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Egypt Utilities Management/Alexandria Results Package

RP 263-0270.02

Draft Report

**High Priority Projects  
Volume I  
September 1999**

Alexandria Water (AWGA)  
Master Plan

CONTRACT NO. 263-C-00-99-00009-00



Camp Dresser & McKee International Inc.

*in association with*

Engineering Consultants Group  
Environmental Quality International  
Pitometer Associates

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## Abbreviations and Acronyms\*

AGOSD :	Alexandria General Organization for Sanitary Drainage
AWGA :	Alexandria Water General Authority
CADD :	Computer Aided Drafting and Design
CDM :	CDM International Inc.
CM :	Construction Management
ECG :	Engineering Consultants Group
EHP :	Environmental Health Project
EQI :	Environmental Quality International
FAR:	Fixed Amount Reimbursable
GIS :	Geographic Information System
GOA:	Governorate of Alexandria
GOE :	Government of Egypt
GPS:	Global Positioning System
GTZ :	German Technical Assistance
HPP :	High Priority Projects
ISC :	Institutional Strengthening Contract
KM :	Kilometers
M <sup>3</sup> :	Cubic Meters
MM :	Millimeters
MHUUC :	Ministry of Housing, Utilities and Urban Communities
MWRI :	Ministry of Water Resources and Irrigation
NGO :	Non-Governmental Organization
O&M :	Operations & Maintenance
PIU :	Project Implementation Unit
PVO :	Private Voluntary Organization
QA/QC :	Quality Assurance/Quality Control
RFP :	Request For Proposal
RP :	Results Package
RWS:	Raw Water Supply
SFD:	Social Fund for Development
TOR :	Terms of Reference
TDS :	Total Dissolved Solids
USAID :	United States Agency for International Development
WHO :	World Health Organization
WTP :	Water Treatment Plant
WWTP:	Wastewater Treatment Plant

\* Abbreviations used in Tables are indicated on Tables or given in applicable report sections.

# Executive Summary

## Introduction and Background

This High Priority Projects Report was prepared by the CDM International Team for the Alexandria Water Master Plan under United States Agency for International Development (USAID) Contract No. 263-C-00-99-00009-00 for Egypt Utilities Management/Alexandria Results Package RP 263-0270.02. The overall master planning effort will result in the preparation of a Master Plan report for the period through 2022. This interim report represents an identification, evaluation and set of recommendations for projects which can and should proceed on an accelerated basis.

Alexandria has had a municipal water system since about 1820 when the Mahmoudia Canal was completed. For most of its history, the system has been operated as a private entity. The enterprise was nationalized in 1961, with the Governor of Alexandria as its chairman. Presidential Decree No.1639 of 1968 established it as the Alexandria Water General Authority (AWGA); and Decree No. 2420 of 1973 assigned ownership to the Alexandria governorate, and the current organization has subsequently developed.

In 1978 USAID funded a Waterworks Master Plan Report prepared for AWGA by Camp Dresser & McKee Inc. There has not been a comprehensive, system-wide, master planning study since the 1978 report.

Today, AWGA serves a year-round population of over four million, which increases to about five million during the summer months. The system extends 300 kilometers along the Mediterranean from Abu Qir in the east to Marsa Matruh in the west, and to the south over 100 kilometers along the Desert Road.

Specific tasks called for in the Scope of Work for the High Priority Project Report include:

- Evaluate needs and recommend changes to the provisional list of priority water facilities presented in the Scope of Work.
- Recommend specific raw water quality improvements.
- Discuss preliminary recommendation with AWGA and USAID.
- Prepare preliminary drawings and/or outline specifications for all approved facilities and/or equipment.
- Prepare estimated costs to construct the facilities and to purchase the commodities.
- Submit a separate report that includes findings, recommendations, plans and specifications, and cost estimates.

## Organization and Content

Volume I of the report includes this Executive Summary and Sections 1.0 through 7.0. Section 1.0, Introduction cites the project's authorization, gives the definition of high priority projects, discusses the context and background of the report and presents the objectives, scope and organization. Section 2.0, Identification of Projects, describes parallel reports, indicates sources of information on projects, and discusses classification and types of projects. Section 3.0, Selection Process, describes the development of lists of projects, criteria for inclusion, ranking, and development of a consolidated list. Section 4.0, Implementation Issues, indicates other agencies and programs involved with projects on the list, sources of funding, and potential implementation mechanisms. Section 5.0 presents Conclusions, and Section 6.0 presents Recommendations. Volume II of the report contains more detailed descriptions, conceptual design drawings and outline specifications for projects recommended as potential high priority projects.

The projects recommended in this report are needed for AWGA's on-going operation of its facilities, provide improvements in the areas of greatest deficiencies, improve service for as many people as possible, are compatible with long term plans for improving services. Several projects are to be carried out by other Government of Egypt (GOE) agencies, especially in the Raw Water Supply category. They are carried as High Priority Projects (HPP) to highlight their importance to AWGA and to encourage AWGA participation through interagency agreements.

A list of candidate projects was developed, ranked and reviewed by USAID and AWGA's Project Implementation Unit (PIU) including Chairman El Shafei.

Following the ranking, a final list of project groupings in the order recommended for funding under the Results Project was established and conceptual designs for those projects are developed in Volume II of this report.

## Findings

As discussed above, AWGA is a mature water utility, with a long history of effective service to its consumers. As a result of rapid population growth and the difficulty of funding capital works over the last 10 to 20 years, there are a number of needs which have developed, some requiring immediate action to avoid possible reductions in the level of service.

There are other donor programs which have been on-going for a number of years. The German and Dutch teams currently working on AWGA projects, and previous reports prepared by their programs have been of major assistance in determining the extent and criticality of many of the projects discussed in this report. Moreover, current projects being undertaken by these agencies fulfill some of the needs for given HPPs. Coordination with these donors' activities is essential to ensure maximum benefit from their funding as well as from the USAID Results Package.

Specific current and/or completed programs which require such coordination for HPP include the German (GTZ) programs for laboratory equipment and training, operation and maintenance (O&M) equipment and training, downtown block mapping, water treatment plants (WTP) production metering and power consumption/optimization studies. The Dutch (Netherlands Embassy) programs include O&M activities at Siouf and Nozha WTPs, Siouf WTP intake improvements, central and Siouf laboratory assessment, distribution system O&M assistance and geographic information system (GIS) assessment.

There are also numerous on-going and planned programs underway or to be conducted by other Egyptian agencies which can assist, impact and/or be impacted by projects recommended herein for HPP implementation. They include programs of the Alexandria General Organization for Sanitary Drainage (AGOSD); the Ministry of Water Resources and Irrigation (MWRI); the Social Fund for Development (SFD); the Ministry of Housing Utilities and Urban Communities (MHUUC); and the Ministry of Agriculture. GOE agencies' programs are outlined in Section 4.0.

As indicated above, there are many issues which require attention in the very near future in order to avoid impacts on the overall levels of service currently provided by AWGA. A number of these issues were identified in the Terms of Reference of the Contract for the Master Plan, including:

- Distribution piping replacement
- Central Laboratory improvements
- Improved WTP reliability
- Provision of research capability for treatment studies
- Improvement to Raw Water Supply (RWS) intakes, pumps and conduits
- Recommendations for improving raw water quality and quantity
- Improvements to water service for the Urban Poor
- Provision of specialized equipment

The projects outlined in the Terms of Reference (TOR) were reviewed, analyzed and verified during development of this report. Although some modifications to specifics were necessary, all issues were concurred upon, and carried as individual projects or as parts of expanded projects. It was also concluded that there are a number of other urgently needed construction and equipment projects. The analyses further concluded that a number of other urgently needed activities are not necessarily directly related to construction or furnishing of equipment. Such needed activities include:

- Establishing a stronger, proactive working relationship with other agencies.
- Development of procedures and protocols to monitor and assist with enforcement of raw water supply related policy.
- Conduct of studies to establish basis for near-term decisions regarding the set of investments to follow implementation of the HPP.
- Development of information, procedures and programs to establish and track current and developing demographic issues.

- Development of means, procedures and programs to acquire and utilize GIS and improved mapping.
- Improvement of process control capabilities.
- Improvement of voice and data communication.

## Recommendations

Development of implementation approaches and consideration of benefits led to the conclusion that grouping projects would facilitate implementation, increase overall program benefits and enhance the ability of AWGA to provide in-kind service as part of its obligation to participate financially in programs to be funded by the USAID Results Package. Therefore, it was concluded that projects should be grouped in the following general classifications:

- The Urban Poor Demonstration Program.
- Projects which will be undertaken for the most part by the MWRI and which require AWGA's input, coordination and progress monitoring.
- Process and mechanical upgrades to the water treatment plants. The most highly ranked of these projects are a mobile pilot plant, chlorine storage facilities, flow monitoring and chemical mixing, and placing the Nozha WTP in service.
- Process control support projects and equipment.
- Development of demographic information including extension of GIS for the AWGA service area.
- Improvement of the reliability of the raw water supply for existing and anticipated facilities.
- Replacement of older distribution system pipelines in the downtown areas of Alexandria. The most critical improvements, which are recommended as top priorities for funding, are the transmission network serving the area from Manshia to Sidi Gaber, and replacement of distribution piping in the Ras At Tin area.

Specific projects to be included in the above groupings are described in Section 6.0, Recommendations, of the report. Section 6.0 also presents preliminary capital cost estimates for each project, and a schedule for each of the project groupings.

It is also recommended that strong consideration be given to private sector participation (PSP) related to several HPP. Outsourced service contracts for computer and other equipment maintenance and calibration is recommended, along with several other possibilities as discussed in more detail in the companion Preliminary Report on Private Sector Participation.

# Section 1.0 Introduction

## 1.1 Authorization

This High Priority Projects Report was prepared by the CDM International (CDM) Team to meet the requirements of Task B of the Terms of Reference for the Alexandria Water Master Plan. This Master Plan is being prepared under United States Agency for International Development Contract No. 263-C-00-99-00009-00 for Egypt Utilities Management/Alexandria Results Package RP 263-0270.02. The overall master planning effort will result in the preparation of a Master Plan report for the period through 2022 plus several interim reports. This interim report represents an identification, evaluation and set of recommendations for projects which can and should proceed on an accelerated basis.

## 1.2 High Priority Project (HPP) Definition

The projects recommended in this report meet the criteria in the TOR, and as established with USAID and AWGA, that HPP:

- Are urgently needed for AWGA's on-going operation of its facilities,
- Provide improvements in the areas of greatest deficiencies,
- Improve service for as many people as possible, and
- Are compatible with the long term plans for improving Alexandria's services.

A number of the projects identified as HPP in this report are projects to be carried out by Government of Egypt (GOE) agencies other than AWGA. They have been included in this report to highlight their relative urgency and because there is the potential for AWGA involvement through inter-agency activities.

## 1.3 Report Context

The amount of available funding for the HPP projects is not finalized for two reasons:

- Results Package funding for other requirements including the Demonstration Program for Urban Poor water service is not yet finally established, and
- Alternate sources of funding may be available for some of the HPP.

It is clear at this time, however, that the total construction value of potential HPP will exceed currently available sources of funding. A list of eligible projects was developed including relevant ones from the TOR. The list also included priority projects developed in the concurrent Raw Water Supply report, and others developed through discussions with AWGA staff, with other donors and as a result of the CDM Team's initial master planning work. The projects were ranked by classification and subsequently as a

consolidated single list. The list development, procedures for ranking and the initial and final rankings were done with input, review and approval of USAID and AWGA's Project Implementation Unit (PIU). Following the ranking procedure described above, the draft final ranking was reviewed by USAID and AWGA's Chairman. Revisions were made as mutually agreed upon by AWGA, USAID and the Project Team.

As work on the HPP listing, ranking and reviews was underway, work on separate reports for Raw Water Supply improvements and for improvements to water service for the Urban Poor was proceeding in parallel. Some of the projects from those efforts were not developed by the time the HPP ranking was done. As such projects were developed they were added to the HPP lists, if they met HPP criteria, with rankings consistent with their relative urgency. A final list of project groupings in the order recommended for funding was established and conceptual designs for those projects are to be developed in Volume II of this report.

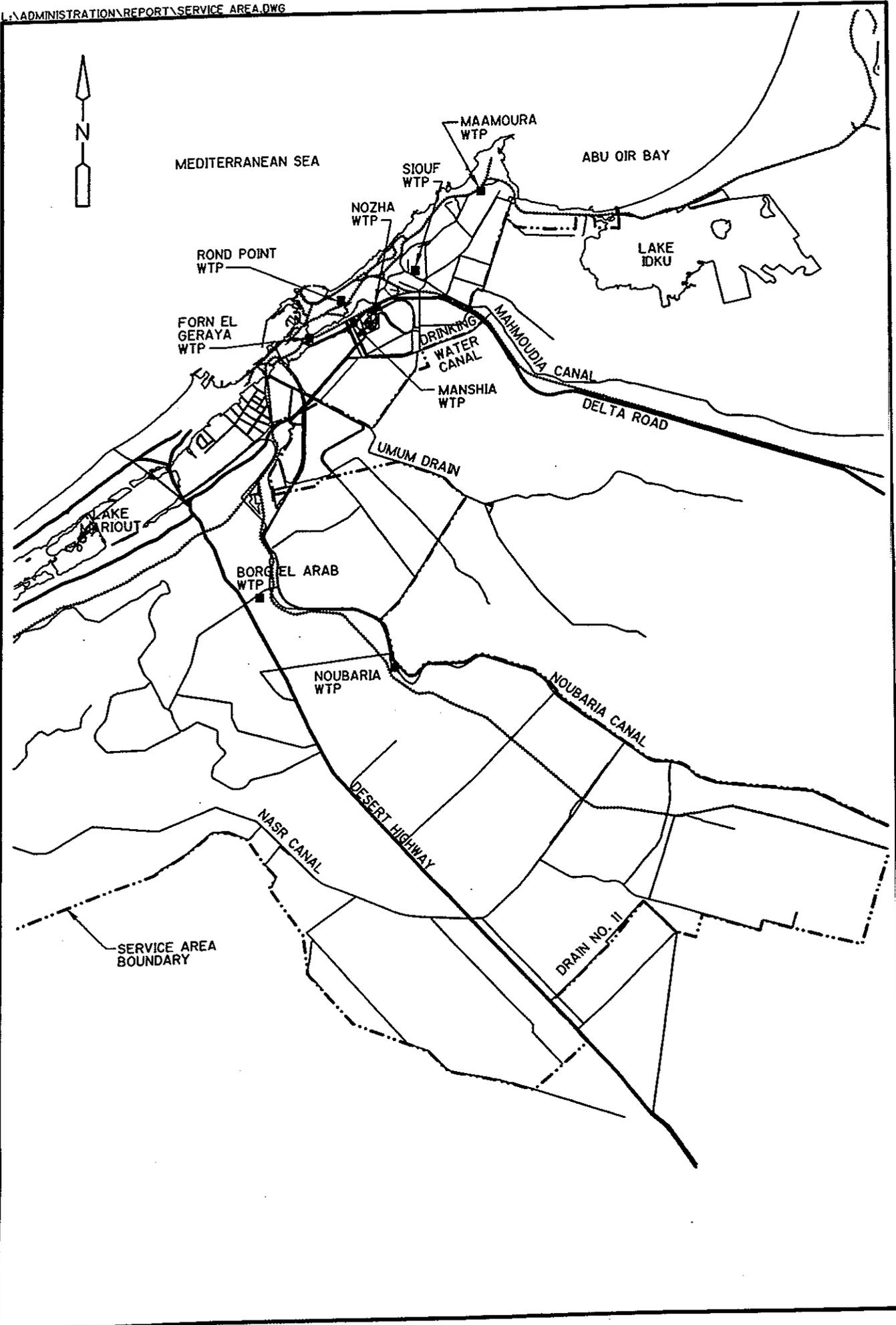
As individual projects are developed in more detail later in the master planning, more accurate cost estimates than those in this Volume I will become available. The ultimate selection of HPP will be made based on those cost estimates and total funding available.

## 1.4 Background

Alexandria has had a municipal water system since about 1820 when the Mahmoudia Canal was completed. For most of its history, the system has been operated as a private entity. Private French interests constructed treatment, pumping and storage facilities and extended the distribution system in the 1850's and 1860's. The enterprise was owned jointly by Egyptian and French interests. In 1879 the company was sold to British interests and it remained a private British company until it was converted to an Egyptian joint stock company in 1954. The enterprise was nationalized in 1961, with the Governor of Alexandria as its chairman. Presidential Decree No. 1639 of 1968 established it as the Alexandria Water General Authority; and Decree No. 2420 of 1973 assigned ownership to the Alexandria governorate, and the current organization has subsequently developed.

In 1978 USAID funded a Waterworks Master Plan Report prepared for AWGA by Camp Dresser & McKee Inc. Since then the governments of Germany, Italy and the Netherlands have provided assistance in a number of technical and institutional areas including operation and maintenance assistance, raw water quality studies, distribution system improvements, water loss analyses, production metering, mapping, laboratory support and public education programs. In general, however, the utility has been operated and managed by AWGA staff and most major improvements have been funded locally and/or by the Government of Egypt. There has not been a comprehensive, system-wide, master planning study since the 1978 report.

Today, AWGA serves a year-round population of over four million, which increases to about five million during the summer months. Service on both "wholesale" and "retail" bases is provided to parts of Beheira and Matruh governorates. The system extends 300 kilometers along the Mediterranean from Abu Qir in the east to Marsa Matruh in the west, and to the south over 100 kilometers along the Desert Road. Figure 1-1 is a map of most of the service area showing the sources of supply, the eight existing Water Treatment Plants and the extent of the system.



service area.dwg 4-24-00 7:27:05 pm EST

Figure 1-1  
AWGA Service Area Map

In 1997, the Environmental Health Project (EHP) report on institutional and technical findings and interventions was prepared for AWGA and for water/wastewater utilities in three other governorates. The report was prepared over a two-month time period under USAID's Environmental Health Project, Activity No. 325-RC, Egypt Utilities Management. The purpose of the report was to assemble and assess existing conditions and to provide a framework for subsequent results packages. The AWGA Water Master Plan is one of the projects which follows from the EHP report. This High Priority Projects Report is one of the major deliverables called for in the TOR for the AWGA Master Plan.

## 1.5 Objectives

The objectives of this High Priority Projects Report include:

- Identification of projects meeting the criteria in 1.2 above which can and should proceed as soon as possible.
- Ensuring that the projects will be compatible with long-term Master Plan recommendations.
- Ranking the projects to assist in developing recommendations for implementation.
- Identifying those projects which may be able to be funded by alternate sources.
- Preparing conceptual designs for construction projects most likely to be funded under the current Results Package.

## 1.6 Scope of Work

Specific tasks called for in the TOR include:

- Evaluate the needs and recommend any changes to the provisional list of priority water facilities for (1) the central district's distribution system improvements, (2) the central laboratory and operational buildings, and (3) miscellaneous improvements to water treatment plants.

*NOTE: The central laboratory building has been constructed under other program(s). Equipment and other laboratory needs are included in the High Priority Projects.*

- Based on the results of the raw water quality study, .... recommend specific raw water quality improvements to be included in the priority facilities program....
- Discuss preliminary recommendations with AWGA and USAID, and obtain approval prior to preparation of preliminary designs and cost estimate.
- Prepare preliminary drawings and outline specifications for all approved facilities to be constructed and lists of approved commodities and equipment to be purchased.

- Prepare estimated costs to construct the facilities and to purchase the commodities. Estimate the value of any cash and in-kind contribution proposed to be made available by the GOE.
- Submit a separate report that includes the consultant's findings, recommendations, plans and specifications, and cost estimates for construction and commodity purchases proposed as high priority projects.

As of the writing of this report, specific budgets have not been established for improvements recommended in the raw water supply study, the Urban Poor Demonstration Program or the overall High Priority Projects Program. Therefore, development of the final HPP list incorporated raw water supply projects and the Urban Poor Demonstration Program along with all others.

## 1.7 Report Organization

Volume I of the report contains an Executive Summary followed by this Section 1.0, Introduction. Section 2.0, Identification of Projects, outlines the three reports being prepared in parallel with this report under the requirements of the TOR; indicates the sources of information on projects considered for inclusion; and discusses the classification and types of projects included. Section 3.0, Selection Process, describes the development of the lists of projects by classifications; the criteria for inclusion as a HPP; ranking within classifications and as a consolidated list. Section 4.0, Implementation Issues, presents a discussion of other agencies and programs which may or will be involved with projects on the HPP list; sources of funding and/or in-kind contributions; and potential implementation mechanisms. Section 5.0 presents the report's Conclusions. Section 6.0, Recommendations, includes group and project descriptions; costs; implementation recommendations; and schedule. An Environmental Review is presented in Section 7.0.

Volume II of the report will contain conceptual design drawings and outline specifications for construction projects and lists of equipment which could be funded as HPP under the USAID Results Package. Many of the HPP in the final listing are known to meet the overall criteria for selection but final sizing, configuration and/or number of units will not be known until the master planning is further along. Therefore Volume II will be completed later in the project.

## Section 2.0 Identification of Projects

### 2.1 Concurrent Reports

There are three other reports, required by the TOR, to be submitted in September 1999 along with this High Priority Projects Report.

The preliminary report on recommendations for improving water service to the Urban Poor was written in June 1999. The final Urban Poor report will be submitted in parallel with this report. The Urban Poor reports recommend and develop a program for improvements to the water distribution system in the informal settlement of Mohsen El Kobra. The initial capital cost estimate for this project is approximately US \$1,000,000. Funding for this program will come from the same USAID Results Project budget as will the HPP.

The report on recommendations for improving Raw Water Supply will also be submitted in parallel with this report. There are a number of Raw Water Supply projects which meet the criteria for inclusion as HPP. These projects have been listed under the Raw Water Supply classification in this report and ranked and evaluated along with the other classifications. Because of the parallel development of the two reports, a number of raw water projects were added, modified or deleted after the ranking and/or consolidation of HPP occurred. These changes are noted, as appropriate, on the relevant tables and in the text of this report.

The Preliminary Report on Private Sector Participation is also to be submitted at the same time. This report will not identify additional projects. However, it will address types of projects which could conceivably be accomplished in whole or in part by private sector participation. It is possible that one or more HPP could be a candidate for private sector participation.

### 2.2 Sources of Information on Candidate Projects

The CDM team pursued a number of sources in developing the list of potential HPP. Those sources included:

- The TOR in the contract with USAID, specifically Annex B, Potential High Priority Projects for Alexandria Governorate;
- The 1997 Environmental Health Project (EHP) report;
- The 1994 Dutch Government-funded Water Supply Plan;
- The 1978 USAID-funded Master Plan for AWGA prepared by CDM;
- Discussions with the Dutch and German teams currently working on AWGA programs;

- Discussions with other agencies including the Ministry of Water Resources and Irrigation (MWRI) and the Social Fund; and
- Most importantly, discussions with USAID and AWGA management and staff from production, treatment plants, laboratories, distribution, modeling, GIS and mapping functions.

The discussions with USAID and AWGA were critical because they served not only to identify needs, but also to verify the accuracy and priority of prior recommendations. For example, although the central laboratory building called for in the TOR has been constructed under another program, a number of laboratory needs regarding equipment and training were identified and included as HPP. Also very important were discussions with Mr. Alexander Burns of RODECO, the firm working for GTZ, the German donor agency; and with Mr. Leo Koreman, of DHV Consultants, and his team working for the Dutch government's donor agency. These discussions also served to identify needs, clarify priorities and indicate areas where the HPP program might overlap with and therefore could logically work cooperatively with the other donors' programs. Meetings and discussions with the MWRI and with the Social Fund's Alexandria office served the same purpose with respect to their programs.

## 2.3 Classification of Projects

Projects have been classified according to their function. Table 2.1 is a list of the classifications and the abbreviations used for projects in the tables in this report.

**Table 2.1**  
**Project Classifications**

<u>Classification</u>	<u>Abbreviations</u>
Raw Water	RW
Water Treatment Plants General	WTG
Water Treatment Plant-Specific	WT
Laboratories	L
Distribution System	D
Mapping and GIS	MGIS

Lists of projects were initially compiled using the sources discussed in Section 2.2, in particular the AWGA management staff responsible for the functions which are carried out under each of the classifications.

## 2.4 Types of Projects

There are several types of projects contained in the lists compiled. Table 2.2 presents the general types by which projects have been identified and the abbreviations used in the tables in this report.

**Table 2.2**  
**Project Types**

<u>Type</u>	<u>Abbreviation</u>
Construction	Const.
Equipment	Equip.
Institutional	Instit.
Technical Services	Svcs.
Training	Tng.

A brief description of each of the project types follows:

- Construction. These are projects which will typically involve final engineering design, development of contract documents, solicitation of bids and selection of a construction contractor, physical construction and startup of the works and oversight and/or construction management by a professional engineering organization.
- Equipment. These projects will typically involve selection of appropriate type and number of equipment items, development of technical specifications and procurement documents, solicitation of bids and selection of an equipment supplier. Witnessing of shop testing may be included in the specification and the supplier may be required to install the equipment. Most equipment will require start-up, testing and training upon delivery/installation.
- Institutional. These are activities to be carried out cooperatively by AWGA in concert with another agency, typically a ministry or another GOE entity. In general, they will require designation of staff to be involved in the activity, development of protocols for achieving the intended result(s), development of appropriate measures of success and monitoring of progress in reaching and maintaining the goals and objectives.
- Technical Services. These are projects which will result in deliverables such as a report, a manual (e.g. for operation and maintenance), mapping or computer applications. Acquisition of these services is typically obtained by development of a scope of work, terms of reference and professional services contract, solicitation of proposals and selection of a professional services firm either through open competitive proposals or on an expedited basis using an already-existing contract mechanism.
- Training. These are a specific type of professional service contract. Acquisition of the services would normally follow the same steps as for general professional services as described above.

## Section 3.0 Selection Process

As discussed in Sections 1.0 and 2.0 above, the most important factor in selection of candidate projects and in their ranking, was the involvement at each step of AWGA staff and USAID. The selection process began with an initial list of projects developed by the CDM team from the various documents and other sources noted in Section 2.2.

### 3.1 Candidate Projects

The initial list of projects was then divided into the classifications described in Section 2.3 other than the Mapping and GIS category which evolved later. Numerous meetings were held with AWGA staff representing raw water supply; production/WTPs; laboratories; the distribution system; and mapping, GIS and technical computer applications. Additional projects were added to the lists as a result of these discussions. Meetings were also held with the Dutch and German teams as well as with the MWRI and the Alexandria office of the Social Fund. These discussions generated a few additional projects and served to clarify others, particularly with respect to plans of those agencies and donors with respect to AWGA – related activities of theirs.

### 3.2 Criteria for Inclusion/Exclusion as HPP

The lists discussed in Section 3.1 included a number of projects which required further study in the master planning evaluations of alternatives. Some are alternatives which may or may not be recommended in the final master plan. Others are known to be required, and will be recommended, but need further definition with respect to such questions as size, capacity, numbers of units and when during the master planning period they will be required to be operational. A list was compiled of projects which will be evaluated during the master planning work, but are not carried as potential HPP projects. That list will be augmented as work on the master plan proceeds and additional long-term alternatives are developed. That list as it existed as of the writing of this report is shown on Table 3.1.

Projects which remain on the HPP lists therefore meet the following criteria:

- There is a demonstrated need for the project in the near future.
- It can be determined now that the project will be recommended in the overall master plan.
- Definition of the project can either be done now, or will be possible by mid-year, 2000. This will enable a selected design team to proceed with final design as soon as a design engineering contract is executed.

Table 3.1  
Master Plan Alternatives Not on HPP List

No.	Description of Alternative	Benefit to AWGA <sup>(2)</sup>	Relative Cost <sup>(1)</sup>	Timing of Implem. <sup>(3)</sup>	Further evaluation in Master Plan
<b>Raw Water Supply</b>					
RW-10	Supply raw water to Borg el Arab and Noubaria WTPs by pipeline from DWC or MC.	Will reduce TDS excursions; costly solution that is technically infeasible due to capacity limitations of MC.	VH	L	No
RW-11	Construct large pipeline in Canal easements to carry water from Nile River to six AWGA WTPs currently served by MC.	Will meet capacity needs and prevent WQ degradation from canal users; costly solution that is technically infeasible due to limited easements and need to keep MC in continuous service during construction.	VH	VL	No
RW-12	Upgrade conventional treatment process trains and leave space for adding advanced treatment processes in the future if water quality degrades.	Will allow treated water quality standards to be met if raw water quality degrades.	H	M	Yes
RW-13	Replace 6 existing pumps at Manshia PS with larger pumps to supply raw water to RP and FEG WTPs.	Will meet design capacity needs for RP and FEG WTPs with largest pump out of service.	M	M	Yes
RW-14	Replace arch conduit from DWC to FPS with 1,160 m of twin 2,000 mm pipelines	Will increase capacity and improve reliability of raw water supply to RP WTP.	H	M	Yes
RW-15	Construct new intake on DWC, and pumping station and force main to serve Nozha WTP.	Will provide reliable supply to Nozha WTP, conflicts with AWGA priority to restore MC as primary raw water supply source.	H	M	Yes
RW-16	Construct box conduits in DWC to transport raw water to multiple WTP intakes.	Will prevent raw water quality degradation by canal users, but conflicts with AWGA priority to restore MC as primary water source.	VH	M	No
<b>Water Treatment Plants</b>					
<b>General (Applies to Multiple WTPs)</b>					
WTG-15	Use free chlorine for primary disinfection through storage reservoirs and ammonia for conversion to chloramines in the distribution system.	Will meet disinfection requirements while minimizing by-product formation; improve bacteriological quality in distribution system; reduce chlorinous odors.	H	M	Yes
WTG-16	Use filter or backwash conditioning chemical treatment aids.	Will improve filtered water turbidity at higher loading rates to meet more stringent performance goals.	L	VS	Yes
WTG-17	Convert from liquid alum to ferric chloride as a primary coagulant.	Will improve settled water turbidity at higher clarification rates.	L	S	Yes

Table 3.1  
Master Plan Alternatives Not on Hpp List

No.	Description of Alternative	Benefit to AWGA <sup>(2)</sup>	Relative Cost <sup>(1)</sup>	Timing of Implem. <sup>(3)</sup>	Further evaluation in Master Plan
<b>Specific (Applies to a Specific WTP) <sup>(4)</sup></b>					
WT1-3	Rehabilitate two Patterson filter buildings at Siouf WTP including: repair or replacement of filter piping, media and instrumentation.	Will improve water quality at higher loading rates and reduce O&M requirements.	H	M	Yes
WT1-4	Replace four pulsator clarifiers at Siouf WTP with Italba pretreatment units.	Will improve water quality at higher loading rates and reduce O&M requirements.	H	M	Yes
WT2-1	Replace two older sedimentation basins (Nos. 3 and 4) at RP WTP with Italba pretreatment trains.	Will increase capacity, improve water quality and extend plant service life.	H	M	Yes
WT2-2	Replace two older filter buildings at RP WTP with new Italba filter trains.	Will increase capacity, improve water quality and extend plant service life.	H	M	Yes
WT6-1	Rehabilitate older filter building at FEG WTP including: repair or replacement of filter piping, media and instrumentation.	Will increase capacity, improve water quality and extend plant service life.	H	M	Yes
WT9-1	Construct new WTP for service to North Coast	Adds to overall system capacity and reliability. Allows existing plants to serve nearer to city.	VH	L	Yes
<b>Distribution System</b>					
D-6	Booster pumping station rehabilitation	Improved system operating pressures under high demand conditions	H	M	Yes
D-7	Increase storage capacity at booster stations	Improved service during peak demand periods	H	M	Yes
D-8	Extend/rationalize master meter network	Better accounting of water produced, better production management	H	M	Yes
D-9	Strengthen/rehabilitate transmission system	Improved capacity, pressure and reliability	H	L	Yes
D-10	Strengthen/rehabilitate distribution system	Improved capacity, pressure and reliability	H	L	Yes
D-11	Expand treated water storage at WTP's	Improved service during peak demand periods	H	M	Yes

1. Costs categories:

VH = Very high cost (>\$10 million USD)  
H = High cost (\$1million - \$10 million USD)  
M = Medium cost (\$100,000 - \$1 million USD)  
L = Low cost (\$20,000 - \$100,000 USD)  
VL = Very low cost (< \$20,000 USD)

3. Time of Implementation Categories

(following project approval)  
VS = Very Short (< 6 months)  
S = Short (6 - 12 months)  
M = Medium (1 - 5 years)  
L = Long (5-10 years)  
VL = Very Long (> 10 years)

4. Individual WTP Alternatives

WT1 - Siouf  
WT2 - Rond Point (RP)  
WT3 - Manshia  
WT4 - Maamoura  
WT5 - Nozha  
WT6 - Fom El Gerreya (FEG)  
WT7 - Borg El Arab (BEA)  
WT8 - Noubaria  
WT9 - New West Plant

2. Abbreviations:

AWGA: Alexandria Water General Authority  
BEA: Borg El Arab WTP  
DWC: Drinking Water Canal  
FEG: Fom El Gerreya WTP  
FPS: Farkha Pump Station  
KC: Khandak Canal  
KM: Kilometer (stationing on canal)  
MC: Mahoudia Canal  
MWRI: Ministry of Water Resources and Irrigation  
NC: Nobarria Canal  
O&M: Operation and Maintenance  
PS: Pumping Station  
RP: Rond Point WTP  
RW: Raw Water  
TDS: Total Dissolved Solids  
WQ: Water Quality  
WTP: Water Treatment Plant

### 3.3 Ranking by Classification

As lists were developed by classification, they were reviewed by USAID, by the PIU and by Chairman El Shafei. The project team developed a draft procedure for ranking projects within each of the classifications. The procedure involved development of a series of ranking criteria, assignment of weights to the criteria, assigning a score for each criterion for each project, and calculating the weighted total to arrive at a prioritized ranking. The rankings were done excluding cost as an explicit criterion, although probable cost-effectiveness did enter into issues such as ease of implementation and energy efficiency.

The criteria and suggested weightings were reviewed with the PIU and Chairman, and adjusted accordingly. The project team then developed a draft ranking by doing an initial scoring and reviewing the draft for each classification with the PIU and Chairman. Tables 3.2 through 3.5 present the ranking criteria and weights used for the Raw Water, Water Treatment Plant, Laboratory and Distribution categories. For the Mapping and GIS category, there was consensus that ranking within the category was unnecessary, and that ranking with the consolidated list of all projects would suffice.

**Table 3.2**  
**Ranking Criteria and Weights**  
**Raw Water Supply**

▪ Capacity	30%
▪ Water Quality	20%
▪ Reliability	10%
▪ O&M	10%
▪ Regulatory Compliance	10%
▪ Operational Flexibility	5%
▪ Ease of Implementation	5%
▪ Gov't Agency Acceptance	5%
▪ Public Acceptance	5%

**Table 3.3**  
**Ranking Criteria and Weights**  
**Water Treatment Plants**

▪ Capacity	30%
▪ Water Quality	30%
▪ Reliability	10%
▪ O&M	10%
▪ Regulatory Compliance	10%
▪ Operational Flexibility	5%
▪ Ease of Implementation	5%

**Table 3.4**  
**Ranking Criteria and Weights**  
**Laboratory**

▪ Staffing/Training	30%
▪ Facilities and Equipment	20%
▪ Organization/Administration	20%
▪ QA/QC	20%
▪ Operational Efficiency	5%
▪ Safety	5%

**Table 3.5**  
**Ranking Criteria and Weights**  
**Distribution System**

▪ Capacity	35%
▪ Reliability of O&M	25%
▪ Water Quality	10%
▪ Energy Efficiency	10%
▪ Safety	10%
▪ Ease of Implementation	10%

It was acknowledged that some of the criteria are overlapping, and have different meanings as applied to the various categories. It was also acknowledged that ranking by category would be superseded by the consolidated ranking (see Section 3.4, below). However, it was believed that the ranking within categories would be a useful guide for reaching consensus on the final consolidated ranking, and that the final ranking should include the application of engineering judgement by USAID, AWGA and the project team to the scoring using the criteria, weights and individual scores assigned. Table 3.6 presents the results of the rankings by classification of projects.

Table 3.6 includes a brief description of each high priority-eligible project and a short explanation of the benefit of the project to AWGA. It also indicates the ranges of capital costs within which it is expected that individual projects will fall; and the probable time required for implementation, also expressed as a range.

**Table 3.6**  
**Project Rankings by Classification**

No.	Description of Alternative	Benefit to AWGA <sup>(1)</sup>	Relative Cost (1)	Timing of Implm. (2)
<b>Raw Water Supply</b>				
RW-1	Establish joint AWGA/MWRI steering committee to coordinate master planning projects and to develop joint policies and procedures for managing the raw water supply system.	Will facilitate the execution of canal improvement projects and improve the overall management of the raw water supply system.	L	S
RW-2	Enlarge cross-section of MC from KM 0 to 16 using sheet pile construction to increase canal carrying capacity.	Proposed MWRI project; will increase canal hydraulic capacity to meet AWGA's future water supply needs.	VH	L
RW-3	Implement MC rehabilitation program (KM 67 to 75) including canal dredging, clean-up and embankment lining; removal of illegal structures and industrial discharges.	Increases the hydraulic capacity and available storage in the MC; will allow re-opening MC intakes to RP, Nozha and FEG WTPs; will improve overall system reliability.	H	M
RW-4	Enforce annual program of removal and off-site disposal of deep-rooted weeds and floating hyacinths to increase canal hydraulic capacity.	Increase canal capacity and reduce water loss; may reduce the scope of costly canal improvement projects.	L	S
RW-5	Implement irrigation demand management program using automatic irrigation control gates, blending of branch canal and drain water, and improved flow allocation methods to agricultural lands.	Approved program by MWRI; projected to reduce irrigation consumption by 15% during peak periods.	VH	VL
RW-6	Redirect drain canal flows (which convey wastewater flows) away from Rosetta Branch to reclaimed lands.	Proposed MWRI project; will improve raw water quality delivered to MC.	VH	VL
RW-7 <sup>(a)</sup>	Use hydrodome (North Airport Lake) for emergency raw water supply storage for MC and DWC raw water supply system.	Will improve reliability of raw water supply in event that MWRI is not able to deliver AWGA's peak water supply requirements.	H	M
RW-8	Upgrade DWC by removing hydraulic restrictions and lining embankments subject to erosion.	Will increase hydraulic capacity and prevent bank failures.	H	M
RW-9	Maximize reliance on flows from the KC to improve water quality.	Improved blended raw water quality in MC, downstream of KC.	M	S
<b>Water Treatment Plants General (Applies to Multiple WTPs)</b>				
WTG-1	Furnish mobile pilot plant and conduct study to evaluate alternative filter media configurations at higher loading rates using alternative treatment chemicals.	Supports the selection of filter media and development of design criteria for the filtration process.	M	S
WTG-2	Install raw water flow meters, transmitters and instrumentation to allow proper dosing and flow pacing of treatment chemicals, and flow splitting across process trains.	Prevents overloading of unit processes; improves pretreatment and filtration performance; reduces chemical treatment costs.	H	M
WTG-3	Repair or replace the filter control system for "upgradeable" filters including: control console, valves, flow, level and head loss control, pneumatic operators and instrument air system.	Improves performance and reliability of filter operations.	H	M
WTG-4	Install primary flow calibration devices (e.g., Pitometer taps) to calibrate existing ultrasonic treated water flow meters and provide equipment upgrades to protect meters from power surges.	Improves accuracy and reliability of flow measurements; reduces susceptibility of existing meters to power surges.	L	VS
WTG-5	Install diesel emergency standby generators to replace non-functional equipment at WTPs.	Improves reliability of WTPs during power outages.	H	M
WTG-6	Repair or replace defective equipment for the Italba process trains, including: Siouf, Rond Point, Noubaria.	Improves overall performance of Italba units and reduces maintenance requirements.	H	M

**Table 3.6**  
**Project Rankings by Classification**

No.	Description of Alternative	Benefit to AWGA <sup>(3)</sup>	Relative Cost (1)	Timing of Implem. (2)
<b>Specific (Applies to Individual WTPs)</b>				
WT1-1	Construct new intake with mechanical screen, rehabilitate intake channel and install new parallel 1,500 mm pipeline at Siouf WTP to increase raw water carrying capacity.	Will increase capacity and reduce sediment loads by allowing settling in the channel.	H	M
<b>Laboratories</b>				
L-1	Perform a comprehensive evaluation of the Central Laboratory and WTP labs.	Results in specific recommendations for upgrading AWGA's laboratory facilities and organization to comply with drinking water standards.	VL	VS
L-2	Provide all required laboratory analytical equipment for monitoring raw and treated water quality, as recommended under L-1.	Improves in-house capability for monitoring pesticides, heavy metals, trace organics and inorganics and petroleum byproducts.	M	S
L-3	Train central laboratory staff in the proper operation of laboratory equipment for biological, bacteriological, organics and inorganic analyses; coordinate with Dutch and GTZ training programs.	Provides in-house laboratory expertise for expanded raw water supply, WTP and distribution system water quality monitoring programs.	L	S
L-4	Design and install a LIMS for the Central Laboratory and WTP labs, as recommended under L-1.	Streamlines communications and data sharing between the Central and WTP labs, and facilitates data analysis and report preparation.	M	M
L-5	Establish a library of standard reference books and journal subscriptions related to water quality analysis and treatment	Helps laboratory, engineering and operational staff to keep abreast of changing WTP technologies, analytical techniques and operational practices.	L	S
L-6	Implement a 4-month raw water quality monitoring program focussing on pesticides, heavy metals, and target pathogens (Giardia and Cryptosporidium).	Provides critical WQ data to support investments in laboratory equipment and need for expanded water quality monitoring program.	L	VS
L-7	Provide automatic composite sampling stations to collect representative samples for WQ analysis on the MC and NC.	Allows representative grab samples to be collected over a 24-hour sampling period to capture diurnal water quality events.	M	S
L-8	Modify procurement procedures for central laboratory to assure availability of reagents, gasses and instrument replacement parts at all times.	Resolves critical laboratory supply shortages resulting from extended shipping delays (up to 1 year) for imported laboratory items.	VL	S
L-9	Provide a 4-wheel drive vehicle for collecting samples and transporting samples to Central Lab.	Facilitates sampling and transporting samples to the Central Laboratory.	L	S
L-10	Provide a motor boat and trailer for routine sampling of the MC and NC.	Facilitates WTP sampling, particularly for the NC which is only sampled 1-2 times per year due to poor access roads.	L	S
<b>Distribution System</b>				
D-1	Replace old distribution pipelines in the downtown area.	Increased capacity, efficiency and quality of service to existing customers; reduced O&M costs.	VH	M
D-2	Update distribution system O&M equipment.	Improved system operations, shorter repair periods.	M	S

**Table 3.6**  
**Project Rankings by Classification**

No.	Description of Alternative	Benefit to AWGA <sup>(a)</sup>	Relative Cost (1)	Timing of Implem. (2)
<b>Mapping and GIS</b>				
MGIS-1A	Upgrade AutoCAD licenses for the modeling group and the mapping group in the survey department; provide AutoCAD training for the modeling and survey departments.	Currently AWGA does not have sufficient recent-version AutoCAD licenses for their immediate needs; by upgrading now all versions will be the same when M-P software and hardware is turned over; AutoCAD operators have received AutoCAD training; supervisors should receive similar training.	VL	S
MGIS-1B	Upgrade ArcView licenses for the modeling group and the mapping group in the survey department	By upgrading now all versions will be the same when M-P software and hardware is turned over.	VL	VS
MGIS-2	Upgrade AWGA Trimble GPS gear now in the survey department	Upgrading the existing equipment will allow much greater accuracy, usability, and versatility than the equipment now has	VL	VS
MGIS-3	Handheld GPS, submeter, with satellite and beacon real-time correction	Provides a portable unit capable of high accuracy position calculations for field inventory work	VL	VS
MGIS-4	Buy Zeiss software for the survey department and provide training for same: Traverse Program for the Zeiss TC1100	The software would allow automated computations of traverses for the survey department's existing total station.	VL	S
MGIS-6	Acquire satellite imagery to facilitate remote sensing of development patterns in Alexandria over time (multi-year series of images)	Would demonstrate where growth trends have occurred in the greater Alexandria area in the recent past; this could be used to help identify patterns and directions of future growth.	L	S
MGIS-7	New mapping including new aerial photography, digital orthophotography, and topographic mapping	A comprehensive map upgrade would allow utilities to accurately map facilities; this map base would benefit users including other utilities and the governorate.	H	M
MGIS-8	Support and help facilitate the expansion of GIS and the block mapping program as implemented by GTZ	This base map would support utilities, business and technical functions.	H	M

1. Costs categories:

VH = Very high cost (>\$10 million USD)  
H = High cost (\$1million - \$10 million USD)  
M = Medium cost (\$100,000 - \$1 million USD)  
L = Low cost (\$20,000 - \$100,000 USD)  
VL = Very low cost (< \$20,000 USD)

2. Time of Implementation Categories:

(following project approval)  
VS = Very Short (< 6 months)  
S = Short (6 - 12 months)  
M = Medium (1 - 5 years)  
L = Long (5-10 years)  
VL = Very Long (> 10 years)

3. Abbreviations:

AWGA: Alexandria Water General Authority  
DWC: Drinking Water Canal  
GIS: Geographic Information System  
GPS: Global Positioning System  
KC: Khandak Canal  
KM: Kilometer (stationing on canal)  
LIMS: Laboratory Information Management System  
MC: Mahmoudia Canal  
MWRI: Ministry of Water Resources and Irrigation  
NC: Noubaria Canal  
O&M: Operation and Maintenance  
PS: Pumping Station  
WQ: Water Quality  
WTP: Water Treatment Plant

(a) Project subsequently modified to feasibility study for potential use of lake.

### 3.4 Consolidated Ranking

Following the ranking of project lists within each classification, the project team developed a proposed methodology, a set of criteria and weighting and a scoring system for developing a single, consolidated, prioritized ranking of all HPP. The approach was reviewed and approved by USAID and AWGA through the Chairman and the PIU.

Development of procedures, draft rankings and scorings, and review meetings took place over several weeks. During that time, additional projects were added and/or it became apparent that given projects' definition could occur in time for their design to proceed as HPP. For this reason, several projects were added, in several classifications. It was agreed that it was not necessary to revise the ranking of classifications, but to allow the consolidated ranking to prioritize such projects relative to others. Those projects added later include: WTG-7 through WTG-14; WT1-2, WT7-1 and WT5-1; D-3, D-4 and D-5; RW-17 through 21; RW-23 and RW-24.

Table 3.7 presents the "Global Non-Cost Ranking Criteria" agreed upon for developing the consolidated ranking.

**Table 3.7**  
**Global Non-Cost Ranking**  
**Criteria**

▪ Adequate Quantity	25%
▪ System Reliability	20%
▪ Operations and Maintenance	20%
▪ Regulatory Compliance	10%
▪ Percentage of Population Served	10%
▪ Organization/Administration	5%
▪ Supports Master Plan Project Work	5%
▪ Speed of Implementation	5%

Guidance for scoring the projects by the criteria was also agreed upon, as follows:

- Adequate Quantity. Improves the probability of AWGA being able to deliver quantity of water required by customers' demands in the future:
  - Sufficient flow in water supply canals.
  - Adequate production capacity, redundancy and flexibility.
  - Adequate transmission, distribution and storage capacity.
- System Reliability. Improves the reliability of the AWGA system to meet future water supply needs during critical events:
  - Peak irrigation/water supply demand periods.
  - Power outages.
  - Equipment failures.
  - Canal system structural or operational problems.

- Unusual water quality events.
- Operations and Maintenance. Improves AWGA's operations and maintenance practices, including:
  - Energy efficiency.
  - Operating costs.
  - Treated water quality.
  - System pressures.
  - Leakage detection.
  - Pipeline, equipment and vehicle repairs.
  - Preventive maintenance practices.
  - Quality control procedures.
- Regulatory Compliance. Improves AWGA's ability to comply with GOE regulations and standards:
  - Drinking water quality standards (Law 27).
  - Canal waterways pollution standards (Law 48).
  - Solid waste management (Law 38).
  - Wastewater discharges to sewer (Law 93).
- Percentage of Population Served. Directly benefits the population to be served by AWGA through the master plan period. Evaluated alternatives based on:
  - Impacts most of service area.
  - Impacts  $\pm$  75% of service area.
  - Impacts  $\pm$  50% of service area.
  - Impacts  $\pm$  25% of service area.
  - Impacts  $<$  15% of service area.
- Organization/Administration. Strengthens the AWGA organization and administrative functions, including:
  - Communications across operating units.
  - Tools for improving data acquisition and management.
  - Training of staff.
  - Accuracy of data for improving daily operations and forecasting.
- Supports Master Plan Project Work. Supports the studies and analyses performed under the master plan and/or subsequent pre-design analyses, including:
  - Mapping of the AWGA service area.
  - Population forecasting.
  - Demand forecasting.
  - Treatment process evaluations.
  - WTP hydraulic analyses.
  - Water quality trending.

- Speed of Implementation. Project can be completed within a specified time frame. Evaluated alternatives based on:
  - Very long-term (>10 years).
  - Long-term (5-10 years).
  - Medium-term (1-5 years).
  - Short-term (6 months-1 year).
  - Very short-term (<6 months).

Using the guidance provided above, the project team prepared a draft scoring and ranking of the consolidated project list. The ranking was reviewed and agreed upon by USAID and AWGA through the Chairman and PIU.

Table 3.8 presents the scoring and ranking agreed upon for the consolidated list. As noted at the beginning of this section, several projects were added after ranking within separate categories had been done. Most of these added projects were scored and ranked in Table 3.8 with those from the original category lists. In a few cases, projects were added subsequent to the presentation of the consolidated ranking to the PIU. For such projects, a consensus overall weighted score was assigned and these projects have been inserted on Table 3.8 without scores for individual criteria.

**Table 3.8  
Consolidated Ranking**

No. (1)	Description of Alternative (2)	Relative Cost (Million US\$)	Adequate Quantity		System Reliability	O & M	Regulatory Compliance	Population Served	Ogran. & Admin	Supports MP Work	Speed of Implem.	Raw Score	Weighted Score (10 maximum)
			25%	20%									
			25%	20%	20%	10%	10%	5%	5%	5%			
RW-1	Establish joint AWGAMMWR management structure to coordinate master planning projects and to develop joint policies and procedures for managing the raw water supply system.	0.02-0.1	10	10	7	10	10	7	10	10	10	74	9.25
WTG-1	Furnish a mobile pilot plant and conduct pilot study to evaluate alternative filter media configurations at higher loading rates using alternative treatment chemicals.	0.1-1	7	10	10	10	10	6	10	10	10	73	9.05
WTG-7	Provide centralized chlorine storage and handling system for all WTPs.	1-10	8	10	10	10	10	7	5	5	5	65	8.85
L-1	Perform a comprehensive evaluation of the Central Laboratory and WTP labs.	< 0.02	5	10	10	10	10	10	10	10	10	75	8.75
WTG-12	Develop capability for calibrating and maintaining WTP instrumentation including: training of instrument technicians, purchase of special tools, for instrument calibration and spare parts	0.1-1	9	9	9	9	10	8	5	5	5	64	8.65
WTG-2	Install raw water flow meters, transmitters and instrumentation to allow proper dosing and flow pacing of treatment chemicals, and flow splitting across process trains.	1-10	7	10	10	8	10	10	5	5	5	65	8.55
D-4	Conduct a detailed study of informal housing areas to include statistically valid determination of water and sewer service, populations and other relevant information.	0.1-1											8.50
RW-2 <sup>nd</sup>	Enlarge cross-section of MC from KM 0 to 16 to increase canal carrying capacity.	> 10	10	10	8	8	8	5	5	5	5	59	8.45
RW-3	Implement MC rehabilitation program (KM 67 to 75) including: canal dredging, clean-up and embankment lining; removal of illegal structures and industrial discharges.	1-10	9	10	8	10	8	5	5	5	5	60	8.40
WT5-1	Conduct an operations testing program at Nozha WTP. Recommend repair, replacement or modifications to place the plant in full operation including raw water supply upgrade	1-10											8.40
WTG-3	Repair or replace the filter control system for "upgradeable" filters including: control console, valves, flow, level and head loss control, pneumatic operators and instrument air system.	1-10	8	10	9	8	10	5	5	5	5	60	8.35
RW-23	Conduct detailed hydraulic analysis of the MC System to predict effects of proposed improvement projects, O&M practices, future demands.	0.1-1											8.35
L-3	Train central laboratory staff in the proper operation of laboratory equipment for biological, bacteriological, organics and inorganic analyses; coordinate with Dutch and GTZ training programs.	0.02-0.1	5	10	10	10	10	10	5	7	7	67	8.35
D-1	Replace old distribution pipelines in the downtown area.	> 10	9	10	9	8	7	7	5	3	3	58	8.30
WTG-9	Install on-line analyzers for monitoring turbidity, chlorine and pH at critical locations in WTP process trains.	0.1-1	7	8	10	10	10	8	5	5	5	63	8.25
MGIS-7	New mapping including new aerial photography, digital orthophotography, and topographic mapping	1-10	5	9	8	6	10	10	5	5	5	58	8.25
MGIS-8	Extend block mapping project begun under GTZ program and integrate with System-wide GIS.	1-10											8.20
RW-7	Conduct feasibility study of North Airport Lake for emergency raw water supply storage for MC and DWC raw water supply system.	0.1-1	9	10	8	8	8	5	5	5	5	58	8.20
WTG-4	Install primary flow calibration devices (e.g., Pitometer taps) to calibrate existing treated water ultrasonic flow meters and provide equipment upgrades to protect meters from power surges.	0.02-0.1	6	9	8	8	10	10	10	10	10	71	8.20
RW-24	Support and assist MWRI enforcement of Law 48. Monitoring, policing, and public outreach.	0.02-0.1											8.15
RW-19	Conduct a feasibility study for North Coast water supply alternatives: aquifer storage, brackish water treatment or desalination	0.1-1.0											8.15
WTG-14	Provide a centralized control system for the Siouf, Manshia and RP WTPs, including a central control room and a distributed digital control system with field mounted sensors, controls and alarm devices.	1-10	8	9	10	8	6	8	5	5	5	59	8.10
RW-21	Modify AWGA's raw water supply monitoring program to include composite sampling, pesticide and heavy metal analyses, increased frequency.	0.1-1											8.10

**Table 3.8  
Consolidated Ranking**

No. (1)	Description of Alternative <sup>(2)</sup>	Relative Cost (Million US\$)	Adequate Quantity		System Reliability		O & M	Regulatory Compliance	Population Served	Operan. & Admin	Supports MP Work	Speed of Implem.	Raw Score	Weighted Score (10 maximum)
			25%	20%	20%	10%								
			25%	20%	20%	10%								
WTG-10	Upgrade WTP intakes with new coarse bar racks, mechanically cleaned screens and facilities to collect and store screening materials.	1-10	9	8	9	6	10	5	5	5	5	57	8.00	
D-2	Upgrade O&M Equipment, to include: tapping machines for making house connections, equipment to support a leak detection program, pressure gage calibration equipment, tools for district maintenance teams, powered valve operators and possible service vehicles.	0.1-1	7	9	10	6	10	5	5	5	7	59	8.00	
RW-20	Implement/complete program to treat/divert wastewater flows from the Umum	1-10											8.00	
D-3	Repair or replace defective treated water pumps and upgrade storage reservoirs.	1-10	9	10	9	7	5	5	5	5	5	55	8.00	
RW-8	Upgrade DWC by removing hydraulic restrictions and lining embankments subject to erosion.	1-10	9	8	10	8	5	5	5	5	5	55	7.90	
L-6 <sup>99</sup>	Implement a 4-month raw water quality monitoring program focussing on pesticides, heavy metals, and target pathogens (Giardia and Cryptosporidium).	0.02-0.1	6	10	5	10	10	7	10	10	10	68	7.85	
RW-4	Enforce annual program of removal and off-site disposal of deep-rooted weeds and floating hyacinths to increase canal hydraulic capacity.	0.02-0.1	9	8	7	6	10	5	5	5	10	60	7.85	
WTG-6	Repair or replace defective equipment for the Italba process trains, at the following WTPs: Siouf; Rond Point; Noubaria; Borg El Arab.	1-10	8	9	9	8	7	5	5	5	5	56	7.85	
WTG-13	Repair and replace defective equipment for Pulsator units, including vacuum chambers, compressors, sludge drawoff system and appurtenances for the following WTPs: Manshia; RP; Siouf; FEG.	1-10	8	9	9	8	7	5	5	5	5	56	7.85	
WTG-11	Provide required tools, equipment and spare parts for WTP workshops.	0.1-1	6	9	10	6	10	5	5	5	7	58	7.75	
L-2	Provide required laboratory analytical equipment and gasses for monitoring raw and treated water quality, as recommended under L-1.	0.1-1	5	8	9	10	10	8	5	5	7	62	7.65	
D-5	Upgrade equipment and augment as necessary to implement a system-wide wireless communication system	0.02-0.1											7.50	
WTG-5	Install diesel emergency standby generators to replace non-functional equipment at WTPs.	1-10	8	9	7	6	9	5	5	5	5	54	7.45	
L-7	Provide automatic composite sampling stations to collect representative samples for WQ analysis on the MC and NC.	0.1-1	5	7	7	9	10	9	10	10	10	67	7.40	
WTG-8	Implement WTP residuals management program that meets water quality, regulatory, operations goals cost effectively.	1-10	6	8	7	10	10	6	5	5	7	59	7.40	
WT1-2	Develop new sanitary waste system at Siouf WTP .	0.1-1	5	6	8	10	2	5	5	5	5	46	7.30	
RW-5	Implement irrigation demand management program using automatic irrigation control gates, blending of branch canal and drain water, and improved flow allocation methods to agricultural lands.	>10	8	7	6	9	10	5	5	5	5	55	7.25	
L-8	Modify procurement procedures for central laboratory to assure availability of reagents, gasses and instrument replacement parts at all times.	<0.02	5	8	7	10	10	8	5	5	7	60	7.25	
RW-17	Conduct planning for Noubaria Canal RWS alternatives after Umum Drain discharge to NC comes online.	0.1-1											7.20	
WT1-1 <sup>99</sup>	Construct new intake with mechanical screens, rehabilitate intake channel and install new parallel 1,500 mm pipeline at Siouf WTP to increase raw water carrying capacity.	1-10	8	9	9	6	2	5	5	5	5	49	7.15	
L-5	Establish a library of standard reference books and journal subscriptions related to water quality analysis and treatment	0.02-0.1	5	7	7	10	10	8	5	5	7	59	7.05	
L-4	Provide a LIMS for the Central Laboratory and WTP labs, as recommended under L-1.	0.1-1	5	8	7	8	10	10	5	5	5	58	7.05	
L-9	Provide a 4-wheel drive vehicle for collecting samples transporting samples to Central Lab.	0.02-0.1	5	6	6	9	10	9	10	10	10	65	7.00	
L-10	Provide a motor boat and trailer for routine sampling of the MC and NC.	0.02-0.1	5	6	6	9	10	9	10	10	10	65	7.00	

**Table 3.8  
Consolidated Ranking**

No. (1)	Description of Alternative <sup>(a)</sup>	Relative Cost (Million US\$)	Adequate Quantity		System Reliability		O & M		Regulatory Compliance		Population Served		Ogran. & Admin		Supports MP Work		Speed of Implem.		Raw Score	Weighted Score (10 maximum)
			25%	20%	20%	10%	10%	10%	5%	5%	5%	5%								
MGIS-2	Upgrade AWGA Trimble GPS gear now in the survey department	< 0.02	5	6	7	5	10	8	10	10	10	61	6.75							
MGIS-3	Provide handheld GPS, submeter, with satellite and beacon real-time correction	< 0.02	5	6	7	5	10	8	10	10	61	6.75								
RW-18	Construct 12.5 km of 1,500 mm raw water pipeline from Siouf raw water pump station to Maamoura WTP to augment existing 1,500 mm raw water pipeline.	> 10	9	7	8	6	1	5	5	5	46	6.70								
MGIS-1A	Upgrade AutoCAD licenses for the modeling group and the mapping group in the survey department; provide AutoCAD training .	< 0.02	5	6	7	6	10	9	5	10	58	6.65								
MGIS-1B	Upgrade ArcView licenses for the modeling group and the mapping group in the survey department	< 0.02	5	6	7	6	10	9	5	10	58	6.65								
RW-9	Maximize reliance on flows from the KC to improve water quality.	0.1-1	5	8	6	9	8	5	5	7	53	6.60								
MGIS-6	Acquire satellite imagery to facilitate remote sensing of development patterns in Alexandria over time (multi-year series of images). Plot current major land features on images.	0.02-0.1	5	6	5	6	10	10	10	10	62	6.55								
RW-6	Redirect drain canal flows (which convey wastewater flows) away from Rosetta Branch to reclaimed lands.	> 10	4	8	7	10	10	5	5	1	50	6.55								
WT7- <sup>(d)</sup>	Upgrade existing circular clarifiers at BEA WTP.	0.1-1	8	7	8	7	1	5	5	5	48	6.55								
MGIS-4	Provide Zeiss software for the survey department and provide training for same: Traverse Program for the Zeiss TC1100	< 0.02	5	6	7	5	10	8	5	7	53	6.35								

Notes: 1. Numbering System  
RW: Raw water  
WTC: WTP General  
L: Laboratories  
D: Distribution System  
WT1: Siouf WTP  
WT4: Maamoura WTP  
WT7: Borg El Arab WTP  
MGIS: Mapping and GIS

2. Abbreviations:  
AWGA: Alexandria Water General Authority  
BEA: Borg El Arab WTP  
DWC: Drinking Water Canal  
FEG: Fom El Geraya WTP  
GIS: Geographic Information System  
GPS: Global Positioning System  
GTZ: German Technical Assistance Program  
KC: Khandak Canal  
KM: Kilometer (canal stationing)  
LIMS: Laboratory Information Management System  
MC: Mahmoudia Canal  
MP: Master Plan  
MWRI: Ministry of Water Resources and Irrigation  
NC: Noubaria Canal  
O&M: Operation and Maintenance  
PS: Pumping Station  
RP: Rond Point WTP  
RWS: Raw Water Supply  
WQ: Water Quality  
WTP: Water Treatment Plant

(a) Subsequently dropped as a HPP because its definition is recommended to follow the hydraulic analysis to be conducted under RW-23  
(b) Subsequently dropped as HPP. To be incorporated in Master Plan.  
(c) Subsequently dropped as HPP. Parallel conduit not required, intake structure included in WTP-10, mechanisms to be provided under Dutch program.  
(d) Subsequently dropped as HPP. To be incorporated in long-term plan.

## Section 4.0 Implementation Issues

In addition to issues related to funding availability, there are several other implementation matters which impact the High Priority Projects' implementability. These include:

- The fact that several of the HPP, especially for Raw Water Supply, are actually to be performed under other GOE agencies' programs. However, their importance to AWGA dictates that they be carried as HPPs and that AWGA establishes and maintains an active involvement in their planning and execution.
- Other donor agencies, currently through the Dutch and German programs, are involved in programs and projects which overlap with or complement HPP carried in this report.
- The fact that the Institutional Strengthening Contract (ISC) project is still in its evaluation/recommendation phase. Thus certain equipment procurement, training and other activities indicated in this report as potential ISC activities, may or may not fit with the ISC team's recommended program for implementation.
- Several HPP could be implemented with Private Sector Participation (PSP).

### 4.1 Potential Participation – Other Agencies/Programs

As indicated in Section 2.2, the HPP list development included input from the Dutch and German donors' teams as well as from the MWRI and the Social Fund. There are many items on the HPP list which require participation by, or potentially overlap with programs or projects of those agencies. Such programs and/or projects affect or are affected by the following listed HPP (in their order of ranking on Table 3.8):

- RW-1, AWGA/MWRI Cooperative Management Structure. This will require cooperative development of a set of protocols and procedures for working together and with other stakeholder agencies.
- WTG-1, Mobile Pilot Plant. As of the writing of this report, the Dutch team working at AWGA was pursuing the possibility of a jointly-funded (with AWGA), locally manufactured unit. If this approach is implemented, the unit recommended as a USAID-funded HPP can be dropped.
- L-1, Laboratory Benchmarking, L-3, Laboratory Staff Training. These projects, and all others pertaining to laboratory evaluation, training and equipment (WTG-12, L-2, L-8, L-5 and L-4) need to be coordinated with the ISC, Dutch and German programs to eliminate overlap.
- D-4, Detailed Study of Informal Housing Area. This project should be carried out cooperatively with AGOSD.

- RW-2, Enlarging Cross-Section, KM 0-16, Mahmoudia Canal. (Not carried as HPP). This is a MWRI project, which AWGA needs to ensure, through the Steering Committee, is given appropriate priority by the Ministry, following the hydraulic analysis recommended in RW-23.
- RW-3, Phase III, Mahmoudia Canal Rehabilitation Program. This is a Social Fund Program, requiring the cooperation and participation of both AWGA and MWRI.
- RW-23, Detailed Hydraulic Analysis, Mahmoudia Canal. This is a technical study requiring close support and cooperation with the MWRI.
- D-1, Replace Distribution System Pipelines. This project will require review by, and close field coordination with AGOSD, the gas and electric companies and other entities with underground utilities or structures.
- MGIS-7, New Mapping from Aerial Photography. This is a program which should be carried out by the Governorate and/or as a cooperative venture of all the utilities in Alexandria.
- MGIS-8, Extended GIS and Block Mapping. This is also a program which could be a Governorate and/or all-utilities cooperative effort. However it will greatly benefit AWGA even if done only for the water system.
- RW-7, Feasibility Study of North Airport Lake For Emergency Storage. This is a technical study which will require coordination with the MWRI and Ministry of Agriculture.
- RW-24, Implement Water Quality Enforcement Programs. Recommended as a joint AWGA/MWRI program.
- RW-19, Conduct North Coast Feasibility Studies. This is a technical study requiring close coordination with MHUUC and MWRI.
- WTG-10, Upgrade all WTP Intakes. Needs to be closely coordinated with Dutch program to rehabilitate the Siouf WTP intake, and with the Mahmoudia Canal Rehabilitation project.
- D-2, Upgrade Distribution System Equipment. This project, and all others requiring the furnishing of equipment for operation and/or maintenance, need to be coordinated with the Dutch and German programs to eliminate overlap.
- RW-20, Program to Divert WW from Umum Drain. A MWRI program, which should be a focus of the AWGA/MWRI Steering Committee.
- RW-4, Annual Canal Maintenance Program. This is a MWRI program which should be a focus of the Steering Committee.
- WTG-11, Tools, Equipment, Spare Parts for WTPs. To be coordinated with Dutch and German programs.

- WTG-8 and WT1-2 Residuals Management Program and Siouf Sanitary Wastewater. The program, and specific project at the Siouf WTP, require coordination and consensus with AGOSD.
- RW-5, Irrigation Demand Management Program. This is a MWRI program which should be a focus of the Steering Committee.
- RW-17, Conduct Planning for Umum Drain Impacts. This is a technical study requiring close coordination with the MWRI.
- RW-9, Maximize Flow from Khandak Canal. This is a policy which would be carried out by the MWRI with a focus by the Steering Committee.
- RW-6, Redirect Drain Canal Flows Away from Rosetta Branch. This is also a policy to be carried out by the MWRI with a focus by the Steering Committee.

## 4.2 Sources of Funding/In-Kind Contributions

In addition to USAID grant funding, there are sources of funds which will or should be available for some of the High Priority Projects. Table 4.1 presents the consolidated ranked list of projects showing relative costs, implementation time, project type and potential implementing agency or program. Possibilities for funding and implementation include:

- Ministry of Water Resources and Irrigation (MWRI). The Ministry already has plans for several of the HPP and intends to carry them out as part of Ministry-funded (with or without other donors) programs. These include all projects on Table 4.1 for which potential implementation mechanism is indicated as GOE except for RW-3, Mahmoudia Rehabilitation; and RW-19, North Coast Studies (on which Ministry participation is anticipated but not full project implementation or funding); MGIS-7, Mapping/Aerial Photography; and MGIS-8, extend GIS; which would involve other agencies.
- Dutch and German Donor Agencies. Both countries have on-going programs which involve technical assistance, provision of equipment, training and other activities. Projects with specific, identified overlap or connection are noted in Section 4.1. Development of purchase orders for equipment and procurement documents for construction will need to include liaison with both teams to define boundaries and avoid overlaps.
- Social Fund for Development. The Social Fund reportedly has plans, and funding, to complete the beautification project for the Mahmoudia Canal from KM 67 to 75. This would be most of the work anticipated under RW-3.
- USAID Results Package (RP) 263-0270.02. It is anticipated that the RP will be a principal source of funds for most of the projects on the HPP list which proceed to implementation in the next year or two. Maximum potential funding for HPP is not yet established. Projects expected to be included in the design/construction management and/or construction/equipment packages to follow this master plan are indicated in the "Potential Implementation column of Table 4.1 as "RP". Training

and equipment expected to be provided under the Institutional Strengthening Contract, including the set-aside for Host Country Procurement, is shown as "ISC".

- AWGA/GOE. The Results Package Grant Agreement calls for contribution in cash and "in-kind" by the grant recipients. In order to provide the contribution called for in the overall grant agreement financial plan, AWGA will be expected to contribute a US dollar equivalent of approximately \$35 million. It is anticipated that the construction contracts under the RP will be jointly funded by USAID and AWGA.
- PSP. As noted in the introduction to Section 4.0, above, several of the HPP could be undertaken with participation by the private sector. As indicated in Section 2.1, Concurrent Reports, the Preliminary Report on Private Sector Participation outlines such possibilities.

**Table 4.1**  
**Project Implementation Possibilities**

No. <sup>(1)</sup>	Description of Alternative <sup>(2)</sup>	Relative Cost (Million US\$)	Implementation Time (Years)	Project Type <sup>(3)</sup>	Potential Implementation <sup>(4)</sup>
RW-1	Establish joint AWGA/MWRI management structure to coordinate master planning projects and to develop joint policies and procedures for managing the raw water supply system.	0.02-0.1	0.5-1	Inst	AWGA/ GOE
WTG-1	Furnish a mobile pilot plant and conduct pilot study to evaluate alternative filter media configurations at higher loading rates using alternative treatment chemicals.	0.1-1	0.5-1	Equip/ Svcs	RP/DA
WTG-7	Provide centralized chlorine storage and handling system for all WTPs.	1-10	1 - 5	Const	RP
L-1	Perform a comprehensive evaluation of the Central Laboratory and WTP labs.	< 0.02	<0.5	Svcs	ISC/DA
WTG-12	Develop capability for calibrating and maintaining WTP instrumentation including: training of instrument technicians and furnishing of special tools for instrument calibration and spare parts	0.1-1	0.5-1	Tng / Equip	ISC
WTG-2	Install raw water flow meters, transmitters and instrumentation to allow proper dosing and flow pacing of treatment chemicals, and flow splitting across process trains.	1-10	1 - 5	Const	RP
D-4	Conduct a detailed study of informal housing areas to include statistically valid determination of water and sewer service, populations and other relevant information.	0.1-1	0.5-1	Svcs	RP
RW-3	Implement MC rehabilitation program (KM 67 to 75) including: canal dredging, clean-up and embankment lining; removal of illegal structures and industrial discharges.	1-10	1 - 5	Const	GOE/ AWGA
WT5-1	Conduct an operations testing program at Nozha WTP. Recommend repair, replacement or modifications to place the plant in full operation including raw water supply upgrade	1-10	<0.5	Const	RP
WTG-3	Repair or replace the filter control system for "upgradeable" filters including: control console, valves, flow, level and head loss control, pneumatic operators and instrument air system.	1-10	1 - 5	Const	RP
RW-23	Conduct detailed hydraulic analysis of the MC System to predict effects of proposed improvement projects, O&M practices, future demands.	0.1-1	0.5-1	Svcs	RP
L-3	Train central laboratory staff in the proper operation of laboratory equipment for biological, bacteriological, organics and inorganic analyses; coordinate with Dutch and GTZ training programs.	0.02-0.1	0.5-1	Tng	ISC/DA
D-1	Replace old distribution pipelines in the downtown area.	> 10	1 - 5	Const	RP
WTG-9	Install on-line analyzers for monitoring turbidity, chlorine and pH at critical locations in WTP process trains.	0.1-1	1 - 5	Const	RP
MGIS-7	New mapping including new aerial photography, digital orthophotography, and topographic mapping	1-10	1-5	Svcs	GOE
MGIS-8	Extend block mapping project begun under GTZ program and integrate with System-wide GIS.	1-10	1-5	Svcs	RP

**Table 4.1  
Projects Implementation Possibilities**

No. <sup>(1)</sup>	Description of Alternative <sup>(2)</sup>	Relative Cost (Million US\$)	Implementation Time (Years)	Project Type <sup>(3)</sup>	Potential Implementation <sup>(4)</sup>
RW-7	Conduct feasibility study of North Airport Lake for emergency raw water supply storage for MC and DWC raw water supply system.	0.1-1	1-5	Svcs	RP
WTG-4	Install primary flow calibration devices (e.g., Pitometer taps) to calibrate existing treated water ultrasonic flow meters and provide equipment upgrades to protect meters from power surges.	0.02-0.1	<0.5	Const	RP
RW-24	Support and assist MWRI in enforcement of Law 48. Monitoring, policing, and public outreach.	0.02-0.1	0.5-1	Inst	AWGA / GOE
RW-19	Conduct a feasibility study for North Coast water supply alternatives: aquifer storage, brakish water treatment or desalination	0.1-1.0	0.5-1	Svcs	RP/DA
WTG-14	Provide a centralized control system for the Siouf, Manshia and RP WTPs, including a central control room and a distributed digital control system with field mounted sensors, controls and alarm devices.	1-10	1-5	Const	RP
RW-21	Modify AWGA's raw water supply monitoring program to include composite sampling, pesticide and heavy metal analyses, increased frequency.	0.1-1	1-5	Equip	RP
WTG-10 <sup>(a)</sup>	Upgrade WTP intakes with new coarse bar racks, mechanically cleaned screens and facilities to collect and store screening materials.	1-10	1-5	Const	RP
D-2	Upgrade O&M Equipment, including: tapping machines for making house connections, equipment to support a leak detection program, pressure gage calibration equipment, tools for district maintenance teams, powered valve operators and possible service vehicles.	0.1-1	0.5-1	Equip	RP/ISC
RW-20	Implement/complete program to treat/divert wastewater flows from the Umum Drain	1-10	1-5	Inst/ Const	GOE
D-3	Repair or replace defective treated water pumps and upgrade storage reservoirs.	1-10	1-5	Const	AWGA
RW-8	Upgrade DWC by removing hydraulic restrictions and lining embankments subject to erosion.	1-10	1-5	Const	AWGA
RW-4	Enforce annual program of removal and off-site disposal of deep-rooted weeds and floating hyacinths to increase canal hydraulic capacity.	0.02-0.1	0.5-1	Inst	GOE
WTG-6	Repair or replace defective equipment for the Italba process trains at the following WTPs: Siouf, Rond Point, Noubaria, Borg El Arab.	1-10	1-5	Const	AWGA
WTG-13	Repair and replace defective equipment for Pulsator units, including vacuum chambers, compressors, sludge drawoff system and appurtenances for the following WTPs: Manshia; RP; Siouf, FEG.	1-10	1-5	Const	AWGA
WTG-11	Provide required tools, equipment and spare parts for WTP workshops.	0.1-1	0.5-1	Equip	ISC

**Table 4.1  
Projects Implementation Possibilities**

No. <sup>(1)</sup>	Description of Alternative <sup>(2)</sup>	Relative Cost (Million US\$)	Implementation Time (Years)	Project Type <sup>(3)</sup>	Potential Implementation <sup>(4)</sup>
L-2	Provide required laboratory analytical equipment for monitoring raw and treated water quality, as recommended under L-1.	0.1-1	0.5-1	Equip	DA/ ISC
D-5	Upgrade equipment and augment as necessary to implement a system-wide wireless communication system	0.02-0.1	0.5-1	Equip	AWGA
WTG-5	Install diesel emergency standby generators to replace non-functional equipment at WTPs.	1-10	1 - 5	Const	RP
L-7	Provide automatic composite sampling stations to collect representative samples for WQ analysis on the MC and NC.	0.1-1	0.5-1	Equip/ Const	RP
WTG-8	Implement WTP residuals management program that meets water quality, regulatory, operations goals cost effectively.	1-10	1-5	Const	RP
WT1-2	Develop new sanitary waste system at Siouf WTP.	0.1-1	1 - 5	Const	RP
RW-5	Implement irrigation demand management program using automatic irrigation control gates, blending of branch canal and drain water, and improved flow allocation methods to agricultural lands.	> 10	> 10	Inst / Const	GOE
L-8	Modify procurement procedures for central laboratory to assure availability of reagents, gasses and instrument replacement parts at all times.	< 0.02	0.5-1	Svcs	ISC
RW-17	Conduct planning for Noubaria Canal RWS alternatives after Umum Drain discharge to NC comes online.	0.1-1	1-5	Svcs	RP
L-5	Establish a library of standard reference books and journal subscriptions related to water quality analysis and treatment	0.02-0.1	0.5-1	Equip	RP
L-4	Provide a LIMS for the Central Laboratory and WTP labs, as recommended under L-1.	0.1-1	1 - 5	Equip	ISC
L-9	Provide a 4-wheel drive vehicle for collecting samples and transporting samples to Central Lab.	0.02-0.1	0.5-1	Equip	RP
L-10	Provide a motor boat and trailer for routine sampling of the MC and NC.	0.02-0.1	0.5-1	Equip	RP
MGIS-2	Upgrade AWGA Trimble GPS gear now in the survey department	< 0.02	<0.5	Equip	ISC
MGIS-3	Provide handheld GPS, submeter, with satellite and beacon real-time correction	< 0.02	<0.5	Equip	ISC
RW-18	Construct 12.5 km of 1,500 mm raw water pipeline from Siouf raw water pump station to Maamoura WTP to augment existing 1,500 mm raw water pipeline.	> 10	1 - 5	Const	RP
MGIS-1	Upgrade AutoCAD and Arcview licenses for the modeling group and the mapping group in the survey department; provide AutoCAD training.	0.02-0.1	0.5-1	Equip / Tng	RP

**Table 4.1  
Project Implementation Possibilities**

No. <sup>(1)</sup>	Description of Alternative <sup>(2)</sup>	Relative Cost (Million US\$)	Implementation Time (Years)	Project Type <sup>(3)</sup>	Potential Implementation <sup>(4)</sup>
RW-9	Maximize reliance on flows from the KC to improve water quality.	0.1-1.0	0.5-1	Inst	GOE
MGIS-6	Acquire satellite imagery to facilitate remote sensing of development patterns in Alexandria over time (multi-year series of images). Plot current major land features on images.	0.02-0.1	0.5-1	Svcs	RP
RW-6	Redirect drain canal flows (which convey treated wastewater flows) away from Rosetta Branch to reclaimed lands.	> 10	>10	Inst/ Const	GOE
MGIS-4	Provide Zeiss software for the survey department and provide training for same: Traverse Program for the Zeiss TC1100	< 0.02	0.5-1	Equip / Tng	ISC

Notes:

1. Numbering System  
RW: Raw water  
WTG: WTP General  
L: Laboratories  
D: Distribution System  
WT1: Siouf WTP  
WT4: Maamoura WTP  
WT7: Borg El Arab WTP  
MGIS: Mapping and GIS

3. Type of Project  
Const = Construction  
Equip = Equipment  
Inst = Institutional  
Svcs = Technical Services  
Tng = Training

4. Potential Implementation  
AWGA = AWGA  
DA = Other Donor Agency  
GOE = Other Govt Agency - Egypt  
ISC = Institutional Strengthening Contract (Including Host Country Procurement program)  
RP = USAID Results Package (design/CMC and construction)

(a) Intake mechanisms at Siouf to be provided under Dutch program.

2. Abbreviations

AWGA: Alexandria Water General Author  
DWC: Drinking Water Canal  
GPS: Global Positioning System  
KC: Khandak Canal  
LIMS: Laboratory Information Manager  
MC: Mahmoudia Canal  
MP: Master Plan  
MWRI: Ministry of Water Resources and Ir  
NC: Noubaria Canal  
PS: Pumping Station  
WTP: Water Treatment Plant  
KM: Kilometer (canal stationing)  
GIS: Geographic Information System  
GTZ: German Technical Assistance Progr  
RP: Rond Point WTP  
BEA: Borg El Arab WTP  
FEG: Fom El Geraya WTP  
RWS: Raw Water Supply

### 4.3 Implementation Possibilities

There are several possibilities for implementation of projects on the HPP list. The potential implementation mechanisms on Table 4.1 include:

- AWGA Contracts. AWGA has, as noted in Section 4.2, an obligation to provide services in-kind or to fund projects in LE. AWGA currently has plans for, or is implementing, the following HPP which are expected to qualify as in-kind contributions:
  - Repair/replacement/upgrade of finished water P.S and reservoirs, D-3.
  - Upgrade/bank protection of the Drinking Water Canal, RW-8.
  - Upgrade wireless communication system.
- Donor Agency Projects. As of this writing there are three HPP known to be planned for implementation under other donors' programs. One is the improvements to the Siouf WTP intake (part of WTG-10) under the Dutch program; the second is the provision of a mobile pilot plant (WTG-1) by the Dutch program; the third is the provision of certain laboratory equipment (L-2) under the GTZ program.
- GOE Projects. The MWRI, the Governorate and the Social Fund have been asked to participate in the Canal Rehabilitation Program (RW-3). The Governorate, AGOSD and other local utilities should be asked to participate in the GIS and mapping projects (MGIS-7 & 8).
- ISC Provision of Training and Equipment. The Institutional Strengthening Contract has provisions for laboratory evaluation and training and for provision of equipment for AWGA. It is recommended that the WTP Instrument Maintenance (WTG-12), Laboratory Evaluation (L-1), Laboratory Procurement Procedures (L-8), Laboratory Analytical Equipment (L-2), if required beyond that provided by GTZ), Data Management System (L-4) and Training of Laboratory Staff (L-3) be provided under this program in cooperation with the Dutch and German programs as appropriate.
- Results Package Projects. The USAID RP can be used for procurement and implementation of professional services, equipment and construction contracts. It is anticipated that this will be the principal mechanism for design and construction of facilities as well as for specification and procurement of equipment.
- PSP. It is recommended that consideration be given to private sector participation in the HPP recommended for PSP in the Preliminary report on Private Sector Participation.

## Section 5.0 Conclusions

As discussed in Section 1.0, AWGA is a mature water utility, with a long history of effective service to its consumers. As a result of rapid population growth and the difficulty of funding capital works over the last 10 to 20 years, there are a number of needs which have developed, some requiring immediate action to avoid possible reductions in the level of service.

### 5.1 Donor Agencies' Programs

There are other donor programs which have been on-going for a number of years. The German and Dutch teams currently working on AWGA projects, and previous reports prepared by their programs have been of major assistance in determining the extent and criticality of many of the projects discussed in this report. Moreover, current projects being undertaken by these agencies fulfill some of the needs for given HPPs. In these cases, as noted in discussions of specific projects, coordination is essential to ensure maximum benefit from their funding as well as from the USAID Results Package.

Specific current and/or completed programs which require such coordination for HPP include:

- German (GTZ) Programs
  - Laboratory equipment and training
  - O & M equipment and training
  - Downtown block mapping
  - WTP production metering
  - Power consumption/optimization studies
- Dutch (Netherlands Embassy) Programs
  - O&M activities at Siouf and Nozha WTPs
  - Siouf WTP intake improvements
  - Central and Siouf laboratory assessment
  - Distribution system O&M Assistance
  - GIS assessment
  - Mobile pilot plant

HPP which could affect or be affected by the programs are noted in Section 4.0, and will need to be coordinated with the appropriate agency's staff as they are developed.

### 5.2 GOE Agencies' Programs

There are numerous on-going and planned programs underway or to be conducted by other Egyptian agencies which can assist, impact and/or be impacted by projects recommended herein for HPP implementation. They include:

- Alexandria General Organization for Sanitary Drainage:
  - Program for sanitary sewer service to informal housing areas
  - Sewer mapping and GIS
  - Conveyance and treatment determinations (including determinations regarding WTP residuals)
- Ministry of Water Resources and Irrigation:
  - Policy setting, master planning and interagency cooperative programs
  - Mahmoudia Canal improvements
  - Canal maintenance programs
  - Irrigation demand management programs
  - Management of flow in Khandak Canal
  - Removal of WWTP- affected drain flows from Rosetta Branch and from the Noubaria Canal
- Social Fund for Development:
  - Phase III, Mahmoudia Rehabilitation Program
- Ministry of Housing:
  - Plans for expansion, Borg El Arab WTP
  - Plans for new North Coast WTP
  - WWTP's for flows into Umum Drain
- Ministry of Agriculture:
  - Policies regarding irrigation practices and pesticide use
  - Operation of fishery – North Airport Lake

As with other donors' programs, GOE agencies' programs are noted in Section 4.0 as requiring coordination during development of the appropriate HPP.

### 5.3 AWGA's High Priority Needs

As indicated above, there are many issues which require attention in the very near future in order to avoid impacts on the overall levels of service currently provided by AWGA. A number of these issues were identified in the Terms of Reference of the Contract for the Master Plan, and this HPP report was a specified deliverable. The list of projects in the TOR included:

- Distribution piping replacement
- Central Laboratory improvements
- Improved WTP reliability
- Provision of research capability for treatment studies
- Improvement to RWS intakes, pumps and conduits
- Recommendations for improving raw water quality and quantity\*

- Improvements to Water Service for the Urban Poor\*
  - Provision of specialized equipment
- \* Detailed development of projects is covered in separate, parallel reports: Raw WaterSupply (for which priority projects are included herein) and Recommendations for Water Service to the Urban Poor (for which a Demonstration Program is recommended and included herein as a HPP).

The projects outlined in the TOR were reviewed, analyzed and verified during development of this HPP report. Although some modifications to specifics were necessary, all issues were concurred upon, and carried as individual projects or as parts of expanded projects. One TOR project is significantly different because the central laboratory building has already been constructed. However, furnishing of equipment and related training is included herein. The analyses made for development of this HPP report also concluded that a number of urgently needed activities are not necessarily directly related to construction or furnishing of equipment. Such needed activities include:

- Establishing a stronger, proactive working relationship with other agencies, especially the MWRI.
- Development of programs, projects, procedures and protocols to implement, monitor and assist with enforcement of RWS-related policy.
- Evaluation, training and development of procedures for laboratory and instrumentation/control systems' operation, maintenance, calibration and technical currency.
- Development of information, procedures and programs to establish and track current and developing demographic issues, especially as related to the Informal Housing sector.
- Development of means, procedures and programs to acquire and utilize geographic information (GIS) and improved mapping.
- Improvement of communication systems.

## 5.4 Project Groupings

Following the ranking of individual projects as discussed in Section 3.0, development of implementation approaches and consideration of benefits led to the conclusion that grouping projects would facilitate implementation, increase overall program benefits and enhance the ability of AWGA to provide in-kind service as part of the GOE obligation to participate financially in programs to be funded by the USAID Results Package. Therefore, it was concluded that projects should be grouped in the following general classifications:

- Program for improving water service to the urban poor, HPP-1.

- Projects which will be undertaken for the most part by the MWRI and which require AWGA's input, coordination and progress monitoring, HPP-2.
- Process and mechanical upgrades to the water treatment plants, HPP-3.
- Process control support projects and equipment, HPP-4.
- Development of demographic information and mapping/GIS and other support capability which will enhance future planning and assist in maintaining and improving service, HPP-5.
- Improvement of the reliability of AWGA's raw water supply, HPP-6.
- Replacement of older distribution system pipelines in the downtown areas of Alexandria and furnishing support systems, HPP-7.

Table 5.1 indicates the recommended HPP group numbers for projects on the consolidated ranked list. More detailed descriptions of projects and project groupings are provided in Section 6.0.

**Table 5.1  
Project Groupings**

No. <sup>(1)</sup>	Description of Alternative <sup>(2)</sup>	HPP Group No.	Project Type <sup>(3)</sup>	Potential Implementation <sup>(4)</sup>	Comments
RW-1	Establish joint AWGA/MWRI steering committee to coordinate master planning projects and to develop joint policies and procedures for managing the raw water supply system.	HPP-2	Inst	AWGA/GOE	Could support MP if instituted by June 2000
WTG-1	Furnish a mobile pilot plant and conduct pilot study to evaluate alternative filter media configurations at higher loading rates using alternative treatment chemicals.	HPP-3	Equip/Svcs	RP/DA	Supports design of future treatment works
WTG-7	Provide centralized chlorine storage and handling system for all WTPs.	HPP-3	Const	RP	Includes central storage at BEA and upgrades at all WTPs
L-1	Perform a comprehensive evaluation of the Central Laboratory and WTP labs.	HPP-4	Svcs	ISC/DA	Could support MP if complete in 2000
WTG-12	Develop capability for calibrating and maintaining WTP instrumentation including: training of instrument technicians and furnishing of special tools for instrument calibration and spare parts	HPP-4	Tng / Equip	ISC	Could support MP if complete in 2000
WTG-2	Install raw water flow meters, transmitters and instrumentation to allow proper dosing and flow pacing of treatment chemicals, and flow splitting across process trains.	HPP-3	Const	RP	
D-4	Conduct a detailed study of informal housing areas to include statistically valid determination of water and sewer service, populations and other relevant information.	HPP-5	Svcs	RP	Supports decisions re expanded program of WS to Urban Poor
RW-3	Implement MC rehabilitation program (KM 67 to 75) including: canal dredging, clean-up and embankment lining; removal of illegal structures and industrial discharges.	HPP-2	Const	GOE/AWGA	Necessary to allow for full implementation of WTG-10
WTG-5	Conduct an operations testing program at Nozha WTP. Recommend repair, replacement or modifications to place the plant in full operation including raw water supply upgrade <sup>(4)</sup>	HPP-3	Const	RP	
WTG-3	Repair or replace the filter control system for "upgradeable" filters including: control console, valves, flow, level and head loss control, pneumatic operators and instrument air system.	HPP-3	Const	RP	
RW-23	Conduct detailed hydraulic analysis of the MC System to predict effects of proposed improvement projects, O&M practices, future demands.	HPP-2	Svcs	RP	Supports future decisions re extent of work required KM 0-16.
L-3	Train central laboratory staff in the proper operation of laboratory equipment for biological, bacteriological, organics and inorganic analyses; coordinate with Dutch and GTZ training programs.	HPP-4	Tng	ISC/DA	Could support MP if completed in 2000
D-1	Replace old distribution pipelines in the downtown area.	HPP-7	Const	RP	From Manshia to Sidi Gaber
WTG-9	Install on-line analyzers for monitoring turbidity, chlorine and pH at critical locations in WTP process trains.	HPP-3	Equip	RP	
MGIS-7	New mapping including new aerial photography, digital orthophotography, and topographic mapping	HPP-5	Svcs	GOE	Should be undertaken by Governorate
MGIS-8	Extend block mapping project begun under GTZ program and integrate with System-wide GIS.	HPP-5	Svcs	RP	Best if coordinated effort by all Alex. utilities
RW-7	Conduct feasibility study of North Airport Lake for emergency raw water supply storage for MC and DWC raw water supply system.	HPP-6	Svcs	RP	Supports decisions re first-stage investments
WTG-4	Install primary flow calibration devices (e.g., Pitometer taps) to calibrate existing treated water ultrasonic flow meters and provide equipment upgrades to protect meters from power surges. <sup>(2)</sup>	HPP-3	Const	RP	
RW-24	Support and assist MWRI in enforcement of Law 48. Monitoring, policing, and public outreach.	HPP-2	Inst.	AWGA / GOE	
RW-19	Conduct a feasibility study for North Coast water supply alternatives: aquifer storage, brackish water treatment or desalination	HPP-6	Svcs	RP/DA	Supports decisions re first-stage investments

**Table 5.1  
Project Groupings**

No. <sup>(1)</sup>	Description of Alternative <sup>(2)</sup>	HPP Group No.	Project Type <sup>(3)</sup>	Potential Implementation <sup>(4)</sup>	Comments
WTG-14	Provide a centralized control system for the Siouf, Manshia and RP WTPs, including a central control room and a distributed digital control system with field mounted sensors, controls and alarm devices.	HPP-3	Const	RP	
RW-21	Modify AWGA's raw water supply monitoring program to include composite sampling, pesticide and heavy metal analyses, increased frequency.	HPP-2	Equip	RP	Supports decisions re first-stage investments
WTG-10	Upgrade WTP intakes with new coarse bar racks, mechanically cleaned screens and facilities to collect and store screening materials.	HPP-3	Const	RP	Mechanisms at Siouf to be provided under Dusch program. Requires completion of RW-3 to allow full implementation.
D-2	Upgrade O&M equipment, including: lapping machines for making house connections, equipment to support a leak detection program, pressure gage calibration equipment, tools for district maintenance teams, powered valve operators and possible service vehicles.	HPP-7	Equip	RP/ISC	
RW-20	Implement/complete program to treat/divert wastewater flows from the Umum Drain	HPP-2	Inst/ Const	GOE	Being implemented By GOE
D-3	Repair or replace defective treated water pumps and upgrade storage reservoirs	HPP-3	Const	AWGA	
RW-8	Upgrade DWC by removing hydraulic restrictions and lining embankments subject to erosion.	HPP-6	Const	AWGA	
RW-4	Enforce annual program of removal and off-site disposal of deep-rooted weeds and floating hyacinths to increase canal hydraulic capacity.	HPP-2	Inst	GOE	Should be done regularly, as needed, by MWRI
WTG-6	Repair or replace defective equipment for the Italba process trains at the following WTPs: Siouf; Rond Point; Noubaria; Borg El Arab.	HPP-3	Const	AWGA	
WTG-13	Repair and replace defective equipment for Pulsator units, including vacuum chambers, compressors, sludge drawoff system and appurtenances for the following WTPs: Manshia; RP; Siouf; FEG.	HPP-3	Const	AWGA	
WTG-11	Provide required tools, equipment and spare parts for mechanical, electrical and workshops at all WTPs and vehicle workshop at Manshia WTP.	HPP-3	Equip	ISC	
L-2	Provide required laboratory analytical equipment for monitoring raw and treated water quality, as recommended under L-1.	HPP-4	Equip	DA/ISC	Could support MP if complete in 2000
D-5	Upgrade equipment and augment as necessary to implement a system-wide wireless communication system	HPP-7	Equip	AWGA	
WTG-5	Install diesel emergency standby generators to replace non-functional equipment at WTPs.	HPP-3	Const	RP	
L-7	Provide automatic composite sampling stations to collect representative samples for WQ analysis on the MC and NC.	HPP-2	Equip/ Const	RP	Subsequently Part of RW-21
WTG-8	Implement WTP residuals management program that meets water quality, regulatory, operations goals cost effectively.	HPP-3	Const	RP	
WT1-2	Develop new sanitary waste system at Siouf WTP .	HPP-3	Const	RP	
RW-5	Implement irrigation demand management program using automatic irrigation control gates, blending of branch canal and drain water, and improved flow allocation methods to agricultural lands.	HPP-2	Inst / Const	GOE	
L-8	Modify procurement procedures for central laboratory to assure availability of reagents, gasses and instrument replacement parts at all times.	HPP-4	Svcs	ISC	Could support MP if complete in 2000
RW-17	Conduct planning for Noubaria Canal RWS alternatives after Umum Drain discharge to NC comes online.	HPP-2	Svcs	RP	Supports decisions re first-stage investments

**Table 5.1  
Project Groupings**

No. <sup>(1)</sup>	Description of Alternative <sup>(2)</sup>	HPP Group No.	Project Type <sup>(3)</sup>	Potential Implementation <sup>(4)</sup>	Comments
L-5	Establish a library of standard reference books and journal subscriptions related to water quality analysis and treatment <sup>(c)</sup>	HPP-4	Equip	RP	
L-4	Provide a LIMS for the Central Laboratory and WTP labs, as recommended under L-1. <sup>(d)</sup>	HPP-4	Equip	ISC	
L-9	Provide a 4-wheel drive vehicle for collecting samples from canals, WTPs and distribution system and transporting samples to Central Lab.	HPP-2	Equip	RP	Subsequently Part of RW-21
L-10	Provide a motor boat and trailer for routine sampling of the MC and NC.	HPP-2	Equip	ISC	Subsequently Part of RW-21
MGIS-2	Upgrade AWGA Trimble GPS gear now in the survey department	HPP-5	Equip	ISC	
MGIS-3	Handheld GPS, submeter, with satellite and beacon real-time correction	HPP-5	Equip	ISC	
RW-18	Construct 12.5 km of 1,500 mm raw water pipeline from Siouf raw water pump station to Maamoura WTP to augment existing 1,500 mm raw water pipeline.	HPP-6	Const	RP	
MGIS-1	Upgrade AutoCAD and Arcview licenses for the modeling group and the mapping group in the survey department; provide AutoCAD training for supervisors.	HPP-5	Equip / Tng	RP	
RW-9	Maximize reliance on flows from the KC to improve water quality.	HPP-2	Inst	GOE	
MGIS-6	Acquire satellite imagery to facilitate remote sensing of development patterns in Alexandria over time (multi-year series of images). Plot current major land features on images.	HPP-5	Svcs	RP	Supports decisions re expanded program of WS to Urban Poor
RW-6	Redirect drain canal flows (which convey treated wastewater flows) away from Rosetta Branch to reclaimed lands.	HPP-2	Inst / Const	GOE	
MGIS-4	Buy Zeiss software for the survey department and provide training for same: Traverse Program for the Zeiss TC1100	HPP-5	Equip / Tng	ISC	

Notes:

- Numbering System  
RW: Raw water  
WTG: WTP General  
L: Laboratories  
D: Distribution System  
WT1: Siouf WTP  
WT4: Maamoura WTP  
WT7: Borg El Arab WTP  
MGIS: Mapping and GIS

- Type of Project  
Const = Construction  
Equip = Equipment  
Inst = Institutional  
PDA = Pre-design Analysis  
Svcs = Technical Services

- Potential Implementation

AWGA = AWGA

DA = Other Donor Agency

GOE = Other Govt Agency - Egypt

ISC = Institutional Strengthening Contract (Including Host Country Procurement Program)

RP = USAID Results Package ( design/CMC and construction)

(a) Subsequently modified to include complementary modifications at Manshia WTP and in distribution system.

(b) Subsequently combined with WTG-2

(c) Subsequently modified to be a document information center for AWGA.

(d) Subsequently modified as a data management system under the ISC program.

- Abbreviations:

AWGA: Alexandria Water General Authority

DWC: Drinking Water Canal

GPS: Global Positioning System

KC: Khandak Canal

LIMS: Laboratory Information Management System

MC: Mahmoudia Canal

MP: Master Plan

MWR: Ministry of Water Resources and Irrigation

NC: Noubaria Canal

PS: Pumping Station

WTP: Water Treatment Plant

KM: Kilometer (canal stationing)

GIS: Geographic Information System

GTZ: German Technical Assistance Program

RP: Rond Point WTP

BEA: Borg El Arab WTP

## Section 6.0 Recommendations

As noted in Section 5.0, it became obvious during review of the consolidated, ranked list of projects that a number of them should be combined for implementation. This has the effect of moving a number of projects up on the HPP list, and was deemed advisable for the following reasons:

- Economies of scale work in favor of grouping similar items, as opposed to individual equipment purchases or construction contracts spread out over time.
- Projects and equipment which support master planning, design development or decisions regarding first-stage investments have the potential to save their cost many times over by improving precision, accuracy and reliability of projections and analyses.
- Many of the groupings will create enhanced overall benefits greater than the effects of the individual projects.

For these reasons, the Project Descriptions below, and the Conceptual Designs in Volume II are presented in the following recommended groupings. Table 6.1, HPP Packages, includes a list of projects in each grouping, the estimated capital cost and an indication of the probable sources of funding. Projects with a check in the "Design/CMC" column, if approved by USAID and AWGA as HPP in the final listing, would be wholly funded by USAID as part of the Design/CMC. Projects with checks in the "Construction" columns will be jointly funded by USAID and AWGA as part of a construction contract (or contracts) designed under the design/CMC project.

Projects with a check in the "In Kind" column are projects currently planned to be locally funded by AWGA, and are expected to be accounted for as GOE in-kind contribution under the USAID/AWGA grant agreement. Projects with no capital cost indicated are to be funded and/or executed by programs/agencies other than the design/CMC contract, its follow-on construction contract(s), AWGA in-kind contributions.

### 6.1 Project Group Descriptions

Project groups presented herein are numbered HPP-1, HPP-2, etc. Each group contains several projects which are combined because they:

- Have related implementation implications (HPP-1, Urban Poor Water Supply Projects, HPP-2, MWRI- Related Projects).
- Could be grouped in logical construction packages (HPP-3 Water Treatment Plant Process and Mechanical Upgrades; HPP-7 Distribution System Improvements); or

- Have mutually supporting characteristics which make the package more valuable than the individual projects (HPP-4, Process Control Support Projects and Equipment; HPP-5, Demographic Information and Support Capability; HPP-6, Raw Water Reliability Improvements).

In most cases, the order of the HPP groups is based on the ranking of the first project in the group. The order of projects within a group is based on the ranking of the individual projects. It should be noted, however, that as work on the overall master planning continued, the order of projects' rankings shifted somewhat, particularly that of the raw water supply (RW) projects. Project descriptions below are presented in the final recommended order for implementation.

Table 6.1  
HPP Packages

HPP No.	Project Description	Estimated Capital Costs (\$1,000)	Potential Source of Funding			
			USAID		AWGA	
			Design CMC	Constr	Constr	In Kind
<b>HPP-1 Urban Poor Water Supply Projects</b>						
UP-1	Mohsen El Kobra demonstration project	\$1,000		✓	✓	
UP-2	To be developed <sup>1</sup>	\$2,000		✓	✓	
UP-3	To be developed <sup>1</sup>	\$2,000		✓	✓	
Subtotal:		\$5,000				
Cumulative:		\$5,000				
<b>HPP-2 MWRI - Related Projects</b>						
RW-1	Cooperative interagency management structure <sup>2</sup>	\$0				
RW-3	Rehabilitation of last 8 km of MC <sup>3</sup>	\$0				
RW-4	MC/KC dredging and weed removal program <sup>2</sup>	\$0				
RW-23	Detailed hydraulic analysis - MC	\$200	✓			
RW-24	Water quality enforcement programs <sup>2</sup>	\$0				
RW-21	Expanded RW monitoring program (includes L-7, L-9 and L-10)	\$120	✓			
RW-6	Agricultural drain flow diversion for Rosetta Branch <sup>2</sup>	\$0				
RW-20	Treatment of wastewater discharges to Umum Drain <sup>2</sup>	\$0				
RW-5	Irrigation demand management program for MC <sup>2</sup>	\$0				
RW-17	Umum Drain impact planning	\$200	✓			
RW-9	Maximize KC Flow to MC <sup>2</sup>	\$0				
Subtotal:		\$520				
Cumulative:		\$5,520				
<b>HPP-3 Water Treatment Plant Process and Mechanical Upgrades</b>						
WTG-1	Mobile pilot plant and initial operation <sup>4</sup>	\$500	✓			
WTG-7	Central chlorine storage and feed facilities	\$9,500		✓	✓	
WTG-2.4	Chemical mixing, dosing, and flow/pressure measurement improvements	\$2,600		✓	✓	
WT5-1	Nozha WTP rehab and startup	\$420		✓	✓	
WTG-3	Filter control system upgrades	\$3,600		✓	✓	
WTG-9	Installation of on-line turbidimeters and chlorine residual analyzers	\$450		✓	✓	
WTG-14	Computerized process monitoring at Siouf, RP and Manshia WTPs	\$3,700		✓	✓	
WTG-10	Raw water intakes and canal outlet structure upgrades	\$3,800		✓	✓	
D-3	Pump station and reservoir upgrades- AWGA Project	\$6,200				✓
WTG-6	Repair / replace Italba unit equipment <sup>5</sup>	\$0				
WTG-13	Pulsator vacuum chamber equipment upgrades <sup>5</sup>	\$0				
WTG-11	Provide workshop tools, equipment and spare parts <sup>6</sup>	\$0				
WTG-5	Install emergency standby generators	\$1,400		✓	✓	
WTG-8	Process residuals handling system for MC WTPs	\$2,700		✓	✓	
WT1-2	New sanitary disposal system at Siouf	\$310		✓	✓	
Subtotal:		\$35,180				
Cumulative:		\$40,700				
<b>HPP-4 Process Control Support Projects and Equipment</b>						
L-1	Perform comprehensive evaluation of Central Lab and WTP labs <sup>7</sup>	\$0				
WTG-12	Furnish equipment and train technicians for WTP instrumentation calibration & maintenance <sup>8</sup>	\$0				
L-3	Train Central Lab staff <sup>7</sup>	\$0				
L-2	Provide lab analytical equipment <sup>6</sup>	\$0				
L-8	Develop and implement lab procurement procedures <sup>7</sup>	\$0				
L-5	AWGA document information center	\$120	✓			
L-4	Data management system for Central and WTP labs <sup>8</sup>	\$0				
Subtotal:		\$120				
Cumulative:		\$40,820				

Table 6.1  
HPP Packages

HPP No.	Project Description	Estimated Capital Costs (\$1,000)	Potential Source of Funding			
			USAID		AWGA	
			Design CMC	Constr	Constr	In Kind
<b>HPP-5 Demographic Information and Support Capability</b>						
D-4	Population and housing surveys	\$500	✓			
MGIS-6	Acquire multi-year satellite imagery	\$100	✓			
MGIS-7	Produce up-dated mapping <sup>2</sup>	\$0				
MGIS-8	Extend GIS and block mapping	\$3,000	✓			
MGIS-2/3/4	Upgrade Survey Department's GPS equipment and survey software <sup>6</sup>	\$0				
MGIS-1	Provide Auto-CAD and Arc View Licenses and Training	\$50	✓			
		Subtotal:	\$3,650			
		Cumulative:	\$44,470			
<b>HPP-6 Raw Water Reliability Improvements</b>						
RW-7	Nozha Airport Lake storage feasibility study	\$300	✓			
RW-8	DWC lining and protection program - AWGA Project	\$1,800				✓
RW-19	North Coast supply feasibility study <sup>10</sup>	\$1,100	✓			
RW-18	Construct 12.5km of 1500mm RW pipeline to Maamoura <sup>9</sup>	\$0				
		Subtotal:	\$3,200			
		Cumulative:	\$47,870			
<b>HPP-7 Distribution System Improvements</b>						
D-1	Replace/upgrade distribution system piping - Manshia to Sidi Gaber					
D-1.1	Replace transmission loop	\$32,000		✓	✓	
D-1.2	Replace first priority area	\$9,500		✓	✓	
D-1.3	Replace second priority area	\$10,000		✓	✓	
D-7	Additional 1000mm trans main Nozha to Manshia	\$3,600		✓	✓	
D-6	700 meters of 700mm main in Masged Gabbari Street	\$800		✓	✓	
D-2	Upgrade distribution system O&M equipment <sup>6</sup>	\$0		✓	✓	
D-5	Upgrade wireless communication system - AWGA Project	\$600				✓
		Subtotal:	\$56,300			
		Cumulative:	\$103,970			

**Footnotes**

- (1) Total capital funding for Urban Poor projects could be up to \$ 5M.
- (2) No capital funds required/ other agencies' programs.
- (3) New canal outlet structure, new WTP intake works included in WTG-10.
- (4) To be done under HPP program, unless Dutch pilot plant program is funded jointly by GON and AWGA.
- (5) Superseded by other projects; dropped as HPP.
- (6) To be funded under ISC host country equipment procurement budget.
- (7) To be done under ISC and/or Dutch program(s).
- (8) To be done under ISC program.
- (9) Estimated capital cost: \$25M, unlikely to be fundable as HPP.
- (10) Hydrogeological field studies may be completed under Dutch-funded MWRI National Water Resources Plan; if so HPP costs would be reduced by approx. \$500,000.

**Abbreviations**

AWGA: Alexandria Water General Authority  
D: Distribution  
DWC: Drinking Water Canal  
GPS: Global Positioning System  
GON: Government of the Netherlands  
HPP: High Priority Projects  
ISC: Institutional Strengthening Contract  
KC: Khandak Canal  
km: Kilometer  
L: Laboratory  
LIMS: Laboratory Information Management System  
MC: Mahmoudia Canal  
MGIS: Mapping & Geographic Information Systems  
mm: millimeter  
MP: Master Plan  
MWRI: Ministry of Water Resources and Irrigation

NC: Noubaria Canal  
O&M: Operations and Maintenance  
PS: Pumping Station  
RW: Raw Water  
UP: Urban Poor  
WT: Water Treatment - Plant Specific  
WTG: Water Treatment - General  
WTP: Water Treatment Plant

### 6.1.1 HPP-1, Urban Poor Water Supply Projects

The first project, UP-1 is designed as a demonstration program. If all stakeholders agree, successive programs in similar areas may be undertaken under the RP.

UP-1: Upgrade Mohsen El Kobra Distribution System (Demonstration Program). The program involves a major upgrading of a portion of the water distribution system for the Mohsen area. New water mains and metered house connections will be installed for a population of about 30,000 people who are currently served by a largely informal distribution system. Elements of the program will be conducted by AWGA staff with assistance of the CDM team, augmented by an experienced Non-Governmental Organization (NGO), and include:

- Modeling of the distribution system using the newly acquired Cybernet model.
- Design of the system, based on model results, and development of contract documents.
- Construction using an existing AWGA indefinite quantity contract with a pipeline construction contractor.
- Community building to ensure buy-in and participation of residents, with assistance from the NGO.
- Institutional Strengthening within AWGA, led by the NGO, to develop the capability to replicate the program in other informal housing areas.

The NGO contract will be added by addendum to the Master Plan Contract. Modeling, design, procurement documents and construction services will be done by AWGA staff and the CDM team under the Master Plan Contract. Construction contract work will be funded by a Fixed Amount Reimbursable (FAR) contract.

UP-2: Urban Poor Project No. 2 – *(TBD)*\*

UP-3: Urban Poor Project No. 3 – *(TBD)*\*

\* Additional projects may be developed, depending upon analysis of results of UP-1.

### 6.1.2 HPP-2, MWRI – Related Projects

A number of the projects listed in this grouping are planned, or in various implementation stages, by MWRI or MHUUC. Therefore they do not require commitment of capital funds by USAID or AWGA. However they are among the most important projects of all for both immediate and long-term management of AWGA's water resource and are thus carried as HPP to emphasize that they need to receive high-level attention from all involved agencies.

RW-1: Implement Cooperative Management Structure. The most critical action is to organize an interagency raw water supply management structure with participation from AWGA, MWRI, MHUUC, the Governorate of Alexandria and other key stakeholders. This action should facilitate MWRI's approval, prioritization and implementation of the canal improvement projects discussed in this section. It will provide a forum for exchanging technical information between AWGA and the Ministry and for coordinating master plan projects. It will also require the Ministry to recognize AWGA's long-term needs in the formulation of national water resources policies and operating procedures. Such an interagency structure is clearly justified given the types of canal improvement projects now underway or being planned by the Ministry, as well as new national policies being formulated for water resources management.

The formation of a high-level interagency steering committee, as described above, will allow AWGA's needs to be duly considered as these and other project and policy initiatives move forward within the MWRI. A more detailed description of this action and of the Ministry projects which follow is found in the RWS report. The Ministry projects, which should be a focus of the steering committee include:

RW-3: Implement Mahmoudia Canal Rehabilitation Project. This project will increase the capacity of the canal, improve water quality and permit reopening the intakes for AWGA pumping facilities, thereby improving overall system reliability. It would be a continuation of the Mahmoudia Rehabilitation Program, currently being managed and funded by the Social Fund for Development. The proposed Phase III project would restore the full cross-section and extend the canal pitching and strip of greenbelt from KM 67 to the Mahmoudia Canal discharge in the Western Harbor at KM 75.

This project will allow, through implementation of WTG-10, bringing abandoned AWGA intake facilities back into service, provide operational flexibility, remove industrial pollution from the canal and remove a source of disease and physical danger. We have recommended in the Raw Water Supply report that the Phase III project include interception and conveyance to proper treatment and disposal of any waste streams currently discharging to the canal.

A sanitary survey to identify any potential sources of domestic or industrial pollution, rehabilitation of AWGA WTP and PS intakes and construction of control gates at the end of the canal are carried in WTG-10. Diversion of WTP residuals is carried in WTG-8.

RW-4: Conduct Frequent Canal Dredging and Maintenance program. This project will increase the hydraulic capacity of the Mahmoudia and Khandak Canals and reduce water loss. The MWRI has an established program to dredge bottom sediments and remove deep-rooted weeds and floating plants from their canals. For a variety of reasons this annual program is not carried out along many reaches of the canal system.

An aggressive maintenance program by the Ministry, and enforcement of illegal dumping of solid wastes into the canal, will significantly increase the hydraulic capacity of the canal and could possibly reduce the size of the canal enlargement project currently planned for the first 16 km of the Mahmoudia Canal. We recommend that such a program proceed immediately to meet short-term capacity needs as early as next summer. Following completion of the maintenance work, the maximum hydraulic capacity of the canal upstream of the Drinking Water Canal takeoff should be verified by

field measurements and hydraulic modeling to determine the design requirements for the upstream canal enlargement project. (See RW-23, below.)

**RW-23: Hydraulic Analysis of Mahmoudia Canal System.** To improve the understanding of the hydraulics of the canal, we recommend a detailed hydraulic analysis of the Mahmoudia system to accurately predict the impacts of proposed canal improvement projects, operational practices and future demand scenarios, on the carrying capacity of the canal and its ability to deliver peak water supply flows to Alexandria. This work should be completed prior to design or construction of the proposed MWRI project to enlarge the first 16 km of the canal, since the results could be used to refine that design and potentially reduce construction costs. A detailed analysis of the Mahmoudia system would include a topographic survey of the canal, flow and water surface elevation measurements, development of steady-state and transient hydraulic models, and the analysis of future flow and demand conditions. It is recommended that this analysis be undertaken as part of the RP design component.

**RW-24: Implement Water Quality Enforcement Programs.** This set of programs is intended to improve the quality of water delivered to AWGA's WTP intakes and to avoid the need for costly advanced water treatment processes. The expanded routine water quality monitoring program (RW-21) would support and complement this set of programs which includes policing of critical reaches of supply canals and public education programs regarding impacts of various activities on canal water quality. AWGA's implementation of WTP residuals management (WTG-8) is also essential to the programs' success.

**RW-21: Raw Water Quality Monitoring Program.** An upgraded and expanded raw water quality monitoring program will allow AWGA's Central Laboratory to determine the presence of pesticides, heavy metals and other difficult-to treat contaminants in the raw water supply and to initiate corrective actions such as additional treatment or identifying and stopping potential sources of pollution. The provision and use of automatic composite samplers will improve the chances of capturing intermittent pollution events, such as the periodic pumping of agricultural drainage water into the supply canals. More frequent (monthly) sampling of the Noubaria Canal will provide critical water quality trends related to salinity and pesticide contaminants in order to evaluate the possible relocation of supply intakes to resolve these water quality problems. This project includes installation of the composite samplers, acquisition of a 4-wheel drive vehicle and a properly equipped boat to enable more frequent laboratory sampling on the Noubaria. The project also involves conducting the first six months of monitoring to include hands-on training for AWGA staff. It is recommended that this program be implemented as part of the RP design component.

**RW-6: Redirect Wastewater Flows Away From Drinking Water Sources.** The MWRI has studied and is moving forward with several projects to redirect treated and untreated wastewater flows away from drinking water supply canals in order to comply with Law 48 environmental regulations. Two major projects have been proposed in the Greater Cairo area to divert the flow of treated wastewater from drains which discharge into the Rosetta Branch to reclaimed desert lands. These projects will improve the quality of water supplied to the Mahmoudia Canal with respect to sewage-related contaminants. However, the project has not received funding to date. This is an example of a critical

project to AWGA with positive public health impacts that could be expedited through the interagency steering committee recommended under RW-1.

RW-20. Implement Program for Treatment of Wastewater to Umum Drain. This is an on-going project by MHUUC to treat wastewater currently being discharged to the Umum Drain. This will improve the quality of water entering the Noubaria Canal when the Umum Drain diversion to the canal begins. It involves construction of WWTPs for the towns of Abu Matamir and Hosh Isa.

RW-5. Implement Irrigation Management Program. This MWRI-approved program could increase the reliability of the drinking water supply by reducing seasonal peaks in the agricultural demand and providing more control on agricultural irrigation usage. The goal of the program is to reduce irrigation consumption on currently irrigated lands by 15 percent during peak demand periods. The program consists of installing automated control gates on outlets to branch irrigation canals, increasing reuse of drainage water by blending with irrigation water in branch canals removed from major drinking water source canals, and improving flow allocation methods to agricultural lands. Whether water saved by this program is used to augment drinking water supplies or for additional irrigation is the type of issue anticipated to be dealt with by the interagency steering committee recommended under RW-1.

RW-17: Conduct Umum Drain Water Quality Impact Planning. This project is intended to provide water quality and cost information to help decide on the necessity and financial feasibility of a new supply canal to the Noubaria and Borg El Arab WTPs. Such a canal, drawing water from upstream on the Noubaria Canal or from the Hagar Canal, would lower the TDS solids in the plant intakes compared to the TDS in the Noubaria downstream of the Umum Drain when it begins to flow to the canal. The elements of the planning project include: Increased water quality monitoring; predictive modeling of water quality impacts; preliminary design for a new supply canal; and a subsequent decision as to whether to proceed to design and construction or wait until the Umum Drain discharge to the Noubaria begins, and assess actual impacts at that time. It is recommended that this analysis and preliminary design be undertaken as part of the RP design component.

RW-9: Maximize Usage of Water from Khandak Canal. This initiative will improve the raw water quality in the Mahmoudia Canal downstream of KM 16 by blending lower quality water from the Rosetta Branch with higher water quality from the Khandak Canal. Initially, the MWRI would be requested to supply as much water as possible year round, to the Mahmoudia from the Khandak. This should be accompanied by an aggressive canal dredging and weed removal program on the Khandak Canal over the next year. This should significantly increase the carrying capacity of the canal. The Ministry should also evaluate the feasibility of enlarging critical cross sections of the canal (by dredging and/or embankment lining) to further increase capacity. By increasing the hydraulic capacity of the Khandak, and maximizing flow year round, it will be possible to reduce reliance on the more polluted Rosetta Branch as the primary source of inflow into the Mahmoudia, until such time as the drain diversion projects on the Rosetta Branch are completed.

### 6.1.3 HPP-3 Water Treatment Plant Process and Mechanical Upgrades

There are numerous mechanical systems at the WTPs which require major rehabilitation, expansion and/or replacement. Implementation of these upgrades will markedly enhance AWGA's current operations and are known to be consistent with long-term recommendations for plant improvements to be made in the Master Plan. The HPP upgrades should include design, construction, start-up and training for the following:

WTG-1: Furnish and Operate Mobile Pilot Plant. This project includes furnishing the pilot plant and conducting a study of alternative pre-treatment chemicals, filter media and filter rates. The pilot plant would be trailer-mounted with multiple units for chemical feed, mixing, flocculation, sedimentation, filter columns and associated instrumentation. Operation of the pilot plant will provide design criteria for filter media selection. It will also allow AWGA to test raw water to determine optimum future treatment plant operational strategies at any location on the canal system. As of the writing of this report, a pilot plant may be furnished under the Dutch program. If not provided through the Dutch program it is recommended that this activity be undertaken as part of the design/CMC work.

WTG-7: Provision of Centralized Chlorine Storage and Handling. This project includes facilities built to current international standards for loading and unloading, storing, feeding, protecting, safety provisions and instrumentation associated with the use of chlorine gas in one-ton cylinders at a central storage facility and at all WTPs. This is an essential project for protection of AWGA employees and neighboring areas. It will also improve chlorine dose control and overall system reliability.

WTG-2/4: Installation of Raw Water Flow Meters, Chemical Mixing, Chemical Feed Equipment, Transmitters and Instrumentation, and Treated Water Primary Flow Calibration Devices. The meters and chemical feed and mixing systems will allow proper dosing and flow pacing of treatment chemicals. Raw water flow meters will enable accurate flow splitting to process trains. This will help avoid over-loading of unit processes and improve pretreatment and filter performance. It will also reduce the costs of chemicals used in the treatment processes.

The project also includes installation of ultrasonic meters or primary flow calibration devices (e.g. Pitometer taps) on finished water lines, calibration of existing WTP production meters and provision and installation of equipment to protect meters from power surges. Training of AWGA staff in the use and servicing of the devices and equipment would be provided. This will enhance AWGA's ability to accurately monitor treatment plant production which is essential for future planning, tracking unaccounted for water programs and providing information to cross-check raw water meters at WTPs.

WT5-1: Nozha WTP Rehabilitation and startup. Project includes off-loading the Manshia WTP to avoid running it at rates significantly over-capacity during summer peak demand periods. The total project includes connecting the 1000 mm pipeline which runs from Nozha to Manshia to the 1000 mm line which runs from Manshia south of Lake Mariout. This connection, and changing valve closures in one of the Manshia finished water pumping stations will allow Manshia to serve the area north of Lake

Mariout out to Agami and Nozha to serve the area south of the lake, which currently must also be served by Manshia. Other elements of this project include a hydraulic testing program to determine effects of pumping raw water at Nozha on Mahmoudia Canal levels; and testing and re-commissioning of the Nozha WTP. The alternative to this project, an uprating of the Manshia WTP is estimated to cost approximately ten times the cost of this HPP.

WTG-3: Repair or Replace Filter Control Systems. The project will include upgrading control consoles; valves; flow, level and head loss controls; pneumatic operators and instrument air systems at the Siouf, Rond Point and Manshia WTPs. The project also includes provision of spare parts at all plants. The project will improve the performance and reliability of the upgraded filters.

WTG-9: Installation of On-line Analyzers for Turbidity and Chlorine. Monitoring points will be at critical locations in WTP process trains. The purpose of the analyzers is to ensure that turbidity removal and disinfection goals are met, and to enable fast operational response to potential problems as they develop. This project should be coordinated with the instrumentation being provided for training purposes under the ISC program.

WTG-14: Provision of Centralized Control Systems for Siouf, Manshia and Rond Point WTPs. For these large and complex plants, a central control capability will improve operations and facilitate efficient operations decisions. The systems should include a central control room at each plant with distributed digital control with field mounted sensors, controls and alarm devices.

WTG-10: Conduct Sanitary Survey of the Mahmoudia Canal, Upgrade four WTP Intakes and Install Control Gates at end of Canal. A sanitary survey should be conducted to ensure that all domestic and industrial wastes have been properly intercepted and conveyed away from the canal. The project also includes installation of new coarse bar racks, mechanically cleaned screens and facilities to collect, store and transfer the screenings at the Manshia, Nozha, Noubaria and Borg El Arab WTPs. New intake structures will be required at Manshia and Noubaria; rehabilitation of existing intake structures will be done at Noubaria and Borg El Arab. These improvements will enhance raw water pumping operations, facilitate maintenance and improve safety at the WTP's raw water P.S. The screen and cleaning mechanism at Siouf will be provided under the Dutch program, and the Dutch design is anticipated to be a guide for improvements at other plants. The project also involves installation of gates and controls at the Mahmoudia Canal outlet in the Western Harbor for canal level control and periodic flushing.

D-3: Pump Station and Reservoir Upgrades. This project is intended to improve treated water storage capacity and raw and treated water pumping at two WTPs; it is also intended to improve storage and pumping at several booster pumping stations. It includes new treated water reservoirs at the Rond Point and Siouf WTP's; improvements to raw and treated water pumping at Rond Point; new pumps or pumping stations at the Merghem, Hawaria, Free Zone and KM 59 booster stations; new reservoirs at the Merghem and New Noubaria City Booster Stations. As of the writing of this report, AWGA is planning to contract for this work directly.

WTG-6 and WTG-13: Repair or Replace Defective Italba/Pulsator units. These projects have been superseded by other master plan recommendations and have been dropped as HPP.

WTG-11: Provide Tools, Equipment and Spare Parts. These items are to be provided for mechanical and electrical maintenance at WTP workshops. Development of final lists of items will follow a detailed determination of the content of AWGA stores and will be coordinated with other donor programs. As of the writing of this report it is anticipated that such items will be acquired through the ISC local procurement program.

WTG-5: Emergency Standby Generators. Furnish and install diesel generators and synchronizer units to improve treatment plant reliability with respect to utility power outages. The project includes two new generators at the Noubaria WTP, one at the Mahmoudia P.S. (which currently pumps raw water from the Drinking Water Canal to Rond Point WTP) and synchronizing units at the Siouf and Noubaria plants.

WTG-8: Implement WTP Residuals Management Program. Assist AWGA to develop institutional agreements and implement necessary works to ensure compliance with regulations and to eliminate discharge to water supply canals. The project includes design of sludge equalization tanks, wash water equalization tanks and related pumping systems at the Siouf, Rond Point and Nouzha WTP's. The project also includes technical assistance to AWGA in negotiating a contract with AGOSD for conveyance, treatment and disposal of sludges.

WT 1-2: New Sanitary Disposal System, Siouf WTP. The project includes storage, pumping and conveyance for acceptable disposal of sanitary wastes at Siouf WTP.

#### 6.1.4 HPP-4 Process Control Support Projects and Equipment

There are several projects related to operation of AWGA's central and WTP laboratories and treatment plant instrumentation which will enhance development and dissemination of information and support plant instrumentation and control functions. Several of the projects will overlap with other donors' programs and/or include evaluations, training and equipment recommended to be provided under the Institutional Strengthening Contract. They include:

L-1: Comprehensive Evaluation of the Central Laboratory and WTP Laboratories. This activity will support specific recommendations for upgrading AWGA's laboratories for compliance with drinking water standards. As of the writing of this report, the evaluations are planned and being carried out under the Dutch and ISC programs.

WTG-12: Furnish Equipment and Train Technicians for WTP Instrument Calibration and Maintenance. The project includes training of instrument technicians to develop AWGA's capability to calibrate and maintain WTP instrumentation. This activity should include furnishing special tools, spare parts and training aids. It will enhance performance of WTP meters and other instrumentation, which is critical for proper flow splitting, chemical feed pacing and production tracking. This activity is planned to be carried out under the ISC program.

L-3: Training of Central Laboratory Staff: This project involves staff training in the proper operation of equipment for biological, bacteriological, organic and inorganic analyses. This activity will increase and enhance AWGA's in-house ability to support expanded future programs for monitoring raw water supplies, WTP processes and the distribution system. This activity is planned and being carried out under the Dutch and ISC programs.

L-2: Provide Laboratory Analytical Equipment. This involves provision of analytical equipment for monitoring raw and treated water quality. This equipment would augment and support recommendations made through the study under L-1. Equipment for the Central Lab is being provided under the GTZ program. Equipment for plant laboratories will be provided under the ISC local procurement program.

L-8: Develop Laboratory Procurement Procedures. This project involves development and implementation of procurement procedures for central laboratory consumables. The purpose of this activity is to ensure the availability of reagents, gasses, glassware and spare parts at all times. This is crucial to enable the laboratories to support monitoring and WTP process testing. This activity is being planned and developed under the Dutch and ISC programs.

L-5: Provide Document Information Center. This project will provide a computerized system for collection and management of technical and other utility-related information. It will also provide a repository for a reference set of all reports, documents, and records produced for and by AWGA. The project includes provision of sets of reference books and journal subscriptions for the Central Laboratory and WTP labs. These references are needed to support laboratory staff in their analytical work. It is recommended that this project be included in the RP design component.

L-4: Provision of a Laboratory Data Management System. This project is a computer-based system to link the Central and WTP laboratories for sharing of data, production of reports and quality management. This activity is planned to be carried out under the ISC program.

### 6.1.5 HPP-5 Demographic Information and Support Capability

These are projects which are related to development of data, information and knowledge with respect to aspects of the service area, the distribution system and its customer base. They include:

D-4: Detailed Analysis, Informal and North Coast Housing Areas. The study should be designed to provide a statistically valid determination of water and sewer service, populations, and other relevant information. This analysis is necessary to plan and execute water supply upgrades for the informal housing and North Coast areas. It is recommended that this study be undertaken as part of the RP design component.

MGIS-6: Acquire Multi-year Satellite Imagery. The project is to initiate acquisition of an on-going series of satellite images of the AWGA service area and thereby permit use of current and historical patterns to help predict future growth of the informal housing sector. It is recommended that this project be undertaken as part of the RP design component.

MGIS -7: Produce Up-dated Mapping. This project should involve new aerial photography, digital ortho-photography and topographic mapping for all of Alexandria Governorate. Adequate, accurate, properly referenced mapping would assist AWGA and all other Alexandria utilities in many areas of their operations including planning, design, distribution system operation and modeling, customer services, billing and collecting, and mapping/GIS activities. It is recommended that this activity be undertaken by the Governorate on behalf of all Alexandria utilities.

MGIS-8: Extend GIS and Block Mapping. The project would develop GIS for the water systems within Alexandria Governorate and would incorporate extension of the block mapping program begun under the GTZ program. This work would continue progress made with respect to improved billing and collection and would enable water system information to be provided as "layers" for a Governorate -wide GIS program. It is recommended that this activity be undertaken as part of the RP's design/CMC.

MGIS-2,3&4: Upgrade Survey Department's GPS Equipment and Survey Software. The upgrade will enable AWGA's equipment to be used to enhance and accelerate acquisition of data for an on-going GIS program. The activity also includes using an existing unit for a permanent base station, a computer to process data and two rover GPS Units. The survey software will allow automation for collection and processing of survey data. Appropriate training will be provided for all equipment and software. This activity is planned to be carried out under the ISC program.

MGIS-1: Upgrade AutoCAD and ArcView Licenses. This project includes provision of the licenses and training of staff to support the GIS program. It is recommended that this activity be included in the RP design.

### 6.1.6 HPP-6 Raw Water Reliability Improvements

This is a set of projects which augment AWGA's existing raw water supply to enhance reliability for peak demand periods, emergency situations and/or extensions of service in the future.

RW-7: Implement Airport Lake Feasibility Study. Determine potential for rebuilding the conduit from the Mahmoudia Canal to the lake, replacing the outlet structure and construction of a conduit connecting the lake to the Drinking Water Canal. This project involves a hydraulic feasibility analysis and a water quality survey. The benefits of pumping into and out of the reservoir should also be investigated as an augmentation of this alternative. The lake could provide storage to offset summer low flows in the Mahmoudia and to mitigate problems from a toxic spill or structural failure of a canal. This project is recommended to be undertaken as part of the RP design component.

RW-8: Completion of Program of Embankment Lining and Protection of the DWC. This project would greatly improve the reliability of the canal, which has experienced bank collapse and construction of illegal draw-offs in the past. As of the writing of this report, AWGA is planning to contract for this work directly.

RW-19: Conduct North Coast Feasibility Studies. This project involves analysis of several options for increasing treated water supply to the North Coast including:

expansion of the Noubaria and Borg El Arab WTPs; a new plant west of Borg El Arab City (including the proposal by MHUUC); analysis of the potential for aquifer storage; analysis of the potential to treat brackish groundwater, analysis of the potential to treat sea-water using waste heat from power generation. As of this writing of this report, it is anticipated that the Dutch program for the MWRI will undertake an analysis of the technical feasibility of aquifer storage on the North Coast. It is recommended that the supporting alternative analyses be undertaken as part of the RP design component.

**RW-18: Construct New RW Pipeline from Siouf WTP to Maamoura WTP.** This project involves construction of a new line, parallel to the existing to increase reliability of RW supply to the Maamoura WTP. Preliminary analyses indicate that a 12.5 km long, 1500 mm diameter line would be required.

### 6.1.7 HPP-7 Distribution System Improvements

**D-1: Replace and Upgrade Piping, Manshia to Sidi Gaber.** This project involves replacement of older, unlined cast iron pipe in the downtown area of Alexandria with ductile iron pipe. The first priority is the major transmission network which serves an area of approximately 10 sq. km from Manshia to Sidi Gaber. Depending on available funding, and analyses performed during the Master Plan work, additional sections of smaller pipe in the area will be included. Initial estimates of greatest need identified approximately 115 km of pipe in diameters from 150 mm to 1,000 mm. The major transmission main replacement/upgrade (Project D-1.1 on Table 6.1) includes approximately 37.5 kilometers of pipe ranging in size from 300 mm to 1000 mm. Replacement of mains in the first priority area, Ras El Tin, shown on Table 6.1 as Project D-1.2, would require approximately 78.2 kilometers of pipe, sizes 100 mm to 500 mm. Additional areas of similar size, such as indicated on Table 6.1 as Project D-1.3, can be expected to be similar in scope and complexity and to cost about \$10,000,000. As previously indicated, the final scope and cost of pipe replacement for HPP D-1 will depend on determinations by USAID and AWGA of final HPP priorities.

**D-6: 700 mm Transmission Main in Kabbari District.** Installation of 1800 meters of transmission main, in Masged Gabbari and Max Streets, connecting two existing 700 mm mains, will greatly improve system pressures in a section of Western Alexandria with chronic low-pressure problems.

**D-7: Construct new 1000 mm Transmission Main, Nozha WTP to Manshia WTP.** This project will augment the capacity of the existing 1000 mm line which runs between the two plants. The line will be approximately 3.0 kilometers long. The project will also include four new 1000 mm butterfly valves. It will enable the full capacity of the Nozha WTP to be used to provide relief of the Manshia WTP for service to western Alexandria and the area south of Lake Mariout.

**D-2: Upgrade Distribution System Operation and Maintenance Equipment.** This equipment package should include tapping machines, leak detection equipment, tools for district maintenance crews, powered valve operators and vehicles. Development of the final lists of items will follow a detailed determination of the contents of AWGA stores and will be coordinated with other donor programs. As of the writing of this report it is anticipated that such items will be acquired through the ISC local procurement program.

D-5: Upgrade and Augment the System-Wide Wireless Communication System. This activity would enable the current system to become operable and support field crews for operation and maintenance of the distribution system. As of the writing of this report, AWGA is planning to contract for this work directly.

## 6.2 Costs

Estimated capital costs are presented on Table 6.1 for all projects requiring additional commitment of funds by USAID and/or AWGA. Capital costs for construction projects in HPP groupings HPP-1, HPP-3 and HPP-7 include a contingency allowance of 20% of estimated construction costs. Costs herein are based on verbal descriptions from AWGA staff of requested work, site visits, development of preliminary scopes and on generalized cost data for similar work. The costs in Table 6.1 provide a guide to determining the probable allocation of funds and the likely fundability of the listed projects as HPPs. Volume II will include more detailed cost development, and costs therein will be based on conceptual designs to be developed as the master planning work continues.

A summary of costs, by project grouping, is presented in Table 6.2. All costs are in millions of US dollars.

**Table 6.2**  
**Summary Costs by Project Grouping**

<u>HPP No.</u>	<u>Group</u>	<u>Estimated Capital Cost</u>
HPP-1	Urban Poor Water Supply Projects	5.0
HPP-2	MWRI-Related projects	0.5
HPP-3	WTP Process and Mechanical Upgrades	35.2
HPP-4	Process Control Support Projects and Equipment	0.1
HPP-5	Demographic Information and Support Capability	3.7
HPP-6	Raw Water Reliability Improvements	3.2
HPP-7	Distribution System Improvements	56.3
TOTALS	TBD from revised Table 6.1	104.0

Total estimated capital costs exceed the available Results Package funding. Upon completion of more accurate costing in Volume II, final determination can be made as to which projects remain as HPP, which will be implemented as Stage I investments under the overall Master Plan, or if additions can be made to the HPP listed. Section 6.3, Implementation, presents a recommended approach to making the final determination.

## 6.3 Implementation

### 6.3.1 Determination of Final HPP List

When conceptual designs are completed and cost estimates based on them are prepared in Volume II, and final costs for in-kind contributions by AWGA are known, more accurate determination will be possible of which projects can be funded as HPP. Some individual projects will need to be deferred for later implementation as first stage investments. The determination of eligibility for HPP status should be made considering individual project ranking. Project D-1, Replacement of Distribution System Piping, fell relatively high on the consolidated ranking of projects, and it is recommended that it be included as a HPP. If the total of other final costs are lower than anticipated, it is recommended that the scope of project D-1 to be expanded to include additional small pipe replacement.

It is also recommended that all projects in HPP-1, HPP-2, HPP-4, HPP-5 and HPP-6 (except for RW-18) be included as HPP. It is true that some individual projects in those groupings were not highly ranked on the consolidated list. However they are generally lower cost, they complement and are complemented by highly ranked projects, and several are important studies which will, if completed expeditiously, enable major cost savings through optimization of the first stage investments to follow the HPP. Therefore, if the final estimate of probable costs does exceed HPP funding availability, it is recommended that AWGA, USAID and the Design/CMC team mutually determine which of the projects in HPP-3, WTP Process and Mechanical Upgrades, can be reduced and /or deferred for implementation as a first-stage investment. If final costs are lower than funding availability, it is recommended that the scope of Project D-1, Replacement of Distribution Piping, be expanded as indicated above.

### 6.3.2 Implementation Mechanisms

There are several potential approaches for implementing and funding the HPP, depending on their type and the responsible agency or contract mechanism. The mechanisms, and projects to be included under them are:

**Amendment to the Master Plan Contract.** This is the mechanism to be used to engage the NGO who will perform community relations, institutional strengthening and environmental assessment tasks for HPP-1, Project UP-1. Funding will be from the USAID Results Package.

**Fixed Amount Reimbursable (FAR) Agreement.** This is the mechanism to be used for construction of the distribution system for the Urban Poor Demonstration Program, Project UP-1 of HPP-1. Funding is anticipated to be 80% from the USAID Results Package and 20% from AWGA for UP-1.

**Oversight of MWRI and MHUUC Projects.** This is the mechanism for ensuring, through the cooperative management structure under Project RW-1, that raw water supply projects crucial to AWGA receive top priority in the responsible agencies and are

fully funded. This mechanism should cover all HPP-2 projects except RW-3, MC Rehabilitation Project; RW-23, Hydraulic Analysis; RW-21, Expanded Monitoring Program; and RW-17, Umum Drain Impact Planning. Funding will be from involved agencies' normal operating budgets and from capital funds budgeted for their projects. No USAID Results Package funding or AWGA capital funds are anticipated to be used other than for RW-23, RW-21 and RW-17.

**Technical and Feasibility Studies in Design and Construction Management Contract.** There are several technical analyses which should be conducted in parallel with the design/CMC work to establish the basis for decisions regarding first-stage investment components. Such projects include:

- RW-23: Hydraulic Analysis – Mahmoudia Canal
- RW-21 Expanded Monitoring Program, Raw Water
- RW-17 Umum Drain Impact Planning
- D-4 Population and Housing Surveys
- MGIS-6 Acquisition and Analysis - Multi-year Satellite Imagery
- MGIS-8 Extend GIS and Block Mapping
- RW-7 Airport Lake Feasibility Study
- RW-19 North Coast Feasibility Study

Funding for such studies would be from the USAID Results Package.

**Evaluation, Provision of Equipment, Training and Development of Procedures for Laboratories and Instrumentation Maintenance; Provision of Workshop and Maintenance Equipment.** This set of projects is recommended to be carried out by a combination of efforts under other donors' programs and through elements of the Institutional Strengthening Contract. These projects include:

- L-1: Laboratory Evaluation
- WTG-12: Equipment/Training-WTP Instrumentation Calibration / Maintenance
- L-3: Train Central Laboratory Staff
- L-2 Provide Laboratory Analytical Equipment
- L-8: Develop and Implement Laboratory Procurement Procedures
- L-4: Laboratory Data Management System
- WTG-11: Workshop Tools, Equipment for WTPs
- D-2: Distribution System O&M Equipment
- MGIS-2,3,4: Upgrade Survey Department Equipment, Software and Training

Funding will be from the Dutch and German Donor programs and, for the Institutional Strengthening Contract, funds already designated under the USAID Results Package.

**Equipment, Material, Software and Training to be Provided under Design and Construction Management Contract.** This includes equipment and material which is not directly associated with construction contracts. (Spare-parts, special tools and consumables necessary for start-up and testing will be provided with major equipment included in construction contracts). Projects included in the non-construction-related category include:

- WTG-1: Furnish and Initial Operation Mobile Water Treatment Pilot Plant
- L-5: Document Information Center
- MGIS-1: Provide Auto-CAD and Arc View Licenses and Training

Funding will be from the USAID Results Package. As of the writing of this report, it is still possible that the mobile pilot plant will be provided under the Dutch Program, in which case it can be deleted as a HPP.

**Conventional Construction Contracts.** It is anticipated that there will be one or two construction contracts. It two, one contract will be for the distribution system pipe replacement (D-1) and any other pipelines not within WTP sites. The other contract will be for all fundable WTP projects that are included in HPP-3 on Table 6.1, other than WTG-1, Mobile Pilot Plant; WTG-11, Workshop Tools, Equipment and Spare Parts; and those projects expected to be directly contracted by AWGA.

Funding will be shared by the USAID Results Package and by AWGA.

**Projects by GOE as Contribution-in-kind under Grant Agreement.** This set of projects will be funded by AWGA and includes:

- D-3, Pump Station and Reservoir Upgrades.
- RW-8, DWC Lining and Protection Program.
- D-5, Upgrade Wireless Communication System: Funding by AWGA.

It is anticipated that an amendment to the Grant Agreement or a Memorandum of Understanding between USAID and GOE will be executed requiring certification of completion of this set of projects as a condition of RP funding.

## 6.4 Schedule

The schedule for HPP is based on completion of all construction, equipment acquisition and startup of works by year-end, fiscal 2004. The overall schedule for the HPP is shown on Figure 6-1. Projects and related activities are depicted on the schedule generally according to the recommended implementation mechanisms, which often cut across the project groupings shown on Table 6.1. The project groupings are intended to show projects that are related technically. For a variety of reasons, projects within a given group may be funded and/or implemented by different agencies and programs, and their schedules will thus depend on those funding and implementation mechanisms.

### 6.4.1 Amendment to Master Plan Contract

NGO activities in support of the Urban Poor Demonstration Program will be procured by an amendment to the Master Plan Contract. Award of a contract to an NGO and conduct of the work (community relations, institutional strengthening) is critical to the overall success of the Demonstration Program. The contract is expected to be awarded third quarter 2000 and to run through December 2000.

#### 6.4.2 Fixed amount Reimbursable (FAR) Agreement

Construction of the pipelines for the Urban Poor Demonstration Program UP-1, will be under-taken in this manner. AWGA will use its existing contract mechanisms to procure pipe and to engage a construction contractor to install pipelines. Design of the system is a joint AWGA/CDM Team effort under the Master Plan, on-going as of this writing. Construction is scheduled to begin in third quarter, 2000. The system is scheduled to be installed and operational by December, 2000.

Assuming successful completion of the Demonstration Program in Mohsen El Kobra, additional Urban Poor projects may be developed. As indicated on Fig.6-1, it is anticipated that these projects would be conducted under future FAR agreements.

#### 6.4.3 USAID – Funded Design, Construction, Construction Management

In order to complete construction of major HPP works, the necessary sequence of events is generally:

Procure and Award Design and CM Contract. The contract should be awarded in November, 2000.

Pre-Design, Design. Design and procurement documents for construction should be completed by mid-August, 2001.

For project WT5-1, the Nozha WTP rehabilitation, startup and pipe connections, water pipeline, an expedited schedule could be developed based on findings of the initial O&M evaluation and startup test. The goal is to get the plant in operation as quickly as possible, with repairs and replacement necessary for long-term, reliable operation being done with the plant in as fully an operational mode as possible.

Construction Management (CM) Services. These activities under the design and CM Contract will commence with development and analysis of pre-qualification documents and submittals for construction contractors. The CM services will therefore overlap with design work. The CM services will extend until works under the program are complete and in operation.

Construction. Construction is expected to be executed under a single contract, although separate contracts for treatment works and for pipeline could be developed. In either case, construction contract award is scheduled for January, 2002. All works should be completed, accepted, and turned over to AWGA by September, 2004.

#### 6.4.4 Technical and Feasibility Studies

This set of projects, if approved as HPP, will be conducted as part of the USAID-funded design and CM contract. In general they are to commence with award of the design/CMC in November, 2000 and to be completed as indicated on Figure 6.1

#### 6.4.5 Process Control and Maintenance Equipment, Training and Procedures

This set of projects is anticipated to be carried out under the ISC host country procurement, under that USAID funded contract or by the Dutch and German donor programs. To the extent that some of all of the work can be completed by end of second quarter 2001, results can be incorporated in the design/CMC work.

#### 6.4.6 Projects By AWGA

Projects in this category are expected to be incorporated in the program by development and execution of a grant amendment or memorandum of understanding which will outline the terms for these projects to constitute part of the GOE share of costs under the USAID Grant.

#### 6.4.7 Oversight of MWRI and MHUUC Projects

This set of projects although included in other agencies' capital programs, is crucial to the quantity, quality and reliability of AWGA's water supply. Thus their expedited implementation makes them among the most critical of HPP. The first required activity is establishment of a mechanism or mechanisms (RW-1) for cooperative interagency activity on these projects. It is recommended that the mechanism be in place and functioning no later than end-of-year 2000. One individual project, Rehabilitation, Last 8 km Mahmoudia Canal, is shown separately because of its time-critical nature with respect to other HPP. As of the writing of this report, work on the roadway adjacent to the canal is underway, but work on the canal has not started. Completion of canal improvements is necessary in order to allow optimum operation of works constructed under WTG-10, Raw Water Intakes and Canal Outlet Structure Upgrades. Moreover, it would be desirable to have the rehabilitation of the canal completed prior to conduct of Project RW-23, Hydraulic Analysis, Mahmoudia Canal.

### 6.5 Long-term Outsourced Maintenance and Calibration Contracts

Several HPP include recommendations for computers, computer-related systems and/or instrumentation for treatment works and the distribution system. All such procurements should include at least a one-year contract for maintenance and calibration beyond the standard warranty period. It is also recommended that AWGA plan on continuing with out-sourced maintenance and calibration of such systems or equipment.

Implementation Mechanism	HPP Nos		2000	2001	2002	2003	2004
	Group	Project					
<b>Amendment to Master Plan Contract</b>							
- NGO Contract for Urban Poor Demonstration Project FAR Agreement	HPP-1	UP-1	Proposal/Award	Conduct Project			
- Install Pipe, Urban Poor Demonstration Project	HPP-1	UP-1	Design/Execute FARA	Construction			
	HPP-1	UP-2		Analyze UP-1	Secure Agreements, Design	Construction	
	HPP-1	UP-3					
<b>USAID - Funded Design, Construction and Construction Management</b>							
- Engineering Design and CMC	HPP 3&7	-	USAID Procurement and Contract Award	Pre-design, Final Design		Construction Management Services	
- Distribution System Construction	HPP-7	*	Construction Contractor Prequal.		Bid & Award	Construction	
- WTP Construction	HPP-3	**			Bid & Award	Construction	
<b>Technical and Feasibility Studies (Part of Engineering Design Contract)</b>							
- Furnish and operate mobil pilot plant	HPP-3	WTG-1		Design/Procure	Operate	Routine Operation - AWGA	
- Hydraulic Analysis, MC	HPP-2	RW-23					
- Expanded Water Quality Monitoring	HPP-2	RW-21		Procurement/Installation		Conduct Expanded Monitoring - AWGA	
- Urum Drain Impact Planning	HPP-2	RW-17		TDS Model/Canal Pre-Design		Implementation	
- Acquisition Multi-Year Satellite Imagery	HPP-6	MGIS-8				Decision	
- Demographic Analysis, Informal Housing	HPP-5	D-4					
- Extend GIS and Block Mapping	HPP-5	MGIS-8					
- Airport Lake Feasibility Study	HPP-6	RW-7		Engineering Feasibility		Water Quality Monitoring - AWGA	
- North Coast Feasibility Study	HPP-6	RW-19					
- AWGA Document Information Center	HPP-4	L-5		Acquisition	Training		
- Auto-Cad and Arc View Licenses and Training	HPP-5	MGIS-1					
<b>Process Control and Maintenance Equipment, Training, Procedures</b>							
- WTP Instrument, Maint./Calibrat. Equipment & Training	HPP-4	WTG-12		Specify	Procure	Training	
- Laboratory Evaluation	HPP-4	L-1					
- Train Lab Staff	HPP-4	L-3		Basic	Advanced		
- Provide Laboratory Analytical Equipment	HPP-4	L-2		Specify	Procure		
- Develop/Implement Lab Procurement Procedures	HPP-4	L-8					
- Lab Data Mgt System	HPP-4	L-4		Specify	Procure	Training	
- Upgrade Survey Dept. Equipment & Software Training	HPP-5	MGIS-2,3,4		Specify	Procure		
- WTP Workshop Tools and Equipment	HPP-3	WTG-11		Specify	Procure		
- Distribution System O&M Equipment	HPP-7	D-2		Specify	Procure		
<b>Projects by AWGA</b>							
- Execute Grant Amendment Or MOU							
- Lining and Protection - DWC	HPP-6	RW-8					
- Upgrade Wireless Communication System	HPP-7	D-5					
- Pump Station/Reservoir Upgrades	HPP-3	D-3					
<b>Oversight of MWRI and MHUUC Projects</b>							
- Establish/Implement Cooperative Mechanism(s)	HPP-2	RW-1		Establish		Implementation	
- Phase III Mahmoudia Canal Rehabilitation	HPP-2	RW-3					
- Oversight/Cooperation on Agencies Projects	HPP-2	***					

\* Includes D-1, D-7, D-8  
 \*\* Includes Projects WTG-7, WTG 2/4, WT5-1, WTG-3, WTG-9, WTG-14, WTG-10, WTG-5, WTG-8, WT1-2  
 \*\*\* Includes Projects RW-4, RW-24, RW-8, RW-20, RW-3, RW-9

## Section 7.0 Environmental Review

### 7.1 Introduction

This is a screening-level environmental review of the HPP listed in Table 6-1, which will be undertaken as part of the USAID-Funded construction activities. This environmental review has been performed at a master-planning level of effort and detail, which is less than that of an environmental assessment. This environmental review process does not replace the environmental requirements for each structural project as it moves into the design stage. Under both Egyptian and US law, most of the projects that are of a structural nature will require a detailed environmental assessment (EA) or environmental impact statement (EIS) when they reach the design phase. (A summary of Egyptian and US environmental laws and procedures may be found in Appendix A.) The purpose of this review is to highlight areas of environmental concern which will require analysis during design.

This set of projects is implemented under the supervision (or with the support of) of the Alexandria Water General Authority, representing the Governorate of Alexandria (GOA), and the United States Agency for International Development (USAID).

Egypt is in the process of establishing a strong commitment to the preservation of the environment. For a project that has reached the design phase, an environmental assessment is required to satisfy the comprehensive body of regulations that have been developed to protect the Egyptian environment based on Law 4 for the Year 1994. In addition to meeting the Egyptian regulations, the USAID environmental procedures embodied in 22 CFR 216 "Environmental Procedures" must be satisfied. These Egyptian and USAID regulation are discussed in the following sub-sections.

#### 7.1.1 Egyptian Environmental Legislation

Law 4 of the year 1994 entitled "Promulgating the Law on the Environment" and its Executive Regulations, the Prime Ministry Decree No. 338 for the Year 1995, set forth the overall framework for protection of the environment. Under the law, whether or not an installation or establishment should be subject to the provisions on evaluation of the environmental impact assessments is determined according to: the type of the establishment's activity; the extent of the establishment's exhaustion of natural resources, especially waters, agricultural lands, and mineral wealth; the site of the establishment; and the type of power used in operating the establishment. The proposed water supply facilities would come under these controls.

Law No. 4/94 requires the preparation of an environmental impact assessment with the application for license for a project. The owner of the establishment, according to the provision of this law, shall attach to his application a statement describing the project, comprising the data included in a form prepared by the environmental affairs agency. In addition the owner shall monitor and record the impact of the project's activity on the environment.

Law 4/94 established an agency for the protection and development of the environment called the "Egyptian Environmental Affairs Agency" (EEAA). This agency replaces the agency which was established by virtue of Republican Decree No. 631 of the year 1982, with all its rights and obligations.

A series of regulations have been issued by different ministries, which are applicable to water supply projects. These include:

- Presidential Decree No. 93/1962 Concerning drainage of liquid wastes
- Decree No. 649/1962                      The executive regulations of Law No.93/1962
- Decree No. 470/1971                      On the norms of atmospheric pollution in establishments and industrial sub-ordinated units
- Law No. 57/1978                              On eliminating pools and swamps and prevention of digging works
- Presidential Decree No.631/1982 Regarding establishing an Environmental Affairs Authority at the Presidency of the Council of Ministers
- Law No. 102/1982                              Concerned with the establishment and management of Egyptian protected natural areas
- Law No. 48/1982                              Protection of the River Nile and waterways from pollution
- Ministerial Decree No. 08/1983              The executive regulations of Law No. 48/198
  - Decree No. 09/1988                      Regarding the amendment of certain provisions of the Ministerial Decree No. 08/1983
- Ministerial Committee                      Reuse of wastewater in irrigation  
Organized under  
law No. 276/1994
- Decree No. 108/1995                          Ministry of health standards for drinking water

In addition to the above regulations NOPWASD, through the Water and Wastewater Institutional Support Project (WWISP), has proposed water and wastewater standards. These standards are included in final report no. CG-11 entitled, "Environmental Standards for Potable Water and Wastewater Discharge", and SR-9 entitled, "Environmental Code Enforcement Program".

### 7.1.2 USAID Environmental Procedures

USAID's environmental procedures are found in 22 CFR Part 216, and are further explained in the Agency's Handbook 3, Appendix 2D. These procedures are consistent with Executive Order 12114, issued January 4, 1979, entitled "Environmental Effects

Abroad of Major Federal Actions” and the purposes of the National Environmental Policy Act of 1970. These guidelines, which were adopted in 1976 and revised in 1980, formalize the agency’s commitment to environmental considerations during the decision-making process leading to implementation or rejection of a project. Within the process, reasonable foreseeable environmental impacts are identified, and alternatives or mitigating measures are recommended. The USAID environmental procedures are outlined in Table 7.1.

For projects falling in various classes of actions (Sect. 216.2.d), including potable water and sewerage projects other than those that are small scale, either an Environmental Assessment (EA) or Environmental Impact Statement (EIS) will be required (Sect. 216.2.d.1.xl). Thus, an EA would be required for the water supply measures eventually proposed for Alexandria as a result of this project.

An EA is defined as “a detailed study of the reasonably foreseeable significant effects, both beneficial and adverse, of a proposed action on the environment of a foreign country or countries” (Sect. 216.1.c.4). It must be prepared when an EIS is deemed unnecessary according to the criteria in Sect. 216.7.

An EIS is defined as “a detailed study of the reasonably foreseeable environmental impacts, both positive and negative, of a proposed AID action and its reasonable alternatives on the United States, the global environment or areas outside the jurisdiction of any nation as described in Sect. 216.7 of the procedures” (Sect. 216.1.c.5). It must be prepared when “agency actions significantly affect... (1) the global environment or areas outside the jurisdiction of any nation (e.g., the oceans); (2) the environment of the United States; or (3) other aspects of the environment at the discretion of the Administrator” (Sect. 216.7.a). In the case of (1) and (3) above, an EIS “will generally follows the President’s Council on Environmental Quality (CEQ) Regulations, but will take into account the special considerations and concerns of AID.”

### 7.1.3 Reporting Requirements for the Alexandria Water Master Plan

The Environmental Reviews undertaken for the High Priority Projects in the present report, and to be performed for the Master Plan activities in the Master Plan itself, are in essence Initial Environmental Examinations, the first level of procedure listed in Table 7.1.

As employed in this report, the process provides an opportunity to classify each proposed project as to the likelihood of its having a significant environmental impact, and to make initial suggestions and comments as to mitigations of adverse impacts and enhancements of beneficial impacts. For the projects with structural components, an initial assessment is made as the nature and degree of impacts to be expected.

Table 7.1 Summary of USAID Environmental Procedures

USAID Environmental Procedures	Description of Environmental Procedures	Remarks
1. Initial Environmental Examination(IEE)	First review of the reasonably foreseeable effects of a proposed action on the environment.	This is the level of effort and detail used in the present study.
2. Threshold Decision	A formal agency decision which determines whether a proposed agency action is a major action affecting the environment.	
3. Negative Declaration	Declaration in writing that the agency will not develop an EA or an EIS regarding an action found to have an effect on the environment.	
4. Scope of EA or EIS	Identification of the significant issues relating to the proposed action and determination of the key issues to be addressed in the EA or EIS. Expert consultations, public and private installations and host governments should participate in the scoping.	Written statements covering the environmental key issues. Review and approval by the Bureau Environmental Officer (BEO) is required.
5. Preparation of EA or EIS	A detailed study of the reasonably foreseeable significant impact, both beneficial and adverse, of a proposed action on the environment.	Report covering the study is required. BEO review and approval is required.
6. Monitoring	Environmental monitoring is an integral part of the EA or EIS and the project implementation to the same extent as other aspects of the project.	EA or EIS should include a monitoring program.
7. Revisions	In the case of major changes in scope of work or nature of project during its implementation, the Negative Declaration will be reviewed and the above procedures will be carried out again.	Supplements to EA or EIS will be required and BEO review and approval is required.

## 7.2 Environmental Classifications

The High Priority Projects, as shown in Table 6.1, can be classified, for purposes of Environmental Review, as being Institutional/Technical, In-Plant, or Structural. (Note that "classification" in this Section 7.0 has a different connotation than in Sections 2.0 and 3.0).

**Institutional/Technical** projects are activities that should improve the knowledge base and/or the way operations are carried out, but which do not directly involve a structural activity. Although some Institutional/Technical project warrant environmental comment, we judge that in general their environmental impact can only be positive, and that no detailed systematic environmental review of these projects is necessary.

**In-plant** projects are those that may involve some structural activity, but are within the confines of existing AWGA water treatment plants or booster stations. All such projects are viewed as having beneficial environmental impacts to a greater or lesser degree, and no adverse impacts as long as all applicable safety codes and procedures are observed. Again, in some instances environmental comment is warranted, but no detailed systematic environmental review of the "In-plant" projects is considered necessary.

**Structural** projects are those that clearly involve construction activity outside of AWGA facilities boundaries, and which should receive detailed environmental assessment. Some of the structural projects are to be undertaken as HPP. Others are either already underway, or expected to be undertaken within other agencies' programs; in which case, responsibility for environmental compliance lies with those agencies.

## 7.3 Environmental Review of the HPP

### 7.3.1 HPP-1: Urban Poor Water Supply Projects

To date, only one project, for the district of Mohsen El Kobra, is in this category. However, others may follow. The project will have both institutional/technical components, and structural components.

The principal environmental comment that can be made at this time is that the improved delivery of water to a district entails an increased need for sewerage. This point is already well recognized, and AWGA is coordinating its plans for improving water service with AGOSD's sewerage plans.

### 7.3.2 HPP-2: MWRI-Related Projects

**RW-1: Implement cooperative management structure.** This institutional measure is of overriding importance, not only to the supply of adequate water to Alexandria, but also in the efficient and rational use of environmental resources such as water, land, energy, and agriculture throughout the west Delta.

**RW-3: Implement Phase III MC Rehabilitation Project.** In addition to the water supply benefits to AWGA, the socio-economic benefits of this project, largely by others, are substantial, and should be supported by AWGA. For review of the components of

this project related to USAID-funded construction, see WTG-10 under HPP-3, below. Environmental regulatory compliance with respect to the canal rehabilitation itself is the responsibility of the implementing agencies: GOA, MWRI, Social Fund for development.

**RW-4: Implement MC/KC dredging and weed removal.** There is a continuous need for this activity, due to the suspended solids and nutrient loads in the Nile water, which settles out as the flow slows. An issue here is that while weed removal will definitely benefit the canal, weeds must be not left to decay on the canal bank, but moved away to an appropriate disposal area, lest the nutrient-rich leachate from the decaying weeds simply flow back into the canal to nourish weed growth once again.

Disposal of the mud and weeds may benefit agriculture, if it is made available as a soil builder and green manure. Plant operation and maintenance, and intake operation, definitely stand to benefit from this project. Conversely, the no-action alternative would result in major adverse impacts on land, water, and energy (because of the increased need for pumping and possibly the construction of a new canal) as well as on human and agriculture impacts (less water for drinking and for irrigation). Note that RW-23, Hydraulic Analysis of the Mahmoudia Canal, may show ways to reduce the frequency and intensity of project RW-4. Environmental regulatory compliance is the responsibility of the MWRI.

**RW-23: Hydraulic analysis of the MC,** is an institutional/technical project that is a prerequisite to improved performance of the Mahmoudia Canal. The benefits of improved performance include:

- Enhanced quantity and reliability of water supply to the WTPs;
- Possible elimination of the need for expanding upstream hydraulic capacity.
- Enhancement of the aesthetic benefits of the MC rehabilitation project.

Hydraulic analysis of the MC also would be of great benefit to WTG-10, upgrade of the WTP intakes, in that it would provide better design criteria for those upgrades.

**RW-24: Implement Water Quality Enforcement Programs.** This is an institutional measure which could greatly benefit all consumers relying on the canal systems for drinking water supply.

**RW-6: Implement agricultural drain flow diversion.** As this is principally an activity of flow management, there is essentially no construction involved, hence negligible construction impacts. By reducing the flow of drain water into the canal system, water quality is improved in the canal, and therefore treatment reliability is improved and salinity is decreased. On the other hand, it likely will increase irrigation energy expenditure, if increased pumping is required. Environmental regulatory compliance is the responsibility of the MWRI.

**RW-20. Implement treatment of wastewater to Umum Drain.** This project, already underway in compliance with Egyptian Law 48, should enhance the overall quality of Umum Drain water drawn upon to augment the flow in the Noubaria system. Environmental regulatory compliance is the responsibility of the MHUUC.

**RW-5. Implement irrigation demand management program.** This project would seek ways to reduce irrigation flows by improved irrigation management and even by having farmers switch away from "thirsty" crops (rice, in particular) to crops of comparable value but requiring less water. If done intelligently and sensitively and in collaboration with the farmers, the adverse impact on agriculture can be minimized, and the positive benefit of increased flow available for urban supply can be substantially increased. This project would involve minimal construction activity, hence negligible construction impacts. Environmental regulatory compliance is the responsibility of the MWRI.

**RW-9. Maximize KC flow to MC.** This activity is largely one of operating existing canal gates; hence construction impacts are minimal. The principal impact issue is that water in the Sahel Markus Canal would receive less KC water and more Rosetta Nile water, via the El Atf Pump Station. It is presumed that Nile water is satisfactory for the irrigation needs of land watered from the Sahel Markus Canal. An important component of this activity is to keep the KC dredged and free of weeds. Environmental regulatory compliance would be the responsibility of the MWRI.

**RW-21: Expanded RW Monitoring Program and RW-17: Umum Drain Impact Planning.** Both are technical projects with no direct environmental impacts. They are designed to collect and evaluate data and information to enable future decisions regarding capital projects and system operations to be optimized technically, financially and environmentally.

### 7.3.3 HPP-3: Water Treatment Plant Process and Mechanical Upgrades.

Most of the projects in this funding package are classified as In-plant, and require no further review herein. However:

**WT5-1: Nozha WTP Rehabilitation and start up.** Involves out-of-plant work in connecting pipelines to enable the Nozha WTP to supply a section of the distribution system currently being served by the Manshia WTP.

**WTG-10: Upgrade WTP intakes and the MC outlet.** Upgrading the intakes will aid the WTP functions directly.. Upgrading the MC outlet, which consists essentially of making it normally leaktight, will greatly improve hydraulic control over the MC, with the resulting benefit of reliable quantity of supply for the WTPs served by the canal.

Besides being normally leaktight, the present goal of the MC outlet project is to have the ability to open a gate wide, to rapidly purge the MC in the event of, say, a toxic spill into it. This environmental review notes that to purge the MC of any such spill would be to release it to the Western Harbor, an adverse impact. At the design stage, the complete EA will need to consider the balance of any adverse impact on the Western Harbor against the benefit of being able to quickly purge the main raw water supply to the city of a toxic spill, should it occur.

**WTG-8: Implement WTP residuals management projects.** The great benefit of this item is relieving the MC of the WTP residuals, which consist not only of the suspended solids transported through the MC to the WTPs, but also the coagulant salts used to settle

the solids in the WTP clarifiers. It will also unburden the clarifiers of any solids recirculating from the residuals WTP intake(s). The principal burden will be on the AGOSD sewerage system, which will have to deal with these residuals henceforth.

#### 7.3.4 HPP-4: Process Control Support Projects and Equipment.

All projects in this funding package are institutional/technical in nature, and require no further environmental review.

#### 7.3.5 HPP-5: Demographic Information and Support Capability.

All projects in this funding package are institutional/technical in nature, and require no further environmental review.

#### 7.3.6 HPP-6: Raw Water Reliability Improvements.

**RW-7: Airport Lake feasibility study.** This institutional/technical study would strongly complement RW-23, the hydraulics study of the MC, whose potential benefits have been described above. A caution is that as the lake is developed as a balancing reservoir, the existing fishery in the lake should be protected.

**RW-8: Completion of DWC lining and protection program.** This activity is well away from congested urban areas, so has no adverse socio-economic impacts, only the beneficial ones of helping to ensure a more reliable water supply. Construction activity may have a minor adverse impact on the quality of the raw water in the canal.

**RW-19: North Coast feasibility studies.** For these institutional/technical studies, it should be noted that the wholesale development of the north coast tourist district certainly has been deserving of careful environmental assessment (by others), and environmental considerations should be part of the balance in water supply projects when they are undertaken. As with HPP-1, the Urban Poor Water Supply Project, increasing the supply of water to people summering on the North Coast will entail a need for proper sewage collection, treatment, and disposal.

**RW-18: Construct 12.5 km of 1500 mm pipeline to the Maamoura WTP.** This project is to build a new pipeline to parallel the existing one. The environmental benefits of a more reliable supply to the eastern districts of the city will have to be balanced against the usual minor ones of increased congestion in the work area during construction.

#### 7.3.7 HPP-7: Distribution System Improvements.

**D-1: Replace and upgrade system from Manshia to Sidi Gaber; D-7: Additional 1000 mm main, Nozha to Manshia; and D-6: 700 mm main in Kabbari District.** Construction activities will have the usual nuisance impacts on life, services, and industry in these areas, due to open trenches in streets. The construction schedule can impact these attributes favorably if prompt, or adversely if it lags. These impacts can be mitigated by using modern trenchless methods of pipeline construction and replacement wherever technically and economically feasible.

The other projects in this funding package, D-2 and D-5, are institutional/ technical, and need no further environmental review herein.

#### 7.4 Matrix Summary analysis

The environmental ramifications of the projects, recommended for USAID/AWGA funding, with structural components are shown on Table 7.2.

Each activity is examined for the likelihood of its having a positive or negative effect in each of several environmental categories, listed in the header row. The major environmental categories are:

- Physical environment (with the sub-categories of Land, Water, Air, Biota, and Energy);
- Socio-Economic (Human, Services, Industry, and Agriculture);
- Aesthetic and Cultural (including any archaeological aspects).

Comments are supported by informal ratings, such as (++) for a very beneficial impact, or (-) for a somewhat adverse impact.

Table 7.2, supported by the individual project discussions above, constitutes the HPP environmental review. The table is a summary of the individual activity impact matrices that were completed for each of the structural HPP, and which may be found in Section 7.5, Table 7.3.

**Table 7.2 Summary Matrix for HPP with Structural Components  
(Recommended For USAID/AWGA Funding)**

Project	Environmental Attributes			
	Physical Environment (Land, Water, Air, Biology, Energy)	Socio-Economic (Human, Services, Industry, Agriculture)	Cultural and Aesthetic	Comments, Conclusions, Mitigation
HPP-1: Urban Poor Water Supply Demonstration Project	Minor construction impacts to land and water	Great benefit to quality of life and human health, and local industry.(++) Very important that AGOSD provide sewerage. (++/- -)		Provision of Sewerage becomes the chief environmental mitigation. Expedited construction also required.
WT5-1: Nozha Rehab. and Start-up		Enables Nozha WTP operation pending MC improvements (++) Avoids over-loading Manshia WTP (++) Minor construction inconveniences (-)		Preferable to costly upgrade at Manshia. Well-planned construction needed to minimize traffic disruptions.
WTG-10: WTP intakes and MC outlet	MC outlet upgrade improves MC performance, hence reduces energy requirements (++)	Intake upgrades improve WTP operation (++) MC outlet upgrade is important part of MC improvement, hence WTP operation (++) . Emergency discharge to purge MC of any toxic spill would have an impact on the Western Harbor (-).	Part of neighbor-hood rehab (++)	MC outlet upgrade is important part of MC rehabilitation. Construction controls required to minimize construction-related water quality and hydraulic impacts in canal.
WTG-8: WTP residuals management	Improves Canal WQ (++) Reduces energy and chemical req'ts in WTP (+)	Extra load to AGOSD sewerage system (-) If AGOSD sludges are used in agriculture, this is a benefit (+)	Improves appearance of canal (+)	WTP residuals management is important part of MC rehab. Controlled discharge to sewers required to minimize impacts on AGOSD systems.
RW-8: DWC lining and protection program	Minor construction impacts to water and to air (-)	Improves reliability of supply to WTPs (++)		Construction controls required to minimize quality & hydraulic impacts
RW-18: New pipeline to Maamoura WTP		Improves quality and reliability of flow to Maamoura WTP (+) Minor disruptions to traffic along route (-)		Construction controls required
D-1: Replace and upgrade distribution system, Manshia to Sidi Gaber; D-7: Additional 1000 mm main Nozha to Manshia; D-6: 700 mm main in Kabbari District		Minor inconvenience to people, services and industry during construction (-) Significant improvement in supply to people, services and industry when completed (++)		Use trenchless methods as feasible. Construction controls required to minimize traffic disruption.

## 7.5 Activity Impact Matrices

For each structural project shown on Table 7.2, the activity impact matrices in Table 7.3 include eight types of construction activities and six types of operation activities, listed in the left marginal column. The final row of the matrix allows one to assess the impacts in the case of no action.

Each activity is examined for the likelihood of its having a positive or negative effect in each of several environmental categories, listed in the header row. The major environmental categories are:

- Physical environment (with the sub-categories of Land, Water, Air, Biota, and Energy);
- Socio-Economic (Human, Services, Industry, and Agriculture);
- Aesthetic and Cultural (including any archaeological aspects).

In the cells of the matrix, a positive number is shown if the effects are judged to be beneficial, and negative if adverse. A "1" denotes a minor effect; a "2" denotes a major effect. The absence of any entry implies that no significant impact is anticipated in the category by this activity.

Occasionally, the notation, "+/- 1" is used to denote an activity that could be mildly adverse if not conducted with care, but that could also be mildly beneficial if done promptly and properly. A "+/- 2" denotes a more major effect in the balance.

The activity impact matrix is not a spreadsheet whose cell values are to be totaled. Rather, it is an attempt to display in a qualitative, compact way the potential environmental impacts of:

[construction and operation activities]  
on  
[physical, social, etc., environmental attributes]  
in  
[each project of the HPP program].

Once completed, the activity impact matrix shows at a glance what aspects of the project have impacts on which environmental attributes.

Table 7.3. Activity Impact Matrices

Table 7.3.1 Activity Impact Matrix for HPP-1:  
Urban Poor Water Supply Project

	Environmental Attributes										
	Physical Environment					Socio-Economic				Cultural and Aesthetic	
	Land	Water	Air	Biology	Energy	Human	Services	Industry	Agri-culture	Cultural	Aes-thetic
<b>Construction Activities</b>											
Taking and occupation of land						-1					
Preparation and drainage of site	-1	-1				-1					
Transport of materials						-1					
Construction activities						-1	-1				
Supply of materials and other resources								+1			
Waste disposal											
Work force and economics						+1					
Construction schedule						+/-1					
<b>Operation Activities</b>											
Material handling and storage											
Wastewater disposal	+/- 2	+/- 2				+/- 2	+/- 2	+/- 2		+/- 2	+/- 2
Supply of materials and other resources											
Plant operation and maintenance											
Intake operation											
Work force											
Presence of facility						+2	+1	+2		+1	+1
<b>No-Action Alternative</b>						- 2	-1	- 2			

**Table 7.3.2 Activity Impact Matrix for Structural Component of WT5-1:  
Nozha WTP Rehab and Startup**

	Environmental Attributes										
	Physical Environment					Socio-Economic				Cultural and Aesthetic	
	Land	Water	Air	Biology	Energy	Human	Services	Industry	Agriculture	Cultural	Aes- thetic
<b>Construction Activities</b>											
Taking and occupation of land											
Preparation and drainage of site											
Transport of materials											
Construction activities						-1					
Supply of materials and other resources											
Waste disposal											
Work force and economics						+1					
Construction schedule											
<b>Operation Activities</b>											
Material handling and storage											
Sludge disposal											
Supply of materials and other resources											
Plant operation and maintenance						+2	+2				
Intake operation											
Work force						+1					
Presence of facility											
<b>No-Action Alternative</b>						-2					

**Table 7.3.3 Activity Impact Matrix for WTG-10:  
WTP intakes and the Mahmoudia Canal Outlet**

	Environmental Attributes										
	Physical Environment					Socio-Economic				Cultural and Aesthetic	
	Land	Water	Air	Biology	Energy	Human	Services	Industry	Agriculture	Cultural	Aes- thetic
<b>Construction Activities</b>											
Taking and occupation of land											
Preparation and drainage of site		-1					-1	-1			
Transport of materials							-1				
Construction activities	-1	-1					-1				
Supply of materials and other resources								+1			
Waste disposal	+/-1	+/-1									
Work force and economics								+1			
Construction schedule											
<b>Operation Activities</b>											
Material handling and storage		+/-1									
Sludge disposal		+/-1									
Supply of materials and other resources											
Plant operation and maintenance					+1	+2		+2			
Intake operation					+1	+2		+2			
Work force											
Presence of facility						+1	+1			+1	+1
No-Action Alternative					-1	-2		-2			

**Table 7.3.4 Activity Impact Matrix for WTG-8:  
WTP Residuals Management**

	Environmental Attributes										
	Physical Environment					Socio-Economic				Cultural and Aesthetic	
	Land	Water	Air	Biology	Energy	Human	Services	Industry	Agriculture	Cultural	Aesthetic
<b>Construction Activities</b>											
Taking and occupation of land	-1										
Preparation and drainage of site											
Transport of materials											
Construction activities	-1					-1	-1				
Supply of materials and other resources											
Waste disposal											
Work force and economics								+1			
Construction schedule											
<b>Operation Activities</b>											
Material handling and storage											
Sludge disposal	-1	+2							+1		
Supply of materials and other resources											
Plant operation and maintenance		+2			+2	+2					
Intake operation		+2									
Work force											
Presence of facility											+1
No-Action Alternative		-2		-2							-2

**Table 7.3.5 Activity Impact Matrix for RW-8:  
Drinking Water Canal lining and protection program**

	Environmental Attributes										
	Physical Environment					Socio-Economic				Cultural and Aesthetic	
	Land	Water	Air	Biology	Energy	Human	Services	Industry	Agriculture	Cultural	Aes- thetic
<b>Construction Activities</b>											
Taking and occupation of land											
Preparation and drainage of site											
Transport of materials			-1								
Construction activities		-1									
Supply of materials and other resources								+1			
Waste disposal											
Work force and economics						+1					
Construction schedule											
<b>Operation Activities</b>											
Material handling and storage											
Sludge disposal											
Supply of materials and other resources											
Plant operation and maintenance							+2				
Intake operation							+1				
Work force											
Presence of facility											
No-Action Alternative	-1						-2				

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**Table 7.3.6 Activity Impact Matrix for RW-18:  
1500 mm Pipeline to Maamoura WTP**

	Environmental Attributes										
	Physical Environment					Socio-Economic				Cultural and Aesthetic	
	Land	Water	Air	Biology	Energy	Human	Services	Industry	Agriculture	Cultural	Aesthetic
<b>Construction Activities</b>											
Taking and occupation of land	-1					-1					
Preparation and drainage of site						-1					
Transport of materials			-1								
Construction activities			-1								
Supply of materials and other resources								+1			
Waste disposal											
Work force and economics						+1		+1			
Construction schedule						+/-1					
<b>Operation Activities</b>											
Material handling and storage											
Sludge disposal											
Supply of materials and other resources							+1				
Plant operation and maintenance							+1				
Intake operation							+1				
Work force											
Presence of facility						+2	+2				
<b>No-Action Alternative</b>						-2	-2				

**Table 7.3.7 Activity Impact Matrix for D-1; D-6; D-7  
Replace Upgrade Distribution System -  
Manshia to Sidi Gaber; 700 mm Main in  
Kabbari District; 1000 mm Main Nozha to Manshia WTP**

	Environmental Attributes										
	Physical Environment					Socio-Economic				Cultural and Aesthetic	
	Land	Water	Air	Biology	Energy	Human	Services	Industry	Agriculture	Cultural	Aesthetic
<b>Construction Activities</b>											
Taking and occupation of land	-2										
Preparation and drainage of site	-1	-1									
Transport of materials			-1								
Construction activities	-2	-1				-1	-1	-1			
Supply of materials and other resources								+2			
Waste disposal											
Work force and economics						+1		+1			
Construction schedule	+/-2					+/-2	+/-2	+/-2			
<b>Operation Activities</b>											
Material handling and storage											
Sludge disposal											
Supply of materials and other resources											
Plant operation and maintenance											
Intake operation											
Work force											
Presence of facility						+2	+2	+2			
No-Action Alternative						-2	-2	-2			