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SANITARY DRAINAGE  
(NOPWASD)

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**CANAL CITIES  
WATER AND WASTEWATER  
PHASE II PROJECT  
USAID CONTRACT 263-0174**

Scoping Reports  
for the Environmental Assessments  
for the Canal Cities Water and Wastewater  
Phase II Project

28 March 1990



BLACK & VEATCH INTERNATIONAL  
ENGINEERS-ARCHITECTS

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Consulting Engineers Inc



in association with  
SABBOUR ASSOCIATES

**SCOPING REPORT  
ENVIRONMENTAL ASSESSMENT OF A NEW WASTEWATER  
TREATMENT PLANT PROPOSED FOR SUEZ CITY**

**Government of Egypt-U.S. Agency for International Development:  
Canal Cities Water and Wastewater Project  
Phase II**

**INTRODUCTION**

Egypt's National Organization for Potable Water Supply and Sanitary Drainage (NOPWASD), in association with the United States Agency for International Development (USAID), is proposing to build a new sewage treatment plant for Suez City. The proposed treatment plant is one element of the Canal Cities Water and Wastewater Project Phase II, partially funded by USAID. Phase II of the project continues more than a decade of effort to rehabilitate Suez's war-damaged wastewater system, and provides capacity for future urban growth of this important region.

NOPWASD and USAID tentatively agree that an Aerated Lagoon treatment method should be used by the proposed Suez wastewater treatment plant, basing their decision on considerations of cost, simplicity of operation, land requirements, and effluent quality. The treatment plant will vastly improve the quality of urban wastewater flowing into Suez Bay from Suez City. Nevertheless, proposed construction of the new facilities has raised several environmental concerns that require further analysis.

NOPWASD is conducting an Environmental Assessment of the proposed new sewage treatment plant for Suez City. An Environmental Assessment (EA) provides decision-makers with information concerning: existing environmental conditions, potential environmental impacts of the proposed project's construction and operation, possible mitigating measures, monitoring programs, opportunities for environmental enhancement, and environmental management plans.

As part of preparation of the EA, scoping meetings were held in Cairo on 8 February and in Suez City on 11 February. The purpose of the scoping meetings was to bring together all parties with an interest in Suez City's proposed new wastewater treatment plant to assist NOPWASD in identifying environmental issues that should be addressed by the EA. The scoping meeting in Cairo was held in reference to the proposed construction of wastewater treatment plants in Ismailia and Port Said as well

as the proposed project in Suez City. Participants were invited to voice their concerns, questions, and comments regarding technical and environmental aspects of the planned wastewater treatment plant. Participants were further invited to submit comments in writing to Construction Management Consultants (CMC) by 1 March. This scoping report summarizes oral and written comments received for the Suez project EA. A list of attendees at the scoping meetings in Cairo and Suez City is attached.

## PROJECT DESCRIPTION

### Design Parameters

The Suez City wastewater treatment plant will be built to meet a projected year-2005 service population, which is expected to constitute 86 percent of the total urban population. The design flow rate for a plant is based on the current population and per capita water consumption for all uses--household, commercial, and industrial--plus the projected population growth times the expected usage rate. The planned capacity for the plant assumes that infiltration will be reduced for newly built areas. The year-2005 design flow for Suez City is 130,000 cubic meters per day.

### Plant Location

Suez City's new wastewater treatment facility will be on the west shore of the Bay approximately 5 km southwest from the existing wastewater treatment facility next to the new power station. Effluent will be discharged into Suez Bay via either the Al Saal Drain or via an outfall-diffuser system extending into the Bay. The precise location and means of discharge will be determined in the final engineering design. A sludge disposal site has been tentatively identified at the west end of the site.

### Aerated Lagoon Treatment Method

After screening and grit removal, the wastewater will flow through aerated and facultative lagoons, which are agitated to provide oxygen, and on to a polishing pond, where treatment continues. The bulk of the solids settle out in the facultative lagoons. Sludge handling is simplified because the sludge is partially stabilized in the lagoons and requires removal as infrequently as every 6 months to 2 years. Collected sludge will be dried in sludge drying lagoons, and then stockpiled at the plant for up to 90 days until disposal. As long as the plant is operating properly, its treated effluent will meet Egypt's Law 48 quality standards for BOD and TSS.

## ENVIRONMENTAL CONSIDERATIONS

In 1989, during preparation of the Alternative Treatment Study, USAID requested a preliminary environmental review of the project. As a result, the following issues were identified for analysis in the EA.

### Effluent Quality and Point of Discharge

Suez City's effluent will be discharged into Suez Bay, either directly or via the Al Saal Drain. Although treatment will greatly reduce the BOD, it will not eliminate it, and effluent nutrient levels will only be partially reduced. Determining the effects on water quality for the discharge alternatives will be an important part of the EA process. Location of the discharge point will be based on consideration of impacts on nearby seawater intakes at the power plant, fisheries research facility, oil refineries, and other shore-based facilities. *The EA will recommend a discharge location and any necessary mitigations to address water quality impacts.*

### Effluent Reuse

Although the plant's preliminary design does not provide for reuse of the treated effluent for agriculture and aquaculture, the planned treatment method and means of effluent discharge do not preclude this as a future possibility. However, such future reuse entails a number of human health issues, which will be fully considered in the EA. High total dissolved solids content of the effluent in Suez may limit reuse in agriculture.

### Sludge Disposal

<sup>also</sup> The design now calls for sludge disposal primarily by on-site land disposal at a dedicated site on the west end of the proposed wastewater treatment plant site. The EA will explore the suitability of sludge use for agriculture subject to conditions imposed by public health and soil contamination concerns.

*The EA will recommend any necessary controls needed to protect the environment at the dedicated sludge disposal site.*

### Public Health and Safety

Pathogens remaining in the effluent and sludge are important environmental concerns. Chlorination of the effluent may be required to significantly reduce the levels of pathogens in the effluent. The chlorine itself poses a threat to fish and other aquatic organisms and may need to be removed if it is deemed to be an environmental threat. Chlorine is in short supply and expensive in Egypt, and therefore may not be a reliable treatment method. The necessity and desirability of chlorination will be appraised in the EA.

Fly and mosquito breeding in wastewater standing at the treatment plant represents another possible disease transmission threat. The extent of the threat will be reviewed and environmentally sound methods of mitigating it identified.

*and suitability of alternatives such as chlorination*

## Groundwater

Suez City has a relatively high groundwater table, both at the plant sites and beneath the collection system. The EA will address the potential for wastewater contamination of groundwater.

## Noise, Traffic, Odors, and Other Nuisances

The proposed wastewater plant is a large capital project, occupying over 900 feddans that unavoidably will produce noise, traffic, odors, and other nuisances--both during construction and normal operation. An aspect of the EA will be fully cataloging these problems and identifying ways of mitigating them.

## Effects on Aquatic and Wildlife Communities

The biotic communities of the Suez Canal region, as with its human communities, should greatly benefit from the proposed new wastewater treatment plant. Reducing the BOD, nutrients, and pathogens now flowing from Suez City will result in healthier aquatic communities in Suez Bay. Urban wastewater is only one of several sources of pollution now flowing into the Bay. The EA will endeavor to put the benefits accruing from improved wastewater treatment to Suez Bay and its associated natural communities in the context of water quality in Suez Bay.

## COMMENTS RECEIVED

### Cairo Scoping Meeting

Several participants at the Cairo scoping meeting offered comments germane to the scope of the EA. The following is a brief summary of these comments.

- o Agricultural reuse of effluent and sludge. Several commentors and lively discussion focused on the desirability of reusing the wastewater and sludge for agriculture.
- o Chlorination. Concern was expressed regarding chlorination of the effluent and its effect on fisheries.
- o Parasites. Potentially high rates of infestation by the nematode Ascaris in the population, the resistance of eggs of this parasite to wastewater treatment, and implications for human health were noted.
- o Disinfection. A question was raised regarding potential use of ozonation as an alternative to disinfection by chlorination.

- o Reduction in fecal coliform. Interest was expressed in the rate of natural die-off of fecal coliform bacteria in the receiving water.
- o Heavy metals. A question was raised about the levels of heavy metals in the sewage.
- o Alternatives considered. Several commentors expressed an interest in alternative treatment methods that had been considered and the reasons for their rejection as the preferred alternative.
- o Algae in treatment lagoons. A question was raised regarding algae blooms in the treatment lagoons, how these would be managed, and their effects on plant operation and the environment.
- o Nutrient loading in Suez Bay. It was noted that if algal levels in Suez Bay increased because of nutrient loading, then adverse effects could result for the nearby power plant seawater intake.
- o Ecological integrity of Suez Canal region. Concern was expressed regarding impacts of the proposed project on ecological functioning of the Suez Canal system and natural barriers to migration of species between the Red and Mediterranean Seas.
- o Assimilative capacity of Suez Bay. Concern was expressed regarding the assimilative capacity of Suez Bay for both municipal and industrial wastes.

These comments and concerns will be considered and addressed by the EA. In addition to these comments germane to the EA, several comments and questions were raised regarding the treatment process and the EA process itself.

### Suez Scoping Meeting

Several participants at the Suez scoping meeting offered comments germane to the scope of the EA. The following is a brief summary of these comments.

- o Reuse of effluent. Several commentors expressed concern regarding the desirability of using effluent for agriculture. A question was raised about the effects of using saline effluent in desert reclamation. One participant asked whether the currently high salt content of the effluent could be reduced by additional treatment.
- o Health risks. A question was raised regarding the health risk associated with operation and maintenance of a plant with the proposed treatment process.

- o Impact on tourism development. Concern was raised regarding effects of outfall discharge on tourism facilities.
- o Future industrial development. A comment regarding the construction schedule and its impact on industrial expansion in the area raised the possibility of future inflow and treatment of industrial wastes at the site.
- o Field study design. Information was requested on location of sampling stations and protocols.
- o Discharge from ships in Suez Bay. A question was raised about the prohibition of discharge from ships in Suez Bay and whether enforcement of regulations occurred.

These comments and concerns will be considered and addressed by the EA. In addition to these comments germane to the EA, several comments and questions were raised regarding the treatment process and the EA process itself.

### Written Comments

Written comments were received at the Suez scoping meeting, but some of these were directed at the projects in Ismailia and Port Said. These comments are incorporated in scoping reports for the respective projects. Written comments germane to the Suez project include:

- o concerns about oil pollution in Suez Bay,
- o interest in expected effluent quality, and
- o energy consumption and costs associated with operation and maintenance.

These matters will be addressed in the EA.

### Summary

Based on preliminary environmental review by the project team and questions and comments received at the scoping meetings for the Suez project, the following appear to be issues of primary concern:

- o the expected impacts of the proposed discharge on water quality of Suez Bay;
- o location of the outfall in Suez Bay and its impacts on seawater intakes at the nearby fisheries research and power plant facilities;

- o impacts of the proposed discharge on plans for tourism development in Suez Bay;
- o potential use of the effluent for agriculture and aquaculture;
- o public health risks associated with effluent discharge and reuse;
- o public health risks associated with re-use of sludge; and
- o alternatives considered and the basis for their rejection as the preferred alternative.

### Work Plan

A tentative outline for the Suez EA is attached. The issues of primary concern will be addressed in appropriate detail in the EA.

Water quality in Suez Bay will be evaluated with data collected during development of the Master Plan and during field studies by the project team in July and December 1989. Data from current meters moored in the nearshore area will improve knowledge of circulation patterns and help evaluate outfall locations. Indicators of sewage sludge deposits in the nearshore zone will be examined to further refine understanding of long-term nearshore circulation. Water quality data collected in 1989 will be used in water quality modeling efforts to evaluate impact of wastewater discharge on Suez Bay.

Development plans for the Suez Bay area will be reviewed to evaluate compatibility of land use plans with construction and operation of the proposed treatment plant facilities.

Quality of the effluent and its suitability for agriculture or aquaculture use will be described. Factors to be considered in re-use of the effluent will be briefly described; this analysis will facilitate future master planning effort for eventual expansion or upgrading of the proposed facility. In particular, quality of effluent and sludge with respect to bacteria and pathogens will be described, and implications for public health assessed.

The EA will briefly described alternatives that were considered and rejected in the planning and preliminary design stages, and explain the reasons for their rejection as the preferred alternative.



## LIST OF ATTENDEES

Cairo Scoping Meeting - 8 February 1990

<u>NAME</u>	<u>POSITION</u>
Mr. Mahmoud Abd El Haleem Abdel Aal	Chairman of NOPWASD
Mr. Aly Hussein Aly	NOPWASD
Mr. Ahmed Hassan Khodeir	NOPWASD
Mr. Hossam El Deen Mohamed	NOPWASD
Ms. Samira Nicola	NOPWASD
Ms. Howaida Ennany	NOPWASD
Ms. Hala Abd El Kader Hassan	NOPWASD
Mr. Nabil Saleh	NOPWASD
Mr. Mohamed Negm El Deen	NOPWASD
Mr. Mohamed Ahmed Abd El Salam	Head of Ismailia City Council
Mr. Maher Faris	Director of Ismailia Sanitary Drainage
Ms. Marcelle Fakhry	General Organization for Reconstruction and Agricultural Development Projects
Mr. Ikhlas Gamal El Deen Mohamed	Center of Environment Health in Imbaba
Mr. Mohamed Kotb Naddar	Ministry of Public Works and Water Resources
Mr. Adel El Zoghbi	Deputy Minister for Foreign Financing (Ministry of Housing)

**NAME****POSITION**

Mr. Abdel Aziz El Basiouni	Suez Canal Authority
Ms. Samaa El Kassaby	STC
Mr. Abd El Salam Awad	Head of the Central Dept for Utilities
Mr. El Sahey Hiragy	Sanitary Drainage - Suez
Mr. Makram Milad	Director of Wildlife Preservation
Mr. Gameel Atta	Department of Wildlife Preservation
Mr. Mostafa Ahmed Mahmoud	Department of Wildlife Preservation - Giza Zoo
Mr. Mohamed Farouk Badawi	Environmental Affairs Agency
Mr. Hamed Badawi	Atomic Energy Authority
Mr. Ahmed Hassan Azzam	Atomic Energy Authority
Ms. Samar Karam Wissa	General Org. for Water Resources
Mr. Mohamed Elwan	General Org. for Development of Fish Resources
Mr. Hozayyen El Diwany	National Research Center
Mr. Hammam El Abd	National Research Center
Mr. Mohamed Ibrahim	Environmental Affairs Agency
Mr. Fathi Haikal	Food Provisions Sector
Mr. Saad Hassan	Food Provisions Sector

<u>NAME</u>	<u>POSITION</u>
Mr. Youssef Mahmoud Shideed	General Authority for Urban Planning Regional Project
Mr. Atef Mohamed Serour	General Authority for Urban Planning Regional Project
Mr. Mohamed Abd El Fattah El Kassas	Faculty of Science - Cairo University
Mr. Atef Diab	Instructor in the Faculty of Science (Suez Canal Univ.)
Mr. Magdi Mohsen Bahgat	Assistant Instructor at the Suez Canal Univ.
Mr. Ahmed Hamza	Alexandria University
Ms. Samia Galal	Higher Institute of Public Health -Alex.
Mr. Mahmoud El Hewagy	Environmental Institute - Ein Shams Univ.
Mr. Mohsen Tawfik	Dean of Environmental Institute - Ein Shams Univ.
Mr. Samir Ghabbour	Prof. at the African Studies Inst. Cairo Univ.
Mr. Mostafa Foda	Assoc. Prof. - Faculty of Science (El Azhar Univ.)
Mr. Paul Thorn	USAID
Mr. Michael Gould	USAID
Mr. John Saccheri	USAID
Mr. Ken Lue Phang	USAID
Mr. Medhat Wissa	USAID

NAME

POSITION

Mr. M.A. Feldt

USAID

Suez Scoping Meeting - 11 February 1990

NAME

POSITION

H.E. Gen. Tahseen Shannan

The Governor of Suez

Mr. Mohamed Negm El Deen

NOPWASD

Mr. Samira Nicola

NOPWASD

Mr. Mohamed Abd El Aziz Ahmed

Deputy of Housing and Utilities  
Dept - Suez

Mr. El Sayeh Haragy Hassan

Head of Suez Sanitary Drainage

Mr. Mohamed Hosni Abd El Maksoud

Suez Agricultural Dept

Mr. Selim Amer

Dept of Health Affairs

Mr. Mohamed Hosni Abd El Maksoud

Suez Agricultural Dept

Mr. Selim Amer

Dept of Health Affairs

Mr. Taha Abou Shousha

General Director of Health  
Affairs

Mr. Hassan

Environmental Affairs Agency

Mr. President the Local Council

Director of Authority for Fish  
Resources

Mr. Yehia Salama

General Information Authority -  
Suez Center

Mr. Hossam Borai

Public Relations in the  
Governorate (Information)

NAME

POSITION

Mr. Abd El Aziz El Basiouni

Manager of General Works Dept  
- SCA

Mr. El Sayed Abd El Shafi

Egyptian Contracting Co (Ex.  
Mokhtar Ibrahim)

Mr. Abdallah El Haddad

Director of Governorate's Public  
Relations

Mr. Gharieb Gohar Gohar

Suez Information Center

Mr. Magdi Mohsen Bahgat

Assistant Instructor - Faculty of  
Science, Suez Canal Univ.

Mr. John Saccheri

USAID

Mr. Jim Gallup

USAID/Washington

Mr. Medhat Wissa

USAID

## TENTATIVE OUTLINE SUEZ EA

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- Land Use
- Public Health
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- Air Quality
- Cultural Resources

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*Continued use of Soap's upgraded treatment plant  
 Chlorination or ozonation  
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References

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- List of People Contacted
- Scoping Report

**SCOPING REPORT  
ENVIRONMENTAL ASSESSMENT OF A NEW WASTEWATER  
TREATMENT PLANT PROPOSED FOR ISMAILIA**

Government of Egypt - U.S. Agency for International Development  
Canal Cities Water and Wastewater Project  
Phase II

**INTRODUCTION**

Egypt's National Organization for Potable Water Supply and Sanitary Drainage (NOPWASD), in association with the United States Agency for International Development (USAID), is proposing to build a new sewage treatment plant for Ismailia. The proposed treatment plant is one element of the Canal Cities Water and Wastewater Project Phase II, partially funded by USAID. Phase II of the project continues more than a decade of effort to rehabilitate Ismailia's war-damaged wastewater system, and provides capacity for future urban growth of this important region.

NOPWASD and USAID tentatively agree that an Aerated Lagoon treatment method should be used by the proposed Ismailia wastewater treatment plant, basing their decision on considerations of cost, simplicity of operation, land requirements, and effluent quality. Plants of similar design are proposed for Suez City and Port Said. The treatment plant will vastly improve the quality of urban wastewater flowing into Lake Timsah from Ismailia. Nevertheless, proposed construction of the new facilities has raised several environmental concerns that require further analysis.

NOPWASD is conducting an Environmental Assessment of the proposed new sewage treatment plant for Ismailia. An Environmental Assessment (EA) provides decision-makers with information concerning: existing environmental conditions, potential environmental impacts of the proposed project's construction and operation, possible mitigating measures, monitoring programs, opportunities for environmental enhancement, and environmental management plans.

As part of preparation of the EA, scoping meetings were held in Cairo on 8 February and in Ismailia on 13 February. The purpose of the scoping meetings was to bring together all parties interested in Ismailia's proposed new wastewater treatment plant to assist NOPWASD to identify environmental issues that should be addressed by the Environmental Assessment Study Team. The scoping meeting in Cairo was held in reference to the proposed construction of wastewater treatment plants in Suez and Port

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Said as well as the proposed project in Ismailia. Participants were invited to voice their concerns, questions, and comments regarding technical and environmental aspects of the planned wastewater treatment plant. Participants were further invited to submit comments in writing to Construction Management Consultants (CMC) by 1 March. This scoping report summarizes oral and written comments received for the Ismailia project EA. A list of attendees at the scoping meetings in Cairo and Ismailia is attached.

## PROJECT DESCRIPTION

### Design Parameters

The Ismailia wastewater treatment plant will be built to meet a projected year-2005 service population, which is expected to constitute 86 percent of the total urban population. The design flow rate for a plant is based on the current population and per capita water consumption for all uses--household, commercial, and industrial--plus the projected population growth times the expected usage rate. The year-2005 design flow for Ismailia is 90,000 cubic meters per day.

### Plant Location

Ismailia's new wastewater treatment facility will be about 7 km south of the existing site on the west side of the Ismailia-Suez desert road, north of the Cairo-Sarabum desert road. Ismailia's effluent will most likely be discharged into El Mahsama Drain or El Manayef Drain at one of three alternative locations, flowing onward to the West Lagoon of Lake Timsah, and ultimately into the lake itself. Other alternatives are being considered, and the final selection of an effluent disposal alternative will probably be made upon completion of the EA. A sludge disposal site has been tentatively identified on the north end of the proposed treatment plant site.

will EA  
recommend  
completion

### Aerated Lagoon Treatment Method

After screening and grit removal, the wastewater will flow through aerated and facultative lagoons, which are agitated to provide oxygen, and on to a polishing pond, where treatment continues. The bulk of the solids settle out in the facultative lagoons. Sludge handling is simplified because the sludge is partially stabilized in the lagoons and requires removal as infrequently as every 6 months to 2 years. Collected sludge will be dried in sludge drying lagoons, and then stockpiled at the plant for up to 90 days until disposal. As long as the plant is operating properly, its treated effluent will meet Egypt's Law 48 quality standards for BOD and TSS.

## ENVIRONMENTAL CONSIDERATIONS

In 1989, during preparation of the Alternative Treatment Study, USAID requested a preliminary environmental review of the project. As a result, the following issues were identified for analysis in the EA.

### Effluent Quality and Point of Discharge

One discharge option is to continue putting effluent into the West Lagoon of Lake Timsah via the El Mahsama Drain. Complicating this alternative is a planned diversion of El Mahsama drain water into the Suez Sweetwater Canal by the Ministry of Public Works and Water Resources. Other alternatives being considered include a discharge of disinfected effluent to El Manayeeef Canal, or discharge via agricultural drains to Moaskar Lake and eventually the Suez Canal between Great Bitter Lake and Lake Timsah. Alternative outfall discharges into the Great Bitter Lake and directly into Lake Timsah have also been considered, but appear to be less acceptable environmentally.

Although treatment will greatly reduce the BOD, it will not eliminate it, and effluent nutrient levels will only be partially reduced. Determining the effects on water quality for the discharge alternatives will be an important part of the EA process. Location of the discharge point will be based on consideration of impacts on Lake Timsah and the Suez Canal.

### Effluent Reuse

Although the present plant's design does not provide for reuse of the treated effluent for agriculture and aquaculture, the planned treatment method and means of effluent discharge do not preclude this as a future possibility. However, such future reuse entails a number of human health issues, which will be fully considered in the EA.

### Sludge Disposal

The design now calls for sludge disposal primarily by on-site land disposal at a dedicated site, tentatively located on the north end of the proposed wastewater treatment plant site. The EA will explore the suitability of sludge use for agriculture subject to conditions imposed by public health and soil contamination concerns.

### Public Health and Safety

Pathogens remaining in the effluent and sludge are important environmental concerns. Chlorination of the effluent may be required to significantly reduce the levels of pathogens in the effluent. The chlorine itself poses a threat to fish and other aquatic organisms and may need to be removed if it is deemed to be an environmental

threat. Chlorine is in short supply and expensive in Egypt, and therefore may not be a reliable treatment method. The necessity and desirability of chlorination will be appraised in the EA.

Fly and mosquito breeding in wastewater standing at the treatment plant represents another possible disease transmission threat. The extent of the threat will be reviewed and environmentally sound methods of mitigating it identified.

### Groundwater

Ismailia has a relatively high groundwater table, both at the plant site and beneath the collection system. The EA will address the potential for wastewater contamination of groundwater.

### Noise, Traffic, Odors, and Other Nuisances

The proposed wastewater plant is a large capital project, occupying over 800 feddans that unavoidably will produce noise, traffic, odors, and other nuisances--both during construction and normal operation. An aspect of the EA will be fully cataloging these problems and identifying ways of mitigating them.

### Effects on Aquatic and Wildlife Communities

The biotic communities of the Suez Canal region, as with its human communities, should greatly benefit from the proposed new wastewater treatment plant. Reducing the BOD, nutrients, and pathogens now flowing from Ismailia will result in healthier aquatic communities in the West Lagoon and Lake Timsah. The EA will endeavor to put the benefits accruing from improved wastewater treatment to Lake Timsah and its associated natural communities in the context of water quality in the West Lagoon.

## COMMENTS RECEIVED

### Cairo Scoping Meeting

Several participants at the Cairo scoping meeting offered comments germane to the scope of the EA. The following is a brief summary of these comments.

- o Agricultural reuse of effluent and sludge. Several commentators and lively discussion focused on the desirability of reusing wastewater and sludge for agriculture.

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- o Chlorination. Concern was expressed regarding chlorination of the effluent and its effect on fisheries.
- o Parasites. Potentially high rates of infestation by the nematode Ascaris in the population, the resistance of eggs of this parasite to wastewater treatment, and implications for human health were noted.
- o Disinfection. A question was raised regarding potential use of ozonation as an alternative to disinfection by chlorination.
- o Reduction in fecal coliforms. Interest was expressed in the rate of natural die-off of fecal coliform bacteria in the receiving water.
- o Heavy metals. A question was raised about the levels of heavy metals in the sewage.
- o Alternatives considered. Several commentors expressed an interest in the alternative treatment methods and disposal options that had been considered and the reasons for their rejection as the preferred alternative.
- o Algae in treatment lagoons. A question was raised regarding algae blooms in the treatment lagoons, how these would be managed, and their effects on plant operation and the environment.
- o Ecological integrity of Suez Canal region. Concern was expressed regarding impacts of the proposed project on ecological functioning of the Suez Canal system and natural barriers to migration of species between the Red and Mediterranean Seas.
- o Poultry operations. Concern was expressed regarding the effect of the proposed construction and operation of the wastewater treatment plant on a large poultry business that has several plants in the vicinity of the wastewater treatment plant.
- o Water quality sampling program. Interest was expressed in the details of the water quality sampling program conducted as part of the preliminary environmental review and engineering design. This comment with respect to Ismailia and Port Said was also raised during the Suez scoping session.

These comments and concerns will be considered and addressed by the EA. In addition to these comments germane to the EA, several comments and questions were raised regarding the treatment process and the EA process itself; these were addressed during the scoping meeting.

## Ismailia Scoping Meeting

Several participants at the Ismailia scoping meeting offered comments germane to the scope of the EA. The following is a brief summary of these comments.

- o Reuse of effluent. Several commentators expressed concern regarding the desirability of using effluent for agriculture. One commentator expressed the opinion that the funds used to carry the wastes to a discharge to a water body should be used to carry the effluent to a desert reclamation site.
- o Discharge upstream of the proposed El Mahsama diversion. One individual noted that discharge of treated effluent upstream of a proposed diversion of El Mahsama Drain water to the Suez Sweetwater Canal would be undesirable.
- o Development plans. It was noted that a plan had been prepared to rehabilitate West Lagoon as part of a fisheries and tourism development project, and that the proposed discharge to El Mahsama Drain may not be consistent with this plan.
- o Impact on tourism development. Concern was raised regarding effects of discharge to Lake Timsah on tourism facilities and fisheries.
- o Ecological integrity of Great Bitter Lake. It was noted that Great Bitter Lake is ecologically and economically significant, and that this should not be considered as an alternative discharge location.
- o Nuisance conditions. Concern was expressed regarding algal growth and mosquito breeding in polishing lagoons, and their impacts on plant operations and human health.

These comments and concerns will be considered and addressed by the EA. In addition to these comments germane to the EA, several comments and questions were raised regarding the treatment process and the EA process itself.

## Written Comments

Written comments were received at the Suez scoping meeting that were directed at the projects in Ismailia and Port Said. Written comments germane to the Ismailia project include:

- o effluent standards for discharge to Lake Timsah and Great Bitter Lake;
- o location of sampling of raw wastewater for chemical analyses;

- o impact of possible diversion of water from El Mahsama Drain to water quality in the Suez Sweetwater Canal, if discharge of effluent were to occur upstream of the diversion; and
- o energy consumption and costs associated with operation and maintenance.

These matters will be addressed in the EA.

### Summary

Based on preliminary environmental review by the project team and questions and comments received at the scoping meetings for the Ismailia project, the following appear to be issues of primary concern:

- o potential use of the effluent for agriculture;
- o the expected impacts of the proposed discharge on water quality of Lake Timsah and the West Lagoon;
- o impacts of the proposed discharge on plans for tourism development around Ismailia;
- o public health risks associated with effluent discharge and re-use;
- o public health risks associated with sludge re-use; and
- o alternatives considered and the basis for their rejection as the preferred alternative.

### Work Plan

A tentative outline for the Ismailia EA is attached. The issues of primary concern will be addressed in appropriate detail in the EA.

Water quality in West Lagoon will be evaluated with data collected during development of the Master Plan and during field studies by the project team in July and December 1989. Water quality data collected in 1989 will be used in mass loading analyses and water quality modeling efforts to evaluate impact of wastewater discharge on West Lagoon and Lake Timsah.

Development plans for the Ismailia area will be reviewed to evaluate compatibility of land use plans with construction and operation of the proposed treatment plant facilities.

Quality of the effluent and its suitability for agriculture or aquaculture use will be described. Factors to be considered in reuse of the effluent will be briefly described; this analysis will facilitate future master planning effort for eventual expansion or upgrading of the proposed facility. In particular, quality of effluent and sludge with respect to bacteria and pathogens will be described, and implications for public health assessed.

The EA will briefly described alternatives that were considered and rejected in the planning and preliminary design stages, and explain the reasons for their rejection as the preferred alternative.

## LIST OF ATTENDEES

Cairo Scoping Meeting - 8 February 1990

<u>NAME</u>	<u>POSITION</u>
Mr. Mahmoud Abd El Haleem Abdel Aal	Chairman of NOPWASD
Mr. Aly Hussein Aly	NOPWASD
Mr. Ahmed Hassan Khodeir	NOPWASD
Mr. Hossam El Deen Mohamed	NOPWASD
Ms. Samira Nicola	NOPWASD
Ms. Howaida Ennany	NOPWASD
Ms. Hala Abd El Kader Hassan	NOPWASD
Mr. Nabil Saleh	NOPWASD
Mr. Mohamed Negm El Deen	NOPWASD
Mr. Mohamed Ahmed Abd El Salam	Head of Ismailia City Council
Mr. Maher Faris	Director of Ismailia Sanitary Drainage
Ms. Marcelle Fakhry	General Organization for Reconstruction and Agricultural Development Projects
Mr. Ikhlas Gamal El Deen Mohamed	Center of Environment Health in Imbaba
Mr. Mohamed Kotb Naddar	Ministry of Public Works and Water Resources
Mr. Adel El Zoghbi	Deputy Minister for Foreign Financing (Ministry of Housing)



**NAME****POSITION**

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Mr. Abd El Salam Awad	Head of the Central Dept for Utilities
Mr. El Sahey Hiragy	Sanitary Drainage - Suez
Mr. Makram Milad	Director of Wildlife Preservation
Mr. Gameel Atta	Department of Wildlife Preservation
Mr. Mostafa Ahmed Mahmoud	Department of Wildlife Preservation - Giza Zoo
Mr. Mohamed Farouk Badawi	Environmental Affairs Agency
Mr. Hamed Badawi	Atomic Energy Authority
Mr. Ahmed Hassan Azzam	Atomic Energy Authority
Ms. Samar Karam Wissa	General Org. for Water Resources
Mr. Mohamed Elwan	General Org. for Development of Fish Resources
Mr. Hozayyen El Diwany	National Research Center
Mr. Hammam El Abd	National Research Center
Mr. Mohamed Ibrahim	Environmental Affairs Agency
Mr. Fathi Haikal	Food Provisions Sector
Mr. Saad Hassan	Food Provisions Sector

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Mr. Atef Mohamed Serour	General Authority for Urban Planning Regional Project
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Mr. Atef Diab	Instructor in the Faculty of Science (Suez Canal Univ.)
Mr. Magdi Mohsen Bahgat	Assistant Instructor at the Suez Canal Univ.
Mr. Ahmed Hamza	Alexandria University
Ms. Samia Galal	Higher Institute of Public Health -Alex.
Mr. Mahmoud El Hewagy	Environmental Institute - Ein Shams Univ.
Mr. Mohsen Tawfik	Dean of Environmental Institute - Ein Shams Univ.
Mr. Samir Ghabbour	Prof. at the African Studies Inst. Cairo Univ.
Mr. Mostafa Foda	Assoc. Prof. - Faculty of Science (El Azhar Univ.)
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Mr. Michael Gould	USAID
Mr. John Saccheri	USAID
Mr. Ken Lue Phang	USAID
Mr. Medhat Wissa	USAID

NAME

POSITION

Mr. M.A. Feldt

USAID

Ismailia Scoping Meeting - 13 February 1990

NAME

POSITION

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Governor of Ismailia

Eng. Abd El Salam El Rafei

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NOPWASD

Ms. Samira Nicola

NOPWASD

Mr. Reda Faisal

Ismailia Governorate

Ms. Salwa Ahmed El Sewerki

Secretariat of the Governor

Mr. Antar El Ashmoni

Ministry of Information

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General Director of Roads &  
Transportation Dept.

Ms. Magda Kisseiba

Director of the Sanitary  
Drainage Laboratories

Mr. Abd El Aziz El Bassiouni

Suez Canal Authority

Ms. Wagida Ahmed Attiyah

General Director of Sinai and  
Canal Information and Director  
of El-Nil Center

Mr. Gameel Abd El Mawla Atta

Wildlife Protection Dept. - El  
Giza Zoo

NAMEPOSITION

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Mr. Mohamed Abd El Gawwad Aref	Head of 1st District
Mr. Ahmed Mohammadein	Head of 2nd District
Mr. Maher Faris	Director of Sanitary Drainage
Mr. El Deen Attiya	Director of Governorate's Public Relations
Mr. Mahmoud El Ibrashi	Ismailia Information Center
Mr. Mohamed Tamar	Ismailia Information Center
Mr. Abdallah El Khodari	Ministry of Health
Mr. Magdi Riad	Suez Canal T.V.
Ms. Fatma Wahba	Suez Canal T.V.
Mr. Mohamed El Saied Farghaby	Suez Canal Univ.
Mr. Richard Hartnoll	Liverpool Univ. (S.C.V. Project, EEC)
Mr. Ahmed Doudar	Vice President of Suez Canal Univ.
Mr. Medhat Wissa	USAID
Mr. John Saccheri	USAID
Mr. James Gallup	USAID/Washington

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*Add Drain*

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No-Action Alternative  
Surface Water Quality

Aquatic Resources  
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Public Health  
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**Preferred Alternatives**

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Terrestrial Habitat  
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Land Use  
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**SCOPING REPORT  
ENVIRONMENTAL ASSESSMENT OF A NEW WASTEWATER  
TREATMENT PLANT PROPOSED FOR PORT SAID**

Government of Egypt - U.S. Agency for International Development  
Canal Cities Water and Wastewater Project  
Phase II

**INTRODUCTION**

Egypt's National Organization for Potable Water Supply and Sanitary Drainage (NOPWASD), in association with the United States Agency for International Development (USAID), is proposing to build a new sewage treatment plant for Port Said. The proposed treatment plant is one element of the Canal Cities Water and Wastewater Project Phase II, partially funded by USAID. Phase II of the project continues more than a decade of effort to rehabilitate Port Said's war-damaged water and wastewater system, and provides capacity for future urban growth of this important region.

NOPWASD and USAID tentatively agree that an Aerated Lagoon treatment method should be used by the proposed Port Said wastewater treatment plant, basing their decision on considerations of cost, simplicity of operation, land requirements, and effluent quality. Plants of similar design are proposed for Suez City and Ismailia. The treatment plant will vastly improve the quality of urban wastewater flowing into Lake Manzala from Port Said. Nevertheless, proposed construction of the new facilities has raised several environmental concerns that require further analysis.

NOPWASD is conducting an Environmental Assessment of the proposed new sewage treatment plant for Port Said. An Environmental Assessment (EA) provides decision-makers with information concerning: existing environmental conditions, potential environmental impacts of the proposed project's construction and operation, possible mitigating measures, monitoring programs, opportunities for environmental enhancement, and environmental management plans.

As part of preparation of the EA, scoping meetings were held in Cairo on 8 February and in Port Said on 19 February. The purpose of the scoping meetings was to bring together all parties interested in Port Said's proposed new wastewater treatment plant to assist NOPWASD to identify environmental issues that should be addressed by the Environmental Assessment Study Team. The scoping meeting in

Cairo was held in reference to the proposed construction of wastewater treatment plants in Suez and Ismailia as well as the proposed project in Port Said. Participants were invited to voice their concerns, questions, and comments regarding technical and environmental aspects of the planned wastewater treatment plant. Participants were further invited to submit comments in writing to Construction Management Consultants (CMC) by 1 March. This scoping report summarizes oral and written comments received for the Port Said project EA. A list of attendees at the scoping meetings in Cairo and Port Said is attached.

## PROJECT DESCRIPTION

### Design Parameters

The Port Said wastewater treatment plant will be built to meet a projected year-2005 service population, which is expected to constitute 87 percent of the total urban population. The design flow rate for a plant is based on the current population and per capita water consumption for all uses--household, commercial, and industrial--plus the projected population growth times the expected usage rate. The year-2005 design flow for Port Said is 190,000 cubic meters per day.

### Plant Location

Port Said's new wastewater treatment facility will be situated on a dredged fill land peninsula extending southwest into Lake Manzala west of the city, about 4 km south from the existing treatment plant. The plant will be bordered to the west by the new ring road presently under construction. Effluent will be discharged into Lake Manzala via one of two alternative outfalls now under study. A sludge landfill site has tentatively been identified east of the Suez Canal opposite Qantara, some 35-40 km southeast of Port Said. Negotiations with the Governorate are still continuing to confirm the availability and suitability of the site.

NEED  
to decide

### Aerated Lagoon Treatment Method

After screening and grit removal, the wastewater will flow through aerated and facultative lagoons, which are agitated to provide oxygen, and on to a polishing pond, where treatment continues. The bulk of the solids settle out in the facultative lagoons. Sludge handling is simplified because the sludge is partially stabilized in the lagoons and requires removal as infrequently as every 6 months to 2 years. Collected sludge will be dried in sludge drying lagoons, and then stockpiled at the plant for up to 90 days until disposal. As long as the plant is operating properly, its treated effluent will meet Egypt's Law 48 quality standards for BOD and TSS.



## ENVIRONMENTAL CONSIDERATIONS

In 1989, during preparation of the Alternative Treatment Study, USAID requested a preliminary environmental review of the project. As a result, the following issues were identified for analysis in the EA.

### Effluent Quality and Point of Discharge

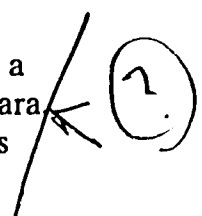
Two alternative effluent discharges to Lake Manzala are being considered. Although treatment will greatly reduce Port Said's total BOD loading to Lake Manzala, it will not eliminate it, and effluent nutrient levels will only be partially reduced. Determining the effects on water quality for the discharge alternatives will be an important part of the EA process. Location of the discharge point will be based on consideration of impacts on Lake Manzala and the nearshore zone of the Mediterranean Sea near the El Gamil Outlet.

### Effluent Reuse

Although the present plant's design does not provide for reuse of the treated effluent for agriculture and aquaculture, the planned treatment method and means of effluent discharge do not preclude this as a future possibility. However, such future reuse entails a number of human health issues, which will be fully considered in the EA.

### Sludge Disposal

The design now calls for sludge disposal primarily by off-site land disposal at a dedicated site, tentatively located 35-40 km southeast of Port Said and east of Qantara. The EA will explore the suitability of sludge use for agriculture subject to conditions imposed by public health and soil contamination concerns.



### Public Health and Safety

Pathogens remaining in the effluent and sludge are important environmental concerns. Chlorination of the effluent may be required to significantly reduce the levels of pathogens in the effluent. The chlorine itself poses a threat to fish and other aquatic organisms in Lake Manzala, and may need to be removed if it is deemed to be an environmental threat. Chlorine is in short supply and expensive in Egypt, and therefore may not be a reliable treatment method. The necessity and desirability of chlorination will be appraised in the EA.

Fly and mosquito breeding in wastewater standing at the treatment plant represents another possible disease transmission threat. The extent of the threat will be reviewed and environmentally sound methods of mitigating it identified.

## Groundwater

Port Said has a relatively high groundwater table. The proposed treatment plant site is fill material dredged from Lake Manzala. The EA will address the potential for wastewater contamination of groundwater.

## Noise, Traffic, Odors, and Other Nuisances

The proposed wastewater plant is a large capital project, occupying over 500 feddans that unavoidably will produce noise, traffic, odors, and other nuisances--both during construction and normal operation. An aspect of the EA will be fully cataloguing these problems and identifying ways of mitigating them.

## Effects on Aquatic and Wildlife Communities

The biotic communities of the Suez Canal region, as with its human communities, should greatly benefit from the proposed new wastewater treatment plant. Reducing the BOD, nutrients, and pathogens now flowing from Port Said will result in healthier aquatic communities in Lake Manzala. The EA will endeavor to put the benefits accruing from improved wastewater discharge to Lake Manzala in the context of water quality concerns for the lake as a whole, whose main source of pollution is Cairo wastewater.

## COMMENTS RECEIVED

### Cairo Scoping Meeting

Several participants at the Cairo scoping meeting offered comments germane to the scope of the EA. The following is a brief summary of these comments.

- o Agricultural reuse of effluent and sludge. Several commentors and lively discussion focused on the desirability of reusing wastewater and sludge for agriculture.
- o Chlorination. Concern was expressed regarding chlorination of the effluent and its effect on fisheries.
- o Parasites. Potentially high rates of infestation by the nematode Ascaris in the population, the resistance of eggs of this parasite to wastewater treatment, and implications for human health were noted.
- o Disinfection. A question was raised regarding potential use of ozonation as an alternative to disinfection by chlorination.
- o Reduction in fecal coliforms. Interest was expressed in the rate of

natural die-off of fecal coliform bacteria in the receiving water.

- o Heavy metals. A question was raised about the levels of heavy metals in the sewage.
- o Alternatives considered. Several commentors expressed an interest in the alternative treatment methods and disposal options that had been considered and the reasons for their rejection as the preferred alternative. One individual asked why a Mediterranean Sea outfall was judged unacceptable at Port Said.
- o Algae in treatment lagoons. A question was raised regarding algae blooms in the treatment lagoons, how these would be managed, and their effects on plant operation and the environment.
- o Ecological integrity of Lake Manzala. Concern was expressed regarding impacts of the proposed project on ecological functioning of Lake Manzala.
- o Water quality sampling program. Interest was expressed in the details of the water quality sampling program conducted as part of the preliminary environmental review and engineering design. This comment with respect to Port Said was also raised during the Suez scoping session.

These comments and concerns will be considered and addressed by the EA. In addition to these comments germane to the EA, several comments and questions were raised regarding the treatment process and the EA process itself; these were addressed during the scoping meeting.

### Port Said Scoping Meeting

Several participants at the Port Said scoping meeting offered comments germane to the scope of the EA. The following is a brief summary of these comments.

- o Reuse of effluent. Several commentors expressed concern regarding the desirability of using effluent for agriculture and urban parks irrigation. One commentor expressed the opinion that the effluent should be piped south to the El Salaam Canal for use in the planned North Sinai irrigation project.
- o Discharge to Lake Manzala. Concern was expressed about continued discharge to Lake Manzala. Questions were raised about the acceptability of discharge to the Mediterranean Sea, with one questioner asking why marine discharge was judged acceptable for Suez Bay but not the Mediterranean Sea.

- o Sludge disposal. The long distance to the proposed sludge disposal site was noted. Interest was expressed in treating sludge on-site and making it available for agriculture.
- o Treatment method. Several questions were raised regarding the selection of the proposed treatment method and the reasons for not selecting other methods as the preferred alternative. A question was raised regarding the possibility of upgrading the existing treatment plant.
- o Nuisance conditions. Concern was expressed regarding algal growth and mosquito breeding in polishing lagoons, and their impacts on plant operations and human health. It was noted that mosquito breeding cycle was 3 days, and detention time in the plant was 11 days.
- o Fish health. Concern was expressed regarding impacts of the proposed project on the health of fish populations in Lake Manzala.
- o Port Fouad facilities. A question was raised regarding the flow projections and whether Port Fouad was included in the service area.

These comments and concerns will be considered and addressed by the EA. In addition to these comments germane to the EA, several comments and questions were raised regarding the treatment process and the EA process itself.

### Written Comments

Written comments were received at the Suez scoping meeting that were directed at the projects in Ismailia and Port Said. Written comments germane to the Port Said project were questions regarding:

- o the quality of effluent that is now discharged to Lake Manzala from Port Said;
- o location of sampling stations; and
- o energy consumption and costs associated with operation and maintenance.

These matters will be addressed in the EA.

### Summary

Based on preliminary environmental review by the project team and questions and comments received at the scoping meetings for the Port Said project, the following appear to be issues of primary concern:

- o the expected impacts of the proposed discharge on water quality of Lake Manzala;
- o impact of sewage discharge and effluent chlorination on fish in Lake Manzala;
- o potential use of the effluent for agriculture, aquaculture, and urban parks irrigation;
- o public health risks associated with effluent discharge and reuse;
- o public health risks associated with sludge reuse; and
- o alternatives considered and the basis for their rejection as the preferred alternative.

### Work Plan

A tentative outline for the Port Said EA is attached. The issues of primary concern will be addressed in appropriate detail in the EA.

Water quality in Lake Manzala will be evaluated with data collected during development of the Master Plan and during field studies by the project team in July 1989. Water quality data collected in 1989 will be used in water quality modeling efforts to evaluate impact of wastewater discharge on Lake Manzala and the El Gamil Outlet to the Mediterranean Sea.

Quality of the effluent and its suitability for agriculture or aquaculture use will be described. Factors to be considered in reuse of the effluent will be briefly described; this analysis will facilitate future master planning effort for eventual expansion or upgrading of the proposed facility. In particular, quality of effluent and sludge with respect to bacteria and pathogens will be described, and implications for public health assessed.

Development plans for the Port Said area will be reviewed to evaluate compatibility of land use plans with construction and operation of the proposed treatment plant facilities.

The EA will briefly described alternatives that were considered and rejected in the planning and preliminary design stages, and explain the reasons for their rejection as the preferred alternative.

## LIST OF ATTENDEES

Cairo Scoping Meeting - 8 February 1990

<u>NAME</u>	<u>POSITION</u>
Mr. Mahmoud Abd El Haleem Abdel Aal	Chairman of NOPWASD
Mr. Aly Hussein Aly	NOPWASD
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Mr. Hossam El Deen Mohamed	NOPWASD
Ms. Samira Nicola	NOPWASD
Ms. Howaida Ennany	NOPWASD
Ms. Hala Abd El Kader Hassan	NOPWASD
Mr. Nabil Saleh	NOPWASD
Mr. Mohamed Negm El Deen	NOPWASD
Mr. Mohamed Ahmed Abd El Salam	Head of Ismailia City Council
Mr. Maher Faris	Director of Ismailia Sanitary Drainage
Ms. Marcelle Fakhry	General Organization for Reconstruction and Agricultural Development Projects
Mr. Ikhlas Gamal El Deen Mohamed	Center of Environment Health in Imbaba
Mr. Mohamed Kotb Naddar	Ministry of Public Works and Water Resources
Mr. Adel El Zoghbi	Deputy Minister for Foreign Financing (Ministry of Housing)

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Mr. Gameel Atta	Department of Wildlife Preservation
Mr. Mostafa Ahmed Mahmoud	Department of Wildlife Preservation - Giza Zoo
Mr. Mohamed Farouk Badawi	Environmental Affairs Agency
Mr. Hamed Badawi	Atomic Energy Authority
Mr. Ahmed Hassan Azzam	Atomic Energy Authority
Ms. Samar Karam Wissa	General Org. for Water Resources
Mr. Mohamed Elwan	General Org. for Development of Fish Resources
Mr. Hozayyen El Diwany	National Research Center
Mr. Hammam El Abd	National Research Center
Mr. Mohamed Ibrahim	Environmental Affairs Agency
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Ms. Samia Galal	Higher Institute of Public Health -Alex.
Mr. Mahmoud El Hewagy	Environmental Institute - Ein Shams Univ.
Mr. Mohsen Tawfik	Dean of Environmental Institute - Ein Shams Univ.
Mr. Samir Ghabbour	Prof. at the African Studies Inst. Cairo Univ.
Mr. Mostafa Foda	Assoc. Prof. - Faculty of Science (El Azhar Univ.)
Mr. Paul Thorn	USAID
Mr. Michael Gould	USAID
Mr. John Saccheri	USAID
Mr. Ken Lue Phang	USAID



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USAID

Mr. M.A. Feldt

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NOPWASD

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NOPWASD

Mr. Mohamed El Imam

NOPWASD

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NOPWASD

Mr. Mohamed Negm

NOPWASD

Mr. Samira Nicola

NOPWASD

Mr. Mohamed Ayyad

NOPWASD

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Mr. Ihsan

Port Said Governorate -  
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Head, Port Said Wastewater  
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Mr. Mohamed El Kholy	Head of the Water Sector of SCA
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Mr. El Sayed Mahmoud Saadoun	Urban Planning
Ms. Zeinab Abu El Inain	Local Council Member
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Mr. Mohamed Abd El Wahhab	Industrial and Engineering Projects Co.

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Mr. Mohamed Ibrahim Gad	Scientific Research Academy - Cairo
Mr. Ken Lue Phang	USAID/Cairo
Mr. Medhat Wissa	USAID/Cairo

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Terrestrial Habitat  
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*Currents and circulation  
Lake Manzala  
(before & after Ring Road)*

Environmental Effects

No-Action Alternative  
    Surface Water Quality  
    Aquatic Resources  
    Terrestrial Habitat  
    Groundwater  
    Land Use  
    Public Health  
    Energy  
    Air Quality  
    Cultural Resources

Preferred Alternatives

Surface Water Quality

Aquatic Resources

Terrestrial Habitat

Groundwater

Land Use

Public Health

Energy

Air Quality

Cultural Resources

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List of People Contacted

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