sites near the locations proposed for the components of the project, the potential for new discoveries in the region is high. If archaeological material is uncovered during construction it would be essential for archaeologists to study the material in order to build a clearer understanding of the region in ancient times.

In summary, the following recommendations are offered for consideration.

1. The proposed WTP site at Zawiyet Sultan Bahri may be considered archaeologically non-sensitive. When the proposed infrastructure project is implemented, however, construction crews must report to the SCA any archaeological material that may be uncovered during excavation.
2. The proposed path of the potable water transmission line may be considered archaeologically non-sensitive due to the disturbance that has already occurred. When the proposed infrastructure project is implemented, however, construction crews must report to the SCA any archaeological material that may be uncovered during excavation.
3. All work should be implemented in full cooperation with the Supreme Council of Antiquities. During construction, a SCA inspector should observe all excavation work and alert construction crews and authorities if antiquities are uncovered. A foreign archaeologist should be available for review and reporting of any archaeological finds, particularly during excavation for the transmission main.

Photo Documentation

Photo 1. View of proposed WTP site near Zawiyet Sultan Bahri (ZS-2).

APPENDIX D2-2

PRELIMINARY ARCHAEOLOGICAL RECONNAISSANCE OF BENI IBAYD

Prepared by Ms. Shari Saunders

Introduction

The USAID Middle Egypt Institutional Strengthening – Water and Wastewater Master Planning Project identifies Beni Ibayd, a village in Abu Qurkas Markaz of Minya Governorate, as a site for a First Stage Investment Program Project. The project, located on the west bank of the Nile River, comprises three elements: a wastewater collection system in Beni Ibayed, a pump station, and a force main that will connect the collection system to an existing wastewater treatment plant West of Abu Qurqas City. Before implementation of the master plan, an environmental assessment is required. A component of the assessment is an archaeological reconnaissance of the areas along the pathway of the proposed potable water transmission line and the proposed sites of the pump stations. The purpose of the reconnaissance is to identify surface evidence of archaeological and historically significant cultural resources that might be encountered during implementation of the infrastructure project.

To date scholars have not recorded any evidence of human activity in ancient times in this region located North of Minia City. Nevertheless, new archaeological discoveries in the area are possible so a careful survey of the areas that may be affected by the proposed infrastructure project is required.

This report documents the archaeological reconnaissance of the Beni Ibayd area: it describes the methodology used to conduct the archaeological reconnaissance, presents the findings of the investigation, and proposes recommendations for proceeding with the implementation of the water project. Illustrating the report are photographs that document the areas surveyed.

Methodology

The objective of the archaeological reconnaissance is to identify any archaeological and historically significant resources in the village of Beni Ibayd and along the route of the force main that might be affected by the proposed infrastructure project.
To accomplish this objective, a site visit to Beni Ibayd was conducted on September 4, 2000. During the visit, Engineer Shehata and Engineer Girgis of the Local Unit, Peter Saunders, Senior Environmental Scientist of the Master Planning Project, and Dr. Said Gohary, Archaeology Expert accompanied the field archaeologist.
Three areas were surveyed: 1) areas within the village that have historic structures and may be affected by the construction of the collection system; 2) an area directly South of the village that is a proposed site for the pump station, and 3) an area West of Nazlet Awolas Gueid that is proposed for the pump station and the adjacent unpaved path along which the force main will pass to the paved road where it will link to an existing force main leading to the WWTP near Abu Qirqus.

Within the built-up areas of Beni Ibayd village, the archaeologist inspected the streets adjacent to historically and culturally significant structures and looked for other significant buildings. At the proposed pump station sites, the field archaeologist walked the perimeter and through the center of the site looking for evidence of archaeological material on the surface and in furrows and irrigation channels of the fields that border the sites. Cut edges of canals, excavation trenches, agriculture furrows etc., are examined because they often reveal evidence of buried archaeological material, if such material is present in the area. Driving along the paved road that is proposed as a corridor for the force main, the archaeologist examined the sides of the road for archaeological material.
The field archaeologist and the Senior Environmental Scientist recorded GPS points for the historic structures and the pump station sites.

Findings

The archaeological reconnaissance of the Beni Ibayd area examined three main areas representing components of the master plan: streets within the village, a proposed site for a pump station South of the village, and another proposed site for the pump station and force main route located West of Nazlet Awolas Gueid.

1. STREETS WITHIN BENI IBAYD

Beni Ibayd contains two significant monuments. A minaret of Fatamid style graces El Ouseya Mosque (E30°46.832' N27°57.095') suggesting that the mosque is more than 500 years old (Photos #1 and 2). Local residents reported that the domed Coptic church dedicated to the Archangel Michael (E30°46.832' N27°57.095') is about 400 years old (Photo #3). Both of these structures are within the built-up area of the village. Although both structures have been substantially renovated, they are classified as monuments according to Egyptian antiquities law which assigns such a designation to buildings more than 100 years old. While driving through the village the archaeologist noted several houses adorned with decorative cut-work wooden balconies. The age of these structures is unknown but it is estimated that they are almost 100 years old. During the reconnaissance of the Beni Ibayd streets, no evidence of archaeological material was found.

2. SITE OF A PROPOSED PUMP STATION, SOUTH OF BENI IBAYD

Immediately South of Beni Ibayd village is an area designated as a possible site for the pump station (Photo #4). No archaeological material—including ancient pottery, a common indicator of ancient activity—was found on the surface. A large portion of the site has been disturbed previously by the construction of a religious school and a cement-lined, meter-deep basin that was part of an irrigation system.

3. SITE OF A PROPOSED PUMP STATION AND FORCE MAIN ROUTE, WEST OF NAZLET AWOLAS GUEID

Immediately West of the paved road that passes Nazlet Awolas Gueid is an area designated as a possible site for the pump station. At the time of the reconnaissance this site was a fallow field. The few non-diagnostic fragments of pottery found in the field are modern.

An irrigation canal passes along the west side of the proposed site. Land on both sides of the canal has been disturbed by an irrigation pumping project. Examining the banks of the irrigation canal, no archaeological material was evident.

Conclusions - Recommendations

As a component of the environmental assessment, an archaeological reconnaissance of Beni Ibayd (Abu Qirqas Markaz) assesses the archaeological sensitivity of areas that will be disturbed by the implementation of a proposed infrastructure project. Based on the findings presented above, the following conclusions are deduced.
The village of Beni Ibayd possesses a long history, judging by the significant age of two religious buildings. These places of worship are culturally and historically significant. Other buildings in the village are of modest historical significance.

There is no evidence to suggest the presence of archaeological sites near the locations proposed for the components of the project. If archaeological material is uncovered during construction it would be essential for archaeologists to study the material in order to build a clearer understanding of the region in ancient times.

In summary, the following recommendations are offered for consideration:

1. Much of village of Beni Ibayd may be considered archaeologically and historically non-sensitive with two important exceptions: the sites of El Ouseya Mosque and Malak Mikhail Church. If possible, the design of the collection system should avoid the streets immediately adjacent to these structures. If construction is required near these structures, construction crews must work cautiously in these areas. In addition, crews should make every effort to avoid damaging historic houses when working in close proximity. The village of Beni Ibayd may be considered archaeologically non-sensitive. When the proposed infrastructure project is implemented, however, construction crews must report to the Supreme Council of Antiquities any archaeological material that may be uncovered during excavation.
2. The proposed site for a pump station South of Beni Ibayd may be considered archaeologically non-sensitive. When the proposed infrastructure project is implemented, however, construction crews must report to the Supreme Council of Antiquities any archaeological material that may be uncovered during excavation.
3. The proposed site for a pump station located West of Nazlet Awolas Gueid and the proposed path of the force main may be considered archaeologically non-sensitive. When the proposed infrastructure project is implemented, however, construction crews must report to the Supreme Council of Antiquities any archaeological material that may be uncovered during excavation.
4. All work should be implemented in full cooperation with the Supreme Council of Antiquities (SCA). During construction, a SCA inspector should observe all excavation work and alert construction crews and authorities if antiquities are uncovered. A foreign archaeologist should be available for review and reporting of any archaeological finds.

PHOTO DOCUMENTATION

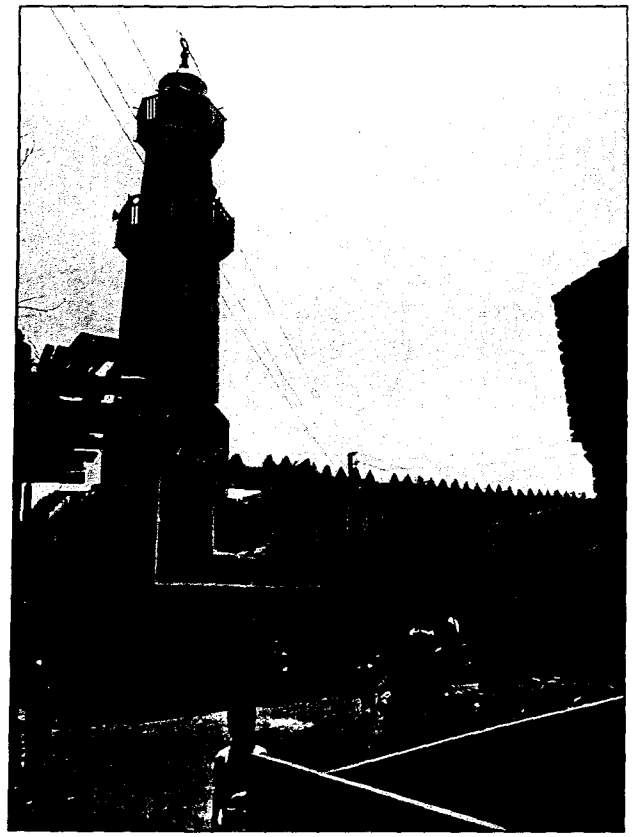


Photo 1. El Ouseya Mosque, Exterior.

Photo 2. El Ouseya Mosque, Interior.

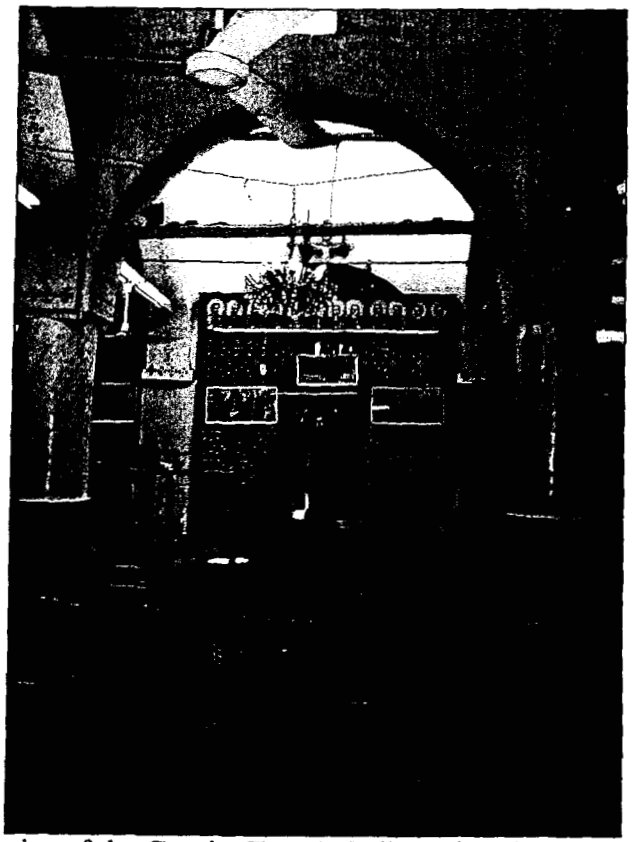


Photo 3. Interior of the Coptic Church dedicated to the Archangel Michael.

APPENDIX D2-3

PRELIMINARY ARCHAEOLOGICAL RECONNAISSANCE OF BANI IBAYD

Prepared by Dr. Said Gohary

On September 4th, 2000, a visit was made to the village of Bani Ibayd, Minya Governorate, to examine the proposed site of a water pump station, and the proposed route of the force main. The visit was conducted by Dr. Said Gohary, Vice-dean, Faculty of Archaeology, Cairo University, accompanied by Mr. Peter Saunders, the Lead Environmental Scientist for the Master Planning Project, Mme. Viola Wahba, Project Manager of Harza Office in Minya, Engineer Bishai Girgis, director of the Water Authority in Abu Qurqas, Engineer Naguib Zaki Shehata, the manager of the Water Authority in the town, and Mr. Mohamed Moustafa Ahmed, a technician from the Water Authority.

Two sites were surveyed: the proposed site of the pump station and the proposed route of the force main. The first site was examined by walking round the area to identify any possible archaeological evidence. No such evidence was found, but a number of points were observed:

1. Approximately 1.5 km north of the site is the largest and most important mosque in the area, the Mosque of El-Awssia, the walls and minaret of which were examined. The mosque appears to belong to the Fatimid Period (10th - 12th centuries CE), and has been restored several times. The walls are built of stone and tree trunks covered with mud-plaster. The minaret is several storeys high and built of the same material, but it is not in a good state of preservation, and could be effected if there was a lot of vibration.

2. Approximately 400 m north of the proposed pump station site is the Church of the Archangel Mikhail, which is probably about 400 years old, and is of historical, as well as religious significance to the local inhabitants. It is built under a house, partly below ground level, and needs some restoration, especially the sanctuary and the pulpit.

3. While walking through the village, a number of recently built houses, shops and schools were observed, some partly constructed from concrete and with several floors. Inquiries revealed that no archaeological material was found when these buildings were under construction.

The proposed route of the force main was then examined by walking south for approximately 1.5 km. The following points were observed:

1. The area selected for the force main is approximately 1050 square metres. This area is surrounded by agricultural land measuring about 36 *kheirat,* most of which

is owned by the government and rented by the farmers. A variety of corn is being grown.

2. In the path of the proposed route for the force main is a modern Islamic religious school, built on an area of approximately 20 m x 60 m. Local inhabitants are expressing much concern that the school may be demolished to make way for the force main. This apprehension should be taken into account, as a large number of boys from the village are enrolled at the school, which is important for the local inhabitants. Some of the walls of the school are in poor condition, and could be damaged by vibration.

3. It is clear that there is sufficient space available to move the line of the force main approximately 100 m to the east, thus avoiding the school and the main road.

4. Very close to the entrance of the school is a large covered trench for wastewater drainage, measuring 7 m square and approximately 2 m deep. No reports of any archaeological discoveries were made when this trench was being dug.

The proposed route of the force main was then examined by walking south, passing by the village of Nazlet Awolad Gueid, closely observing the sides of the road, fields, irrigation and drainage channels. Nothing of archaeological significance was found.

The following day, September 6th, Dr. Said Gohary went to the Minya office of the Supreme Council of Antiquities and inquired about the site. No record of any discoveries was found there.

Recommendations

1. The site proposed for the pump station is not considered archaeologically sensitive, and is far enough away from the mosque and church.

2. The route proposed for the force main is in the middle of a large empty area, with no buildings on it, so it is possible to route the force main avoiding the religious school and the main road.

APPENDIX D2-4

PRELIMINARY ARCHAEOLOGICAL RECONNAISSANCE OF MINIA CITY

Prepared by Dr. Said Gohary

INTRODUCTION

The USAID Middle Egypt Institutional Strengthening - Water and Wastewater Master Planning Project identifies Minia City as a site for a High Priority Project. The projected project comprises the construction of new water distribution lines and wastewater force mains in the city, and a pump station may also be constructed.

Before implementation of the master plan, an environmental assessment is required. A component of the assessment is an archaeological reconnaissance of Minia City. The purpose of the reconnaissance is to identify surface evidence of archaeological and historically significant cultural resources, that might be encountered during force main improvements, and should be avoided, or require special protection measures.

Minia Governorate is in Middle Egypt, situated between the governorate of Beni Suef to the north and that of Assiut to the south. The chief city of the governorate is also called Minia, more precisely Minia el-Fuli (after Sheikh Ahmed el-Fuli), to distinguish it from other towns in Egypt with the same name. The name Minia probably comes from the Coptic, Ta-moni, meaning 'wet-nurse'. In ancient Egyptian records the area is referred to as Menat-Khufu. The province of Minia played an important role in ancient Egyptian history, especially during the so-called Amarna Period, (1350 - 1334 BC), when the pharaoh Akhenaten built a new capital city on the east bank opposite present-day Mallawi. It continued in importance during the Graeco-Roman period, as mentioned on papyri discovered at El Bahnasa, and published by Granville and Hunt between 1897 and 1907.

It is widely believed that the Holy Family resided in several places in this part of Middle Egypt during their flight into Egypt. When Christianity was introduced into Egypt, the city of Minia was one of the first to adopt the new faith. The city still has a sizable Christian community. The Arabs besieged the city in 642 AD, after they had conquered the northern part of the country.

This report documents the archaeological reconnaissance of Minia City: it describes the methodology used to conduct the archaeological reconnaissance, presents the findings of the investigation, and proposes recommendations for proceeding with the implementation of the proposed project. Illustrating the report is a map supplied by Harza Environmental Services (Harza), and photographs from publications of some of the historic buildings.

METHODOLOGY

The objective of the archaeological reconnaissance was to identify any archaeological or historically significant cultural resources in Minia City that might be affected by the proposed project.

To accomplish this objective, visits to Minia City were conducted on September 3 and 4, 2000. During these visits the archaeological expert, Dr. Said Gohary, Vice-dean, Faculty of Archaeology, Cairo University, was accompanied by Engineer Viola Wahba, Project Manager of Harza office Minia.

On September 3, 2000, Dr. Gohary and Engineer Wahba visited the office of the MEGAWS in Minia City.

The following day, a visit was made to the Minia offices of the Supreme Council of Antiquities. At the SCA office for Pharaonic Monuments, information was obtained from Mr. Mahmoud Hamza, the Director for Pharaonic Monuments in Middle Egypt, Mr. Samir Anis Salib, Chief Inspector for South Minia Governorate, and Mr. Adel Hassan Mahmoud, Chief Inspector for North Minia Governorate. SCA records were also checked for information on historical monuments. For a full report, it was necessary to visit the SCA offices for Coptic and Islamic Monuments, where information was obtained from Mr. Yahia Hassanein, the Director.

Dr. Gohary also visited the SCA office in Cairo responsible for Coptic and Islamic monuments throughout Egypt, where he met Mr. Abdullah el-Attar, the Director, and Mr. Hussein Bolbol, the deputy Director. As there did not appear to be a complete record of all historical sites, Dr. Gohary also consulted recent researches on Islamic monuments in Minia City in the university library.

Visits were made to the archaeological and historical sites in Minia City, accompanied by an inspector from the Minia SCA office for Coptic and Islamic Monuments, to see if those areas would be affected by the infrastructure project. No ancient pharaonic sites have been recorded in Minia City, so the sites surveyed were Islamic. The sites surveyed were:

1. The Mosque of El-Amrawy, which is on the Nile corniche, opposite the new Minia bridge. This is also called the 'Farewell' Mosque, as it is used for funeral services before the deceased is taken across the river to the cemetery. It is sometimes referred to as El-Amri Mosque, and sometimes the Hanging Mosque, because it was originally on higher ground than the rest of the city. The mosque was built in 1439 AD, and has been restored several times.

2. The Mosque of El-Lamatty is also on the Nile, north of the new Minia bridge, east of the Mosque of El-Amrawy, and south of the Mosque of El- Fuli. The western facade overlooks El-Horreya Street, the eastern and northern facades face the Nile, and the south facade overlooks the houses of the city and the Youth Organization Club. The mosque was built in 1182 AD by Negm el-Din el-Lamatty, and was restored in 1987. It is also known locally as the Mosque of Sheikh Saad.

3. The Mosque and Mausoleum of El-Fuli is on the Nile next to the police station. It was built in the early 17th century AD by Ali Ibn Mohamed Ibn Ali-el-Masri el-

Yemeni (born 1582), who came originally from Yemen. It was later rebuilt into a larger mosque.

4. The Mosque of Odah Bashy is located in Bier Abu Shamia Street, off Sidi Habib Street, to the south-west of the El-Amrawy Mosque. The mosque was built in 1749 AD by Abwaz Odah Bashy, who was known as el-Miniawi. On the National Survey maps, this is known as Qadaa Pasha Mosque.

5. The Mosque of El-Kashef is in the same street as the Mosque of Odah Bashy, and to the east of it. There are no records referring to the date of this mosque, which was built by Hassan Kashef, but the style indicates the 18th century AD.

6. The Mosque and Mausoleum of Sheikh Ali El-Masri is next to the police station, and beside the hospital of Minia University, opposite the El-Amrawy Mosque, at the junction of Horreya Street and Mohamed Badawy Street. The exact date of the mosque is not known, but it is Ottoman in style, and is referred to in the 'Description d'Egypte', plates 25 and 26. The mosque was completely rebuilt in 1992, when several tombstones were found, which are now in Minia Museum.

7. Ottoman period bath, to the north-west of El-Amrawy Mosque, at the junction of Horreya Street and Mohamed Badawy Street. Most of the bath has gone, apart from the water cistern.

8. The Coptic Orthodox Cathedral of St. Mark. Minia City is the episcopal see of the Coptic Orthodox bishop of Minia and el-Eshmunein. As well as the cathedral, there are several Coptic Orthodox churches in Minia City but none of them are old enough to be considered as historical monuments.

FIINDINGS

The archaeological reconnaissance of Minia City examined the different districts of the city to identify archaeological or historically significant cultural resources in Minia City that might be affected by the proposed project.

1. After the survey, it is clear that most of the historical sites in Minia City are Islamic, and are all located in close proximity to each other in certain areas close to the Nile corniche, where the majority of the population of the city lives. These monuments include mosques, mausoleums and a bath cistern.

2. There are no pharaonic monuments recorded in Minia City, the earliest evidence of human activity being from the Christian and Islamic periods.

3. Although the Coptic Orthodox Cathedral and churches are not historical monuments, they obviously have great religious and cultural significance.

CONCLUSIONS – RECOMMENDATIONS

As a component of an environmental assessment, an archaeological reconnaissance of Minia City assessed the archaeological sensitivity of areas that may be disturbed by the implementation of a project to construct new water distribution lines and wastewater force mains in the city, and the possible construction of a pump station. Based on the findings presented above, the following conclusions are deduced.

The areas marked 1 to 8 on the accompanying Harza map, the sites of the Mosque of El-Amrawy (1), the Mosque of El-Lamatty (2), the Mosque and Mausoleum of El-Fuli (3), the Mosque of Odah Bashy (4), the Mosque of El-Kashef (5), the Mosque and Mausoleum of Sheikh Ali El-Masri (6), the Ottoman Bath (7), and the Coptic Orthodox Cathedral of St. Mark (8), are all highly sensitive historically and/or culturally.

Historic mosques, such as those surveyed in Minia City, were frequently accompanied by related buildings, evidence of which could be uncovered during construction work.

In summary, the following recommendations are offered for consideration:

1. The mosques and cathedral indicated at Nos. 1 to 8 on the Harza map are highly sensitive historically and/or culturally, and should be avoided if possible.

2. Construction crews should exercise caution when working near these historic buildings, and report any discoveries of archaeological material to the Supreme Council of Antiquities.

APPENDIX D3

ENVIRONMENTAL RECONNAISSANCE REPORTS

APPENDIX D3-1

ENVIRONMENTAL RECONNAISSANCE OFTHE ZAWIAT SULTAN WATER TREATMENT PLANT SITES, MINIA

Site Descriptions:

Zawiyat Sultan (Site ZS1)

This site is located just south of the Minia City Bridge, 2.4 km. north of the village of Zawiat Sultan and adjacent to a newly developed military resort complex. It consists of a somewhat elevated, flat area of the riverbank, gently sloping down to the water level. The ground surface is covered with sandy deposits.

Zawiyat Sultan (Site ZS2)

This site is located 15 km. north of the village on the east bank of the River Nile. It consists of a somewhat elevated, flat area of the riverbank, steeply sloping down to the water level. The ground surface is covered with sandy deposits as well as exposed bedrock and clays.

Biodiversity resources:

Zawiyat Sultan (Site ZS1)

The site is mostly barren, with the exception of the grass covered lower riverbank and areas immediately next to the neighboring cultivated fields. Scattered throughout the site, however, are several Tamarix trees and bushed *Tamarix nilotica.*

The lower riverbank is mostly free of dense vegetation, but a few, small stands of *Phragmites australis* and *Typha domengensis* are scattered along the bank. Submerged vegetation of at least four or five species were observed in the shallow water fronting the site during this survey. The most dense vegetation, however, occurs on the islands fronting the site. This vegetation appears to be dominated by *Phragmites australis* and *Typha domengensis* (none of the islands were visited during this survey)., In the slow-flowing water near the islands and their reed beds, dense cover of the floating Water *Hyacinth Eichhorina crassipes* accumulates. It appears, however, that none of the plant species or habitats observed in or around the site is restricted to this area or considered threatened in any way.

Animal life on the site itself appears to be limited. Adjacent cultivated fields and the adjacent Nile water and red beds probably supports considerable wildlife. A list of vertebrate species expected to be found in this area is shown in Table 1.

No reptiles or amphibian were observed on the site during this visit. Several species almost certainly exist in this type of habitat and are shown in Table 1. None of these is peculiar to this area, rare or threatened either locally or nationally.

The most spectacular element of the wildlife of the area, however, is bird life (Table 1). Several bird species have been observed on the trees on the site and many more over the Nile

and in its water. Many of these species are migrants that pass through the Nile Valley during this time of the year. None of the bird species observed appeared to be specifically restricted to this site or considered locally or regionally threatened.

Although no wild mammals were observed on this site during this survey, the type of available habitats allow us to predict that a number mammal species may at least occasionally utilize the site and adjacent fields (Table 1). Most common among those are the Wolf Jackal *Canis aureaus lupaster*, the Red Fox *Vulpes vulpes*, and the African Wild Cat *Felis silvestris*. With the Exception of the Wild Cat *Felis silverstris,* which is listed as "Vulnerable" in the IUCN Red Lists, all other mammals that are known or expected to inhabit the area or its immediate surroundings are not among threatened species in Egypt or elsewhere.

Zawiat Sultan (Site ZS2)

Wild vegetation of this site is limited to a few weeds and some Marsh vegetation on the lower part of the riverbank and around the island. The biodiversity of this site may be considered essentially identical to that of Site ZS1.

Conclusions and Recommendations

No critical habitats or wildlife occur on either of the two sites or in areas immediately adjacent to them. The most important element that may potentially be impacted by the building of the proposed water treatment plant is the aesthetic quality of the area. Activities related to the operation of the plant are not expected to have any significant effect on the physical, biotic or human elements of the environment.

Table 1.

Common vertebrate fauna of the proposed sites for the Zawiat Sultan Water Treatment Facility, Minia.

Species		**Status in Egypt**
Common Name	**Scientific Name**	
Reptiles		
Turkish Gecko	Hemidactylus turcicus	LR
Fan-footed Gecko	*Ptyodactylus guttatus*	LR
Egyptian Gecko	*Tarentola annularis*	LR
Bosc's Lizard	*Acanthodactylus hoskianus*	LR
Eyed Skink	*Chalcides ocellatus*	LR
Bean Skink	*Mabuya quinquetaeniata*	LR
Theban Sand-Boa	*Eryx colubrinus*	LR
Flowered Snake	*Coluber florulentus*	LR
Montpelier Snake	*Malpolon monspessulanus*	LR
African Beauty Snake	*Psammophis sibilans*	LR
Cliffor's Royal Snake	*Spalerosophis diadema*	LR
Egyptian Cat Snake	*Telescopus dhara*	LR
Egyptian Cobra	*Naja haje*	LR
Amphibians		
Egyptian Toad	*Bufo regularis*	LR

Species		Status in Egypt
Common Name	**Scientific Name**	
Mascarene Frog	*Ptychadena mascareniensis*	LR
Birds		
Cattle Egret	*Egretta ibis*	LR
White Stork	*Ciconia ciconia*	LR
Black-shouldered Kite	*Elanus caeruleus*	LR
Marsh Harrier	*Circus aeruginosus*	LR
Kestrel	*Falco timunculus*	LR
Stone Curlew	*Burhimus oedicnemus*	LR
Senegal Thick-knee	*Rostratula benghalensis*	LR
Spur-winged Plover	*Hoplopterus spinosus*	LR
Lapwing	*Vanellus vanellus*	LR
Redshank	*Tringa totanus*	LR
Rock Pigeon	*Columba livia*	LR
Turltle Dove	*Streptopelia turtur*	LR
Palm Dove	*Streptopelia senegalensis*	LR
Snegal Coucal	*Centrpus senegalensis*	LR
Barn Owl	*Tyto alba*	LR
Little Owl	*Athene noctua*	LR
Little Green Bee-eater	*Merops orientalis*	LR
Blue-cheeked Bee-eater	*Merps superciliosus*	LR
Bee-eater	*Merps apiaster*	LR
Roller	*Caracias garrulus*	LR
Hoope	*Upupa epops*	LR
Crested Lark	*Galerida cristata*	LR
Swallow	*Hirundo rustica*	LR
House Martin	*Delichon urbica*	LR
Red-throated Pipit	*Anthus cervinus*	LR
Yellow Wagtail	*Motacilla flava*	LR
Grey Wagtail	*Motacilla cinerea*	LR
White Wagtail	*Motacilla alba*	LR
Common Bulbul	*Pycnonotus barbatus*	LR
Rufous Bush Robin	*Cercotrichas galactotes*	LR
Robin	*Erithacus rubecula*	LR
Thrush Nightingale	*Luscinia luscinia*	LR
Bluethroat	*Luscinia svecica*	LR
Redstart	*Phoenicurus phoenicurus*	LR
Stonechat	*Saxicola torquata*	LR
Fan-tailed Warbler	*Cisticola juncidis*	LR
Graceful Warbler	*Orina gracilis*	LR
Lesser Whitethroat	*Sylvia curruca*	LR
Whitethroat	*Phylloscopus collybita*	LR
Chiffchaff	*Muscicapa striata*	LR
Spotted Flycatcher	*Lanius collurio*	LR
Red-backed Shrike	*Lanus minor*	LR
Lesser grey Shrike	*Lanius excubitor*	LR
Hooded Crow	*Corvus corone*	LR

Species		Status in Egypt
Common Name	**Scientific Name**	
Starling	*Strumus vulgaris*	LR
House Sparrow	*Passer domesticus*	LR
Spanish Sparrow	*Passer hispaniolensis*	LR
Greenfinch	*Carduelis chloris*	LR
Goldfinch	*Carduelis carduelis*	LR
Linnet	*Acanthis cannabina*	LR
Mammals		
Long-eared Hedgehog	*Hemiechinus auritus*	LR
Egyptian Fruit Bat	*Rousetus aegypliacus*	LR
Nile Rat	*Arvicanus niloticus*	LR
Brown Rat	*Rattus rattus*	LR
House Mouse	*Mus musculus*	LR
Egyptian Wolf Jackal	*Canis aureus lupaster*	LR
Red Fox	*Vulpes vulpes*	LR
Egyptian Mongoose	*Herpestus ichenumon*	LR
Wild Cat	*Felis silverstris*	VU

APPENDIX D3-2

ENVIRONMENTAL RECONNAISSANCE OF THE BENI IBAYED PROPOSED PUMP STATION SITE AND FORCE MAIN ROUTE, MINIA

Site Description

The proposed site for the pump station is located in the outskirts of the Beni Ibayed Village. The site, which is about $100m^2$ is partly occupied by an old, empty building that served as a school in the past. Areas all around the site are typical agricultural fields where mostly corn is grown. The area is connected to the village by a dirt road.

The Harza-proposed route for the force main outside the village follows existing roads to the WWTP in Abu Qurkas. These route suggested by MEGAWS engineers follows a small, abandoned agricultural drain, then cutting cross country opposite to the village of Nazlet guide before it connects to the route proposed by Harza running parallel to the paved road. This route passes through a typical, more or less ecologically featureless agricultural land.

Biodiversity Resources:

Biodiversity resources of the site as well as the force main routes (both cross-country and parallel to existing roads) are limited to species typical of cultivated areas of the Nile Valley. Vegetation is represented by cultivated plants, including occasional tress, and the common weeds species. None of these species is unique to the area.

Wild fauna observed at the site was restricted to common bird species that are usually encountered in agricultural land throughout Middle Egypt such as the Palm Dive *Streptopalia senegalensis*, Kestrel *Falco timunculus*, House Sparrow *Passer domesticus*, hooded crow *Corvus corax* and others. Wild mammal species that are expected to be found in the area include common species such as the Nile Rate *arvicthus niloticus*, the Jackal *Canis aureus*, and the Red Fox *Vulpes vulpes*. It can be safely assumed that fauna and flora of this site and the force main routes is of little significance both at the local and national levels.

Conclusions and Recommendations:

No critical habitats or wildlife occur on the site or the proposed force main routes. Alteration of existing environmental setting in the area is not expected to have any significant impact on wildlife and habitats locally or nationally.

APPENDIX D4.

FLORA AND FAUNA OF MINIA

Table D2-1. Common Plants of Minia

Table D2-2. Fishes of Middle Egypt and Their Status

Table D2-3. Amphibians and Reptiles of Minia Governorate

Table D2-4. Birds of Minia Governorate

Table D2-5. Mammals of Minia Governorate

Table D2-6. Threatened Plants and Animals of Minia and their Distribution in the Governorate and in Protected Areas of Egypt

TABLE D4-1

Common Plants of Minia (Zaharan, M & Willis 1992)

I. Aquatic habitats:		
Elodea canadensis	Marsilea aegyptiaca	Ruppia maritima
Vallisneria spiralis	Eichhorina crassipes.	Zannichellia palustris
Lemna gibba	Potamogeton nodosus	
Myriophyllum spicatum	*Ranunculus saniculifolius*	
II. Swamps:		
Phragmites australis	*Echinochloa stagnina*	*Polygomum salicifolium*
Typha domengesis	Diplachne fusca	*P. senegalense*
Juncus rigidus	*Jussiaea repens*	*Paspalidium geminatum*
Alternanthera repens	*Veronica anagallis*	*Cyperus articulatus*
III. River/canal banks:		
Acacia nilotica	*Tamarix arborea*	*Conyza dioscordis*
Ficus sycamorus	*Ziziphus spina-christi*	*Cynodon dactylon*
Melia azedarach	*Alhagi maurorum*	*Desmostachya bipinnata*
Morus alba	*Arthrocnemum glaucum*	*Imperata cylindrica*
M. nigra	*Arundo donax*	*Panicum maximum*
Chenopodium ambrosioides	*Salix safsaf*	*Suaeda vermiculata*
IV. Cultivated land:		
Anagallis arvensis	*Convolulus arvensis*	*Amaranthus angustifolius*
Brassica nigra	*Cynodon dactylon*	*Argemone mexicana*
Chenopodium album	*Corchorus olitorius*	*Ageratum conyzoides*
Aster squamatus		
V. Nile islands:		
Acacia nilotica	*Tamarix nilotica*	*Desmostachya bipinnata*
A. albida	*Francoeuria crispa*	*Imperata cylindrica*
A. seyal	*Leptadenia heterophylla*	
VI. Desert:		
Leptadinia pyrotechnica	Acacia raddiana	*Cyprus laevigatus*
Cocculus pendulus	Nitraria retusa	Sporobolus spicatus
Alhagi Maurorum	*Phoenix dactylifera*	*Zygophyllum album*
Desmostachya bipinnata	Calligonum comosom	*Z. coccinium*
Tamarix aphyla.	*Sporobolus spicatus*	

TABLE D4-3

AMPHIBIANS AND REPTILES OF MINIA GOVERNORATE (SALEH M., 1997)

Status in Egypt is indicated using IUCN categories as follows: EX = extinct, EW = extinct in the wild, CR = critically endangered, E = endangered, VU = vulnerable, LR = low risk.

Species	Status in Egypt	Habitat			
		Human dwellings	Desert	Cultivated Fields	Aquatic habitats
REPTILIA					
GEKKONIDAE: *H. turcicus*	LR	++++	-	-	-
Ptyodactylus guttatus	LR	+++	+++	-	-
Stenodactylus petrii	LR	-	+++	-	-
S. sthenodactylus	LR	-	++	-	-
Tarentola annularis	LR	+++	+++	-	-
Tropiocolotes steudneri	LR	-	++	-	-
T. tripolitanus	LR	-	++	-	-
AGAMIDAE: *Trapelus mutabilis*	LR	-	+++	-	-
Trapelus pallida	LR	-	+++	-	-
Psuedotrapelus sinaitus	Lr	-	+++	-	-
Agama agama	LR	-	+++	-	-
LACERTIDAE: *Acanthodactylus boskianus*	LR	-	++++	-	-
A. Scutellatus	LR	-	++++	-	-
M. guttulata	LR	-	++++	-	-
M. rubropunctata	LR	-	+++	-	-
SCINCIDAE: *Chalcides ocellatus*	LR	-	-	++++	-
Mabuya quinquetaeniata	LR	++++	-	++++	++
Scincus scincus	LR	-	+++	-	-
Sphenops sepsoides	LR	-	++++	-	-
VARANIDAE: *Varanus griseus*	LR	-	+++	-	-
Varanus niloticus	VU	-	-	-	++
TYPHLOPIDAE: *Typhlops vermicularis*	E	-	++	-	-
LEPTOTYPHLOPIDAE: *Leptotyphlops macrorhynchus*	E	-	-	++	-

Species	Status in Egypt	Habitat			
		Human dwellings	Desert	Cultivated Fields	Aquatic habitats
BOIDAE: *Eryx colubrinus*	VU	-	++	++	-
COLUBRIDAE: *Coluber florulentus*	LR	++	-	+++	-
C. nummifer	VU	+	-	+	-
C. rhodorhachis	LR	-	++	-	-
Lycophidion capense	CE	-	-	-	-
Lytorhynchus diadema	LR	-	++++	-	-
Malpolon moilensis	LR	-	++++	-	-
M. monspessulanus	LR	-	-	++++	-
Natrix tessellata	LR	-	-	++++	++++
Psammophis schokari	LR	-	++++	-	-
P. sibilans	LR	-	-	++++	++
Spalerosophis diadema	LR	-	+++	-	-
Telescopus dhara	LR	++	-	+++	-
ELAPIDAE: *Naja haje*	LR	-	-	+++	+++
Naja nigricolis	LR	-	-	++	++
VIPERIDAE: *Cerastes cerastes*	LR	-	++++	-	-
C. vipera	LR	-	++++	-	-
Echis carinatus	LR	-	+++	-	-
AMPHIBIA					
BUFONIDAE: *B. regularis*	LR	-	-	++++	++++
RANIDAE: *Ptychadena mascareniensis*	LR	-	-	++++	++++

TABLE D4-4

Birds of Minia Governorate (Goodman and Meininger, 1989)

Breeding status and relative abundance in Egypt are: - = absent, + = very rare, ++ = rare, +++ = common, ++++ = very common) RB = resident breeder; CB = casual breeder; MB = migrant breeder; WV = winter visitor; PV = passage visitor.

Species	Breeding Status	Biotope		
		Nile Valley	Desert	Aquatic Habitats
Black-necked Grebe	WV	-	-	++
Cormorant	PV, WV	-	-	+++
Squacco Heron	RB, PV, WP	++	-	++
Cattle Egret	RB, PV, WV	++++	-	++++
Little Egret	RB, PV, WV	++	-	+++
Great White Egret	PV, WV	-	-	++
Grey Heron	CB, PV, WV	-	-	+++
Purple Heron	PV, WV	-	-	++
Black Stork	PV, WV	+	-	-
White Stork	PV, WV	+++	++	++
Glossy Ibis	PV, WV	-	-	++
Spoonbill	RB, PV, WV	-	-	++
Greater Flamingo	RB, PV, WV	-	-	-
Shelduck	WV	-	-	++
Wigeon	PV, WV	-	-	+++
Teal	PV, WV	-	-	++++
Mallard	PV, WV	-	-	+++
Pintail	PV, WV	-	-	+++
Garganey	PV	-	-	++++
Shoveler	PV, WV	-	-	+++
Pochard	PV, WV	-	-	+++
Ferrugineous Duck	PV, WV	-	-	+++
Tufted Duck	PV, WV	-	-	+++
Honey Buzzard	PV	-	+	-
Black-shouldered Kite	RB	+++	-	-
Marsh Harrier	PV, WV	++	-	++
Long-legged Buzzard	CB, PV, WV	-	++	-

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Species	Breeding Status	Biotope		
		Nile Valley	Desert	Aquatic Habitats
Kestrel	RB, PV, WV	++++	+	-
Sooty Falcon	MB	-	++	-
Lanner	RB, WV	++	++	-
Peregrine	PV, WV	-	-	+
Spotted Crake	PV, WV	++	-	++
Moorhen	RB, PV, WV	++++	-	++++
Purpul Galinule	RB	++	-	+++
Coot	RB, WV	-	-	++++
Common Crane	PV	++	-	+++
Painted Snipe	RB	++	-	+++
Black-winged Stilt	MB, PV, WV	-	-	+++
Avocet	CB, PV, WV	-	-	+++
Stone Curlew	RB, PV, WV	+++	+++	++
Senegal Thick-knee	RB	++++	-	+++
Ringed Plover	PV, WV	-	-	+++
Spur-winged Plover	RB, PV, WV	++++	-	++++
Lapwing	PV	++++	-	++++
Little Stint	PV, WV	-	-	++
Temmink's Stint	PV, WV	-	-	++
Dunlin	PV, WV	-	-	++
Ruff	PV, WV	-	-	++
Common Snipe	PV, WV	+++	-	+++
Reshank	PV, WV	-	-	+++
Marsh Sandpiper	PV, WV	-	-	++
Common Sandpiper	PV, WV	-	-	++
Great Black-headed Gull	PV, WV	-	-	+
Black-headed Gull	PV, WV	-	-	+++
Slender-billed Gull	RB, PV, WV	-	-	+
Lesser Black-backed Gull	PV, WV	-	-	++
Yellow-legged Gull	RB, WV	-	-	++
Whiskered Tern	PV, WV	-	-	+++
Black Tern	PV, WV	-	-	+++
White-winged Black Tern	PV, WV	-	-	+++
Spotted Sandgrouse	RB	-	+	-
Chesnut-bellied Sandgrouse	RB	-	+	-

Species	Breeding Status	Biotope		
		Nile Valley	Desert	Aquatic Habitats
Rock Pigeon	RB	++++	+++	
Turtle Dove	MB PV WV	++++	++++	-
Palm Dove	RB	++++	-	-
Cuckoo	PV	++	+	-
Senegal Coucal	RB	++++	-	-
Barn Owl	RB	++++	-	-
Little Owl	RB	++++	-	-
Short-eared Owl	PV WV	+	+	-
Egyptian Nightjar	RB PV	++	++	-
Swift	PV	+++	+++	-
Pallid Swift	RB MB PV	+++	+++	-
Alpine Swift	PV WV	+	-	-
Kingfisher	CB WV	+++	-	+++
Pied Kingfisher	RB WV	+++	-	+++
Little Green Bee-eater	RB	+++	-	-
Bee-eater	MB PV	+++	+++	-
Hoopoe	RB PV	+++	+++	-
Bar-tailed Desert Lark	RB	-	++	-
Desert Lark	RB	+++	+++	-
Hoopoe Lark	RB	-	++++	-
Short-toed Lark	PV WV CB	-	+++	-
Lesser Short-toed Lark	RB WV	-	+++	-
Crested Lark	RB	++++	-	-
Sand Martin	MB PV WV	+++	+++	-
Pale Crag Martin	RB	-	+++	-
Swallow	RB PV WV	++++	++++	-
Red-rumped Swallow	PV WV	+++	+++	-
House Martin	PV WV	+++	+++	-
Tawny Pipit	PV WV	+++	+++	-
Tree Pipit	PV	+++	+++	-
Meadow Pipit	PV WV	+++	-	-
Red-throated Pipit	PV WV	++++	++++	-
Water Pipit	PV WV	+++	-	-
Yellow Wagtail	RB PV WV	+++	+++	-
Grey Wagtail	OV WV	+++	+++	-
White Wagtail	PV WV	++++	++++	-
Common Bulbul	RB	++++	-	-
Rufous Bush Robin	MB PV WV	+++	++	-
Robin	WV	+++	+++	-
Thrush Nightingale	PV	+++	-	-
Bluethroat	PV WV	+++	-	-

TABLE D4-5

Mammals of Minia Governorate (Osborn and Helmy, 1980)

Status in Egypt is indicated using IUCN categories EX = extinct, EW = extinct in the wild, CR = critically endangered, E = endangered, VU = vulnerable, LR = low risk. Relative abundance in Egypt are as follows: - = absent, + = very rare, ++ = rare, +++ = common, ++++ = very common.

Species	Status in Egypt	Habitat			
		Human Dwellings	Desert	Cultivated Fields	River & canal Banks
Hemiechinus auritus	LR	-	+++	++++	+++
Rousetus aegyptiacus	LR	-	-	++++	+++
Rhinopoma hardwickei	LR	-	+++	+++	+++
Aselia tridens	LR	-	+++	+++	+++
Gerbillus pyramidum	LR	-	++++	++++	–
Gerbillus gerbillus	LR	-	++++	-	–
Meriones crassus	LR	-	++++	-	–
Acomys caherinus	LR	-	++++	-	–
Acomys russatus	LR	-	++++	-	–
Seekytemes clarus	LR	-	++++	-	–
Pachyrumus duprasi	VU	-	++	-	–
Jaculus jaculus	LR	-	++++	-	–
Arvicanus niloticus	LR	-	-	++++	++++
Rattus rattus	LR	++++	-	-	++
Mus musculus	LR	++++	++	-	
Canis aureus lupaster	VU	-	+++	+++	++
Vulpes vulpes	LR	-	+++	+++	+++
Vulpes zerda	VU	-	++	-	–
Vulpes reuppelli	LR	-	+++	-	–
Fekis Chaus	LR	-	-	++	+++
Felis libyca	V	-	-	+	++
Addax nasomaculata	Ex	-	-	-	–
Oryx Dammah	Ex	-	-	-	–
Gazella leptoceros leptoceros	CR	-	+	-	–
Gazella dorcas doecas	E	-	+	-	–
Ammotragus lervia	Ex	-	-	-	–

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TABLE D4-6

Threatened Plants and Animals of Minya and their Distribution in the Governorate and in Protected Areas of Egypt (Bishai, 1997; Kasssas, 1993; Osborn and Helmy, 1980; Saleh, 1997; and Zaharan and Willis, 1992)

EX = extinct; CE = critically endangered; E = endangered; VU = vulnerable; LR = lower risk; DD = data deficient; NE = not evaluated.

Species	Status	Legal Protection	Occurrence			
			Nile Valley	Eastern Desert	Western Desert	In PAs Of Egypt
Plants: *Aizoon hispanicum*	NE	None	Rare	-	-	?
Atriplex rosea	NE	None	Rare	-	-	?
Abutilon pannosum	NE	None	-	-	Rare	?
Polygonum obtusifolium	NE	None	-	-	Rare	?
Alopecurus myosuroides	NE	None	-	-	Rare	?
Bromus fasciculatus	NE	None	-	-	Rare	?
Echinochloa colonum	NE	None	-	-	Rare	?
E. crusgalli	NE	None	-	-	Rare	?
Paspalidium obtusifolium	NE	None	-	-	Rare	?
Fimbristylis ferruginea	NE	None	-	-	Rare	?
Cyperus fuscus	NE	None	-	-	Rare	?
Scirpus fistulosus	NE	None	-	-	Rare	?
Ornithogalum trichophyllum	NE	None	-	-	Rare	?
Najas pectinata	NE	None	-	-	Rare	?
Myriophyllum spicatum	NE	None	-	-	Rare	?
Salix subserrata	NE	None	-	-	Rare	?
Tamarix passerinoides	NE	None	-	-	Rare	?
Fishes: Black carp (*Labeo horie*)	NE	None	Rare	-	-	-
Black carp (*L. coubei*)	NE	None	Rare	-	-	-
Chrysichthys rueppelli	NE	None	Rare	-	-	-
Spiny catfish (*Clarotes laticeps*)	NE	None	Rare	-	-	-
Black-spotted catfish (*Auchenoglanis biscutatus*)	NE	None	Rare	-	-	-
Spotted catfis (*A. occidentalis*)	NE	None	Rare	-	-	-
Siluranodon auritus	NE	None	Rare	-	-	-

Species	Status	Legal Protection	Occurrence			
			Nile Valley	Eastern Desert	Western Desert	In PAs Of Egypt
Squeaker (*Synodontis serratus*)	NE	None	Rare	-	-	-
Reptiles: Greek Blind Snake (*Typhlops vermicularis*)	E	None	-	-	Very rare	-
Beaked Thread Snake (*Leptotyphlops macrorhynchus*)	E	None	-	-	Rare	-
Theban Sand Snake (*Eryx colubrinus*)	VU	None	-	-	Rare	-
Coin-marked Snake (*Coluber nummifer*)	VU	None	-	-	Rare	-
Cape Wolf Snake (*Lycophidion capense*)	CE	None	-	-	Very Rare	-
Birds (resident species): Greater Flamingo (*Phoenicopterus ruber*)	E	Protected	Rare	Rare	-	Lake Bardawil
Marbled Duck (*Marmaronetta angustirostris*)	E	None	-	Very rare	-	-
Collard Pratincole (*Glareola pratincola*)	NE	None	Rare	Very rare	-	-
Kittlitz Plover (*Charadrius pecuarius*)	NE	None	Rare	-	-	-
Great Spotted Cuckoo (*Clamator glandarius*)	NE	None	-	-	Very rare	-
Egyptian Nightjar (*Caprimulgus aegyptius*)	NE	None	-	-	Rare	-
Sardinian Warbler (*Sylvia melanocephala*)	NE	None	Common	Rare	-	-
Mammals: Striped Hyena (*Hyaena hyaena*)	E	Protected	Ex	-	Ex	St. Catherine
Wild Cat (*Felis sylvestris libyca*)	VU	Protected	Common	-	Common	Several PAs
Fennec Fox (*Vulpes zerda*)	V	Protected	Ex	Rare	-	-
Wild Boar (*Sus scrofa*)	Ex	-	Ex	-	-	-
Scimitar-horned Oryx (*Oryx damma*)	Ex	-	Ex	Ex	Ex	-

Species	**Status**	**Legal Protection**	**Occurrence**			
			Nile Valley	**Eastern Desert**	**Western Desert**	**In PAs Of Egypt**
Addax (*Addax nasomaculatus*)	Ex	-	Ex	Ex	Ex	-
Bubal Hartebeest (*Alcelaphus buselaphus*)	Ex	-	Ex	Ex	Ex	-
Slender-horned Gazelle (Gazella l. leptoceros)	CE	Protected	Ex	CE	CE	-
Dorcas Gazelle (*Gazella dorcas*)	E	Protected	Ex	CE	CE	Several PAs
Barbary Sheep (Ammotragus lervia)	CE	Protected	Ex	Ex	Ex	Gabal Elba

APPENDIX D5.

WATER QUALITY SAMPLING PLAN

Table D5-1. Analytical Compound List

Table D5-2. Egyptian Standards Potable Water

Table D5-3. Egyptian Standards for Industrial Treated Liquid Wastes Discharged to the Nile River from Boundaries of Southern Egypt to Delta Barrage

Table D5-1.

Analytical Compound List

List	Preferred Method(s)[1]	Compound	Typical Units
General Water Quality (field analysis)	SM 2550 B	Water Temperature	Degerees C
		Sample Depth	meters
	SM 4500-H^+ B	pH	unitless
	SM 4500-O G	Dissolved Oxygen	mg/L
	SM 2510 B	Conductivity	uS/cm
	SM 2130 B	Turbidity	NTU
General Water Quality (laboratory analysis)	SM 2150	Odor	unitless
	SM 2120	Color	PtCo units
	SM 2540	Total Dissolved Solids	mg/L
	SM 2340	Total Hardness	mg/L as CaCO3
	SM 4500-SO_4^{2-} E.	Sulfates	mg/L
	SM 4500-Cl^- B,C,D	Chlorides	mg/L
	SM 4500-F^- B,C	Fluorides	mg/L
	SM 3111	Calcium	mg/L as Ca
	SM 3111	Magnesium	mg/L
Total Residual Chlorine (field analysis)	SM 4500-Cl G	TRC	mg/L
Nutrients	SM 4500-P D	Reactive Phosphorus / Ortho-Phosphate	mg/L
	SM 4500-NH_3	Ammonia as N	mg/L
	SM 4500-NO_2	Nitrites as N	mg/L
	SM 4500-NO_3	Nitrate as N	mg/L
Metals	SM 3113	Aluminum	mg/L
	SM 3113	Arsenic	ug/L
	SM 3111	Chromium	ug/L
	SM 3111	Copper	mg/L
	SM 3111/ 3500-Fe	Iron	mg/L
	SM 3111/ 3500-Mn	Manganese	mg/L
	SM 3112	Mercury	ug/L
	SM 3111/ 3500-Na	Sodium	mg/L
	SM 3111/ 3500-K	Potassium	mg/L
	SM 3111	Zinc	mg/L
Pollutants	SM 4500-CN^-	Total Cyanides	mg/L

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List	Preferred Method(s)[1]	Compound	Typical Units
Microbiological Parameters	SM 9221/9222	Total Coliform	CFU/100 mL
	"	Fecal Coliform	CFU/100 mL
	SM 9215	Bacterial Plate Count	CFU/mL
	SM 10200	Algae Count	units/mL
Phenols	EPA 604/ SM 6420	2-Chlorophenol	ug/L
	"	Phenol	ug/L
	"	2-Nitrophenol	ug/L
	"	2,4-Dimethlphenol	ug/L
	"	2,4-Dichlorophenol	ug/L
	"	4-Chloro-3-methylphenol	ug/L
	"	2,4,6-Trichlorophenol	ug/L
	"	2,4-Dinitrophenol	ug/L
	"	4-Nitrophenol	ug/L
	"	2-Methyl-4,6dinitrophenol	ug/L
	"	Pentachlorophenol	ug/L
Total Organic Carbon	SM 5310 C	Total Organic Carbon	mg/L
Hydrocarbons	EPA 413.2/ 418.1 SM 5520	Total Oils & Grease	mg/L
Chlorinated Phenoxy Acid Herbicides	SM 6640 B	2,4-D	ug/L
	"	2,4,5-TP (SILVEX)	ug/L
	"	2,4,5-T	ug/L
EDB and DBCP	EPA 504/ SM 6231	EDB &DBCP	ug/L
Nitrogen and Phosphorus-Containing Pesticides/ Triazine Pesticide	EPA 619	Simazine	ug/L
	"	Atrazine	ug/L
	"	Prometon	ug/L
	"	Propazine	ug/L
	"	Ametryn	ug/L
	"	Prometryn	ug/L
	"	Terbutryn	ug/L
Polychlorinated Biphenyls	EPA 608/ SM 6630 C	PCB-1221	ug/L
	"	PCB-1016	ug/L
	"	PCB-1232	ug/L
	"	PCB-1242	ug/L
	"	PCB-1254	ug/L
	"	PCB-1248	ug/L
	"	PCB-1260	ug/L

List	Preferred Method(s)[1]	Compound	Typical Units
Pesticides	EPA 608/ SM 6630 C	Alpha BHC	ug/L
	"	Beta BHC	ug/L
	"	Gama BHC	ug/L
	"	Delta BHC	ug/L
	"	Heptachlor	ug/L
	"	Aldrin	ug/L
	"	Heptachlorepoxide	ug/L
	"	Endosulfan-1	ug/L
	"	DDE	ug/L
	"	Dieldrin	ug/L
	"	Endrin	ug/L
	"	Endosulfan-2	ug/L
	"	DDD	ug/L
	"	Endrinaldehyde	ug/L
	"	Endosulfansulfate	ug/L
	"	DDT	ug/L
	"	Methoxychlor	ug/L
	"	Endrinketon	ug/L
	"	Toxaphene	ug/L
	"	Chlordane	ug/L
Carbamate Pesticides	EPA 531.1 SM 6610 B	Aldicarb sulfoxide	ug/L
		Aldicarb sulfone	ug/L
		Oxamyl	ug/L
		Methiomyl	ug/L
		3-Hydroxcarfuran	ug/L
		Aldicarb	ug/L
		Propoxur	ug/L
		Carbfuran	ug/L
		Carbaryl	ug/L
		Methiocarb	ug/L

Note:

1. Methods should be equivalent to methods specified by United States EPA, European Economic Community or Standard Methods (APHA 1998) for analysis of drinking water. Quantitative detection limits of method should be demonstrated to be lower than the maximum permissible limit specified in Minister of Health Decree No. 108/1995. Preferred methods are referred to as EPA or SM (= Standard Methods).

Table D5-2.

Egyptian Standards Potable Water
(As Approved by the High Committee at February 26, 1995)

Parameter	Maximum Allowable Limit	Units
First-Natural Characteristics:		
Color	Maximum 20 – 30	Cobalt Platinum units
Taste	Acceptable	
Odor	Odorless	
Turbidity	5	Jackson units[1]
	10	Jackson units[1]
pH	6.5 – 9.2	
Second-Inorganic Materials That Affect the Taste and the In-house Use:		
Dissolved Solids at 120oC	1200	mg/L
Iron		
Filtered water	0.3	mg/L
Groundwater and mixed water	1.0	mg/L
Manganese		
Filtered water	0.1	mg/L
Groundwater and mixed water	0.5	mg/L
Copper	1.0	mg/L
Zinc	5.0	mg/L
Total Hardness as CaCO3	500	mg/L
Calcium	200	mg/L
Magnesium	150	mg/L
Sulfate	400	mg/L
Chlorine	500	mg/L
Sodium	200	mg/L
Aluminum	0.2	mg/L
Calcium equilibrium	± 0.1	
Third- Chemical Materials That Have Effect on Public Health:		
a. Inorganic materials:		
Lead	0.05	mg/L
Arsenic	0.05	mg/L
Cyanide	0.05	mg/L
Cadmium	0.005	mg/L
Selenium	0.01	mg/L
Mercury	0.002	mg/L
Chromium	0.05	mg/L
Nitrate as N	10	mg/L
Nitrite as N	0.005	mg/L
Fluorides	0.8	mg/L

Parameter	Maximum Allowable Limit	Units
b. Organic materials:		
1. Pesticides:		
Alachlor	20	ug/L
Aldicarb	10	ug/L
Aldrin/ dialdrin	0.03	ug/L
Atrazine	2	ug/L
Bentazon	30	ug/L
Carbofuran	5	ug/L
Chlordane	0.2	ug/L
Chlorotoluron	30	ug/L
D.D.T	2	ug/L
1,2 Dibromo- 3 chloropropane	1	ug/L
2,4 D	30	ug/L
1,2 Dichloropropane	20	ug/L
1,3 Dichloropropane	20	ug/L
Hexaclorobenzene	1	ug/L
Isoproturon	9	ug/L
Lindane	2	ug/L
MCPA (Chlorophenoxy)	2	ug/L
Methoxychlor	20	ug/L
Metolachlor	10	ug/L
Molinate	6	ug/L
Pendimthaline	20	ug/L
Pentachlorophenol	9	ug/L
Permethrin	20	ug/L
Propanil	20	ug/L
Simazine	2	ug/L
Trifluralin	20	ug/L
Chlorophenoxyd herbicides other than 2,4 dand MCPA		
2,4 D B	90	ug/L
2,4 Dichloroprop	100	ug/L
Fenoprop	9	ug/L
Mecoprop	10	ug/L
2,4,5 T	9	ug/L
2. Other organic materials:		
Tributyl tin Oxide	2	ug/L
Phenol	2	ug/L
Disinfectants and disinfectants bi-products		
Monochloramine	3	ug/L
Di and trichloramine	5	ug/L
Bromate	25	ug/L
Chlorite	200	ug/L
2,4,6- Trichlorophenol	200	ug/L
Trihalomethanes	100	ug/L
Chlorinated acetic acids		
Dichloro acetic acid	50	ug/L
Trichloro acetic acid	100	ug/L
Trichloro acetaldhyde	10	ug/L

Parameter	Maximum Allowable Limit	Units
Halogenated acetonitriles		
Dichloro acetonitrile	90	ug/L
Dibromo acetonitrile	100	ug/L
Trichloro acetonitrile	1	ug/L
Cyanogen Chloride	70	ug/L
Chlorinated Alkanes		
Carbon tetrachloride	2	ug/L
Dichloromethane	20	ug/L
1,2 dichloroethan	30	ug/L
1,1,1 Trichloroethane	200	ug/L
Chlorinated Ethanes		
Vinyl chloride	5	ug/L
1,1 Dichloroethane	30	ug/L
1,2 Dichloroethane	50	ug/L
Trichloroethane	70	ug/L
Tetrachloroethane	40	ug/L
Total Hydrocarbons as Toluene	100	ug/L
Benzene	10	ug/L
Benzo (a) pyrene	0.7	ug/L
Chlorinated Benzenes		
Monochlorobenzene	300	ug/L
1,2 dichlorobenzene	1000	ug/L
1,4 dichlorobenzene	300	ug/L
Triclorobenzene	20	ug/L
Di (Ethyl hexyl) adipate	80	ug/L
Di (Ethyl hexyl) phthalate	8	ug/L
Acrylamide	0.5	ug/L
Epichlorohydrin	0.4	ug/L
Hexachlorohybutadiene	0.6	ug/L
Edetic Acid (EDTA)	200	ug/L
Nitrilotriactic	200	ug/L

Notes: 1) Jackson turbidity units or equivalent for filtered water
2) Jackson turbidity units or equivalent for groundwater or mixed water

Table D5-3

Egyptian Standards for Industrial Treated Liquid Wastes Discharged to the Nile River from Boundaries of Southern Egypt to Delta Barrage (Egyptian Law 48 Clause 61)

Parameter	Units	Limit
Temperature	Degress C	35
pH	unitless	6 to 9
Color	PtCo Units	Free of colored
BOD	mg/L	30
COD (Dichromate)	mg/L	40
COD (Permanganate)	mg/L	15
Total Dissolved Solids	mg/L	1200
Inorganic Dissolved Solids	mg/L	1100
Suspended Solids	mg/L	30
Ash of Inorganic Suspended Solids	mg/L	20
Sulfide	mg/L	1
Greases, Oils, and Resins	mg/L	5
Phospates (Inorganic)	mg/L	1
Nitrates as NO3	mg/L	30
Phenol	mg/L	0.002
Fluoride	mg/L	0.5
Residual Chlorine	mg/L	1
Heavy Metals (sum of those indicated by *)	mg/L	1
Mercury*	mg/L	0.001
Lead*	mg/L	0.5
Cadmium*	mg/L	0.01
Arsenic*	mg/L	0.05
Chromium, hexavalent*	mg/L	0.05
Cobalt*	mg/L	1
Nickel*	mg/L	0.1
Iron*	mg/L	1
Manganese	mg/L	0.5
Zinc	mg/L	1
Silver	mg/L	0.05
Artificial Detergents	mg/L	0.05
Total Coliforms in 100 mL	MPN/ 100 mL	2500

APPENDIX E.

SUMMARY OF SCOPING REPORTS AND OTHER PUBLIC COMMENT

APPENDIX E

SUMMARY OF SCOPING REPORTS AND OTHER PUBLIC COMMENT

SCOPING ACTIVITIES

The Middle Egypt Water and Wastewater Master Planning Project began in January, 1999. Background data collection activities associated with the development of master plans for the Middle Egypt governorates supported scoping by providing data relative to the present status of water and wastewater services. Meetings with governmental agencies, other donors and NGO's, and private organizations were held during the data collection phase. The purpose of most of these meetings was to identify environmental issues relative to water and wastewater development within the Middle Egypt Governorates and to obtain information relative to assessment of the identified issues. A Scoping Session was held in Minia City on 6 March 2000 in preparation for environmental assessment of several High Priority Projects (HPPs) that had been identified during the early phase of the MEMPP. The HPP Scoping Session focused on identifying the following:

- General issues related to water and wastewater development,
- Issues related to construction and operation of slow sand filter water treatment plants, and
- Issues related to rehabilitation of the Minia Raw Water Intake.

The second, FSIP, Scoping Session, which was held on 22 August 2000, focused on environmental issues related to the five FSIP projects and revisited the Minia Raw Water Intake HPP. This chapter summarizes scoping activities to date.

Meetings with Governmental Agencies

In addition to consultation with MEGAWS, meetings were held with Representatives of Government of Egypt Agencies, Research Institutes within the Ministry of Public Works and Water Resources, and representatives of governorate agencies (Appendix 1).

Scoping Session

The Scoping Session was held on 22 August 2000 in the auditorium of the Governorate Building in Minia. Prior to the meeting an "Initial Scoping Document" was circulated (Appendix 2). Copies of the document in both Arabic and English versions were also available to participants at the meeting.

Sixty invitations to organizations and individuals outside MEGAWS and the project team were circulated one week prior to the meeting (Appendix 2). Seventy two participants registered at the meeting (Appendix 3). These included:

- 10 representatives from the Governorate or Central Government Departments,
- six representatives from six of the nine marakaz,
- nine representatives from the Local Units and Local Popular Councils,
- one representative from the local academic community, and
- four representatives from NGO's and community development organizations.

In addition, 35 representatives of MEGWAS and the master planning Technical Committee, one representative from USAID, and six members of the Harza Team participated in the meeting.

The meeting was opened with brief remarks by Mahmoud Abu Zeid, Vice-Chairman of MEGAWS; Mr. Omar Abo El Maati, USAID; and Mr. Jeff Hendrich, Harza Chief of Party. Mr. Peter Saunders, Harza Lead Environmental Scientist, described the six projects being considered at the Scoping Session, presented an overview of the environmental assessment process and described the potentially significant environmental issues identified. After the presentation by the Harza staff, the remainder of the meeting was devoted to statements and comments by the participants.

Presentations at the meeting were in English with Arabic Translation or in Arabic. Comments received were in Arabic. Comments and statements by the participants were recorded. A Scoping Questionnaire was provided to allow participants an opportunity to comment in writing if they were reluctant to provide verbal comments. A detailed summary of the participants' remarks and questionnaire responses is provided in Appendix 4.

Comments Received

The comment session was moderated by Eng. Mahmoud Abu Zeid, Vice Chairman of MEGAWS. Five participants outside the project team or MEGAWS commented or made statements. In addition, Eng. Mahmoud Abou Zeid provided informational statements in response to comments or offered comments on behalf of MEGAWS. A summary of the issues raised in these comments is presented in Chapter 3.

Written Statements Received

During the meeting, participants were encouraged to provide written comments. Nine questionnaires with written statements were received during, or after, the meeting.

SCOPING STATEMENT

The scoping statement for the Minia Water Treatment System was submitted to the USAID Cairo Mission in January 2001. The Scoping Statement was approved by USAID Washington in March 2001.

APPENDIX F.

LIST OF ASSESSMENT PREPARERS

APPENDIX F

LIST OF ASSESSMENT PREPARERS

NAME	EDUCATION	POSITION
W. Peter Saunders, Jr	M.S Fisheries Biology	Lead Environmental Specialist
Mostafa M. Saleh	Ph.D. Biology	Senior Ecologist
Said Gohary	Ph.D. Egyptology	Archeologist
Ahmed Abd El Hamid	M.S. Engineering	Environmental Engineer
Shari Saunders	M.S. Archeology	Archeologist
Mohamed Hassen Husein	Ph.D. Public Health	Public Health
Sharon A. Waller	M.S. Civil Engineering	Environmental Engineer