



**Arab Republic of Egypt  
Ministry of Electricity and Energy  
Egyptian Electricity Holding Company  
Cairo Electricity Production Company**

**GIZA NORTH 2 x 750 MWe GAS-FIRED  
COMBINED CYCLE POWER PROJECT**

***Environmental and Social  
Impact Assessment***

**EXECUTIVE SUMMARY**

**FINAL REPORT  
Volume – II(A)**

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# GIZA NORTH 2 x 750 MWe GAS-FIRED COMBINED CYCLE POWER PROJECT

## *Environmental and Social Impact Assessment*

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**ABBREVIATIONS AND ACRONYMS**

BOD	Biochemical Oxygen Demand
BPIP	Building Profile Input Program
CAA	Competent Administrative Authority
CAPMAS	Central Agency for Public Mobilization and Statistics
CEPC	Cairo Electricity Production Company
COD	Chemical Oxygen Demand
CWDS	Circulating Water Discharge Structure
DCS	Distributed Control System
DO	Dissolved Oxygen
DS	Dissolved Solids
EAAQLs	Egyptian Ambient Air Quality Limits
EEA	Egyptian Electricity Authority
EEAA	Egyptian Environmental Affairs Agency
EEHC	Egyptian Electricity Holding Company
ED	Environmental Department
EGAS	Egyptian Natural Gas Holding Company
EGSMA	Egyptian Geological Survey and Mining Authority
EHS	Environmental Health and Safety
EIA	Environmental Impact Assessment
EMS	Environmental Management Staff
ENIT	Egyptian National Institute of Transport
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
EUPS	Egyptian Unified Power System

FHWA	Federal Highway Administration, (US)
FM	Finance Manager
GARBLT	General Authority for Roads, Bridges and Land Transport
GASCO	Egyptian Natural Gas Company
GEP	Good Engineering Practice
GDP	Gross Domestic Production
GIS	Gas-Insulated Switchgear
GNPP	Giza North Power Plant
GT	Gas Turbine
HCM	Highway Capacity Manual
HFO	Heavy Fuel Oil
HGVs	Heavy Goods Vehicles
HSE	Health, Safety and Environment
LFO	Light Fuel Oil
LOS	Level of Service
MWRI	Ministry of Water Resources & Irrigation
MSDSs	Material Safety Data Sheets
MWe	Mega-Watt electrical
NFRA	National Fire Protection Authority
NRIAG	National Research Institute for Astronomy and Geophysic
OSHA	Occupational Safety and Health Administration
PCBs	Polychlorinated Biphenyls
PCDA	Public Consultation and Disclosure Activities
pcph	passenger car per hour
PMU	Project Management Unit
PRS	Pressure Reducing Station

RIGW	Research Institute for Ground Water
SFD	Social Fund for Development
SS	Suspended Solids
STG	Steam Turbine Generator
TDS	Total Dissolved Solids
TOC	Total Organic Carbon
TSS	Total Suspended Solids
TWA	Time-Weighted Average
vph	vehicle per hour

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## GIZA NORTH 2 x 750 MWe GAS-FIRED COMBINED CYCLE POWER PROJECT

### *Environmental and Social Impact Assessment*

### EXECUTIVE SUMMARY

#### 1. INTRODUCTION

##### 1.1 Background

1. Engineering Consultants Group (ECG), a private consulting firm (Egypt) was commissioned by the Egyptian Electricity Holding Company (EEHC) / Cairo Electricity Production Company (CEPC) to prepare the technical documents and procedures required by the World Bank Group (WB) and other Development Banks concerning the Environmental and Social Assessment of the Giza North Power Project.

2. EEHC is seeking financial assistance from the WB for the construction and operation of this 2x750 MWe, dual fuel Combined Cycle power plant. The proposed plant is designated as a Category A project under WB rules and a Category C project under the Egyptian environmental regulations and therefore requires a full Environmental Impact Assessment. Financing from WB and other Development Banks is conditional upon obtaining the environmental clearance from both the Egyptian regulatory authorities and the International & Regional Banks, i.e. the WB & other Development Banks.

##### 1.2 Project Overview

3. Cairo Electricity Production Company (CEPC), a company incorporated in Egypt and affiliated to the Egyptian Electricity Holding Company (EEHC) proposes to construct and operate a new combined cycle power plant at Giza North, which is along the El-Rayyah El-Beheiry and about 30km north west of the Cairo city on the eastern coast of the El-Rayyah El-Beheiry. The site is within an existing piece of land purchased on 7<sup>th</sup> June 2009 by CEPC from the land owner Mr. Mohamed Galal Mohamed Kandil, who was offering the land for sale. The overall proposed site area is approximately 295,000 m<sup>2</sup>.

4. The proposed power plant is a 1,500 MWe Combined Cycle Gas Turbines (CCGT) comprising two 750 MWe modules, each module will include two gas turbines, each with a nominal electricity generating capacity of 250 megawatts (MWe) and two heat recovery steam generators (HRSG) feeding one steam generator with a nominal electricity generating capacity of 250MWe, which will be known as Giza North Power Plant. The overall generating capacity of the power plant will be 1500MWe. The power plant is

intended to be operational by the year 2012/2013. The power output from the proposed plant will be sold to the Egyptian Electricity Transmission Company (EETC).

5. The power plant will utilize natural gas as its primary fuel, and also have the capability to operate using solar (light fuel oil). The ability to "dual-fuel" the power plant (with natural gas or solar) will provide security of electricity supply in the event that gas supplies are unavailable for any reason. In addition, a small emergency generator, for the plant safe shut down, operating on solar oil (light fuel oil) will also be provided on-site to drive key items of equipment within the power plant in the event of a power supply failure.

6. The power plant will incorporate a direct (once through) cooling system using water abstracted from the El-Rayyah El-Beheiry. The abstracted water will also be used, following pre-treatment demineralization and desalination, to provide process water make-up in the boiler system. Potable water supplies will be drawn from the potable water network feeding near villages around the power plant site.

7. The main demand for water is due to the direct cooling system. The use of a direct cooling system maximizes the electrical efficiency of the power plant and, after use, virtually all of the water will be returned to the El-Rayyah El-Beheiry at a slightly elevated temperature compared to the abstraction. No evaporative cooling towers are required, hence there is no opportunity for water drift or the formation of visible plumes of water vapor or ground fogging.

8. Canal water will be used as non-contact cooling water and for process water following desalination. Canal water will be pumped through a piping system running underground for water intake whilst heated cooling water will be returned to the canal via a discharge piping system running underground, too and released approximately on the verge of the canal bank.

9. A wastewater treatment facility on the site will treat liquid wastes and produce an effluent suitable for discharge into the canal. All oil waste effluents will be collected into a separate network and sent to an oil separator, then disposed of by petroleum company.

10. The Giza North site is located on the eastern bank of the El-Rayyah El-Beheiry (El-Beheiry Canal), which is a part of the sub-branch of the Rosetta Branch of the Nile River. The site is located approximately 30 kilometers northwest of Cairo City and just along the Manshyet El-Qanater / Etay El-Baroud Regional Road, which runs parallel to the El-Rayyah El-Beheiry. The site is bordered to the North by a fodder factory within a cultivated land and consists of flat agricultural land approximately 295,000 squared meters, out of which approximately 125,000m<sup>2</sup> are allocated for the facilities of the project. The remaining 170,000m<sup>2</sup> has been set aside for future uses as a lay down area during construction and plant landscaping during operation.

11. The site is bordered to the south by agricultural areas. Construction laydown, as mentioned, is planned to be accommodated within the Giza North

project land on, therefore, the proposed site. The site of the proposed power plant is shown on *Figure 1*. Also, *Figure 2(A&B)* depicts this location within the context of the 6 of October and Giza Governorates. *Figure 3* illustrates a landsat image (general view) of the proposed site land.

12. *Table 1* of this E.S. Report presents environmental, health and safety issues relating to construction and operation of Giza North power project.

13. The key Environmental Issues associated with the development of the proposed power plant, identified during local ESIA and RPF scoping and consultation, are summarized in *Table 13*, page 103 of this E.S. Report, under "Public Consultation and Disclosure", and these issues were subsequently taken into account in the preparation of ESIA documentation both for local permitting requirements and this ESIA report.

Table 1

***Environmental, Health and Safety Issues Relating to  
Construction and Operation of Giza North Power Project***

Subject Area	Potential Impacts During Construction	Potential Impacts During Operation
Air Quality	Dust from construction activities. Traffic-related air quality impacts.	Impacts of emissions from stacks on ambient air quality. Traffic-related air quality impacts. Global warming potential.
Aquatic Environment	Control and management of site drainage. Wastewater discharge. Sewage disposal and foul drainage.	Thermal water discharge. Water requirements for power plant operation. Discharge of process and wastewater. Operation of drainage systems on site. Discharge of storm water, sewage and drainage.
Noise and Vibration	Noise from construction activities.	Noise from power plant operations on surrounding land uses.
Land Use, Landscape and Visual Issues	Land use on site. Land use in the surrounding area. Effects of construction activities on landscape character. Visual impact of construction activities.	Land use on site. Land use in the surrounding area. Effects on landscape character. Visual impact of the power plant and operation activities.
Soils, Geology and Hydrogeology	Effects on soils and geological features. Soil contamination. Effects on groundwater.	Soil contamination. Effect on groundwater.
Flora and Fauna	Loss of habitat or species due to landtake. Disturbance or damage to adjacent habitat of species.	Disturbance or damage to adjacent habitat. Effects of structures on bird migration routes.
Traffic	Traffic conditions/disruption to road users. Traffic-related air quality. Traffic-related noise.	Traffic conditions/disruption to road users. Traffic-related air quality impacts. Traffic-related noise impacts.
Major Accident Hazards	Risk to third-party hazardous industry.	Risk to third-party hazardous industry. Risk to power plant of third-party hazardous industry.
Natural Disaster Risk	Seismic risk. Flood risk.	Seismic risk. Flood risk.
Solid Waste Management	Contamination of soils and water. Hazards to workers health. Accident risks.	Contamination of soils and water. Hazards to workers health. Accident risks.
Occupational Health and Safety	Accidents. Effects on health of workforce. Safety at work.	Accidents. Effects on health of workforce. Safety at work.

Figure 1

**Location Map of the Proposed Site  
within the Egyptian Context**

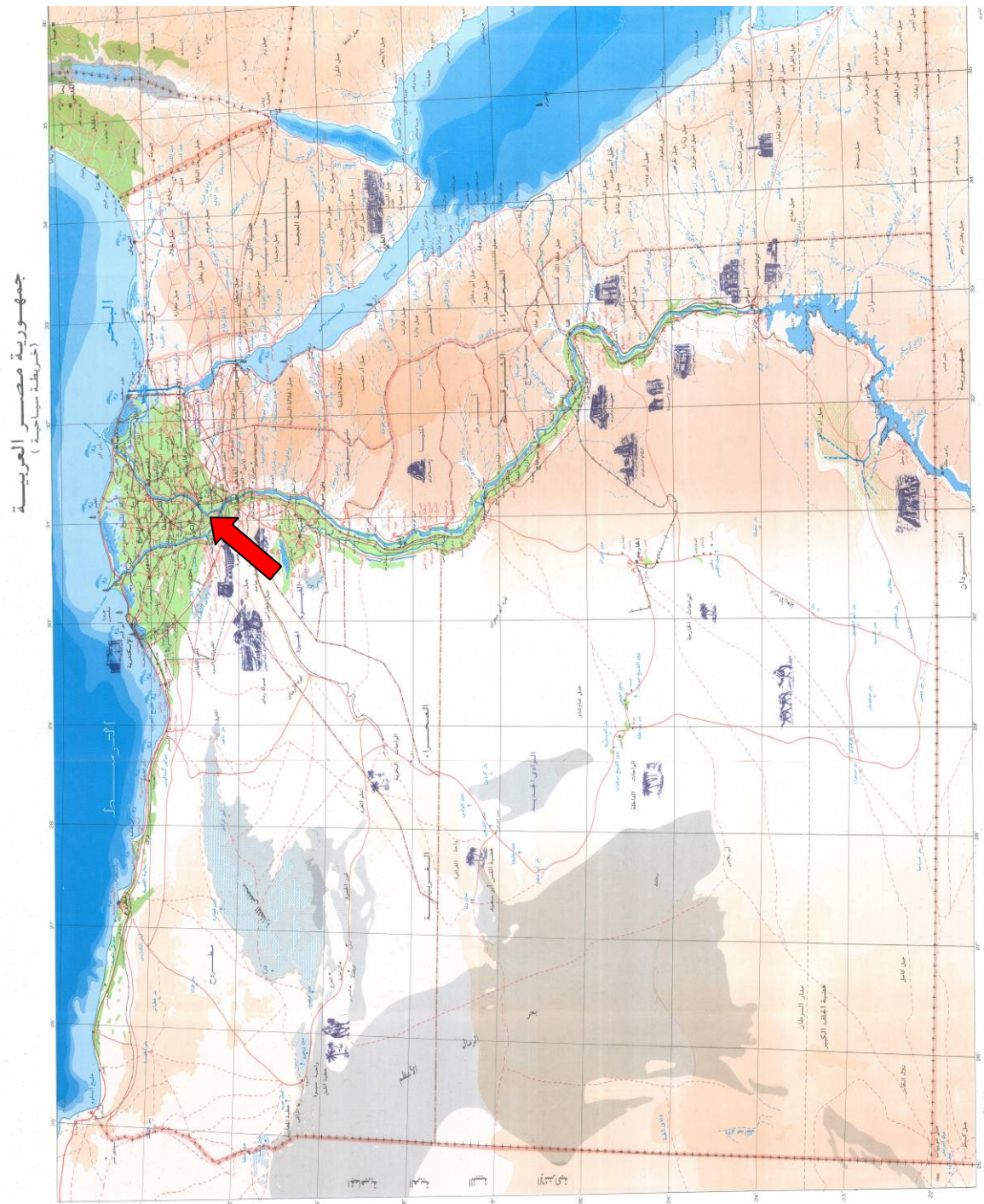


Figure 2 (A)

**Location Map of the Proposed Site  
within the 6<sup>th</sup> of October governorate Context**

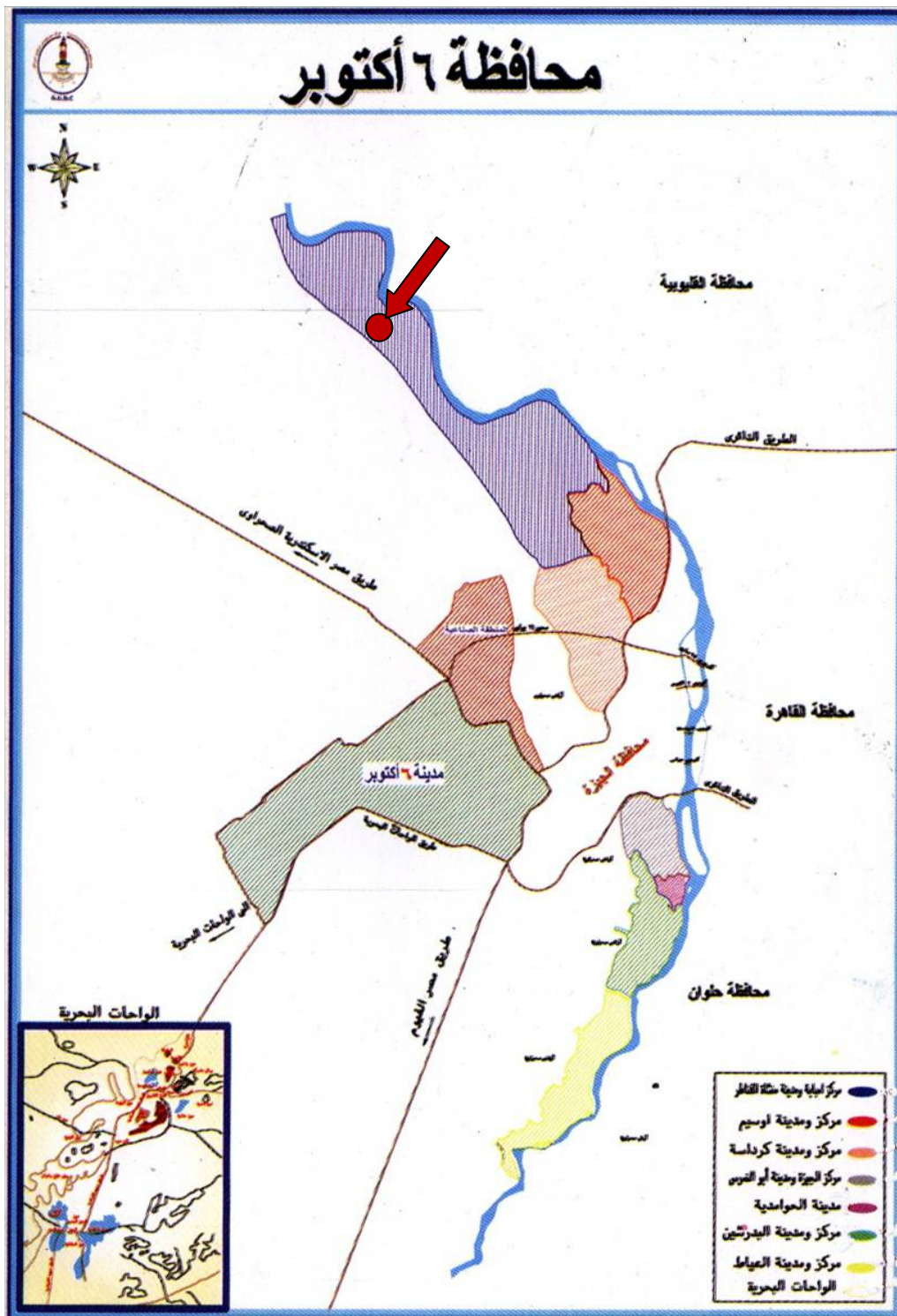


Figure 2 (B)

**Location Map of the Proposed Site within the Giza Governorate Context  
(before separation of the 6<sup>th</sup> of October Governorate)**

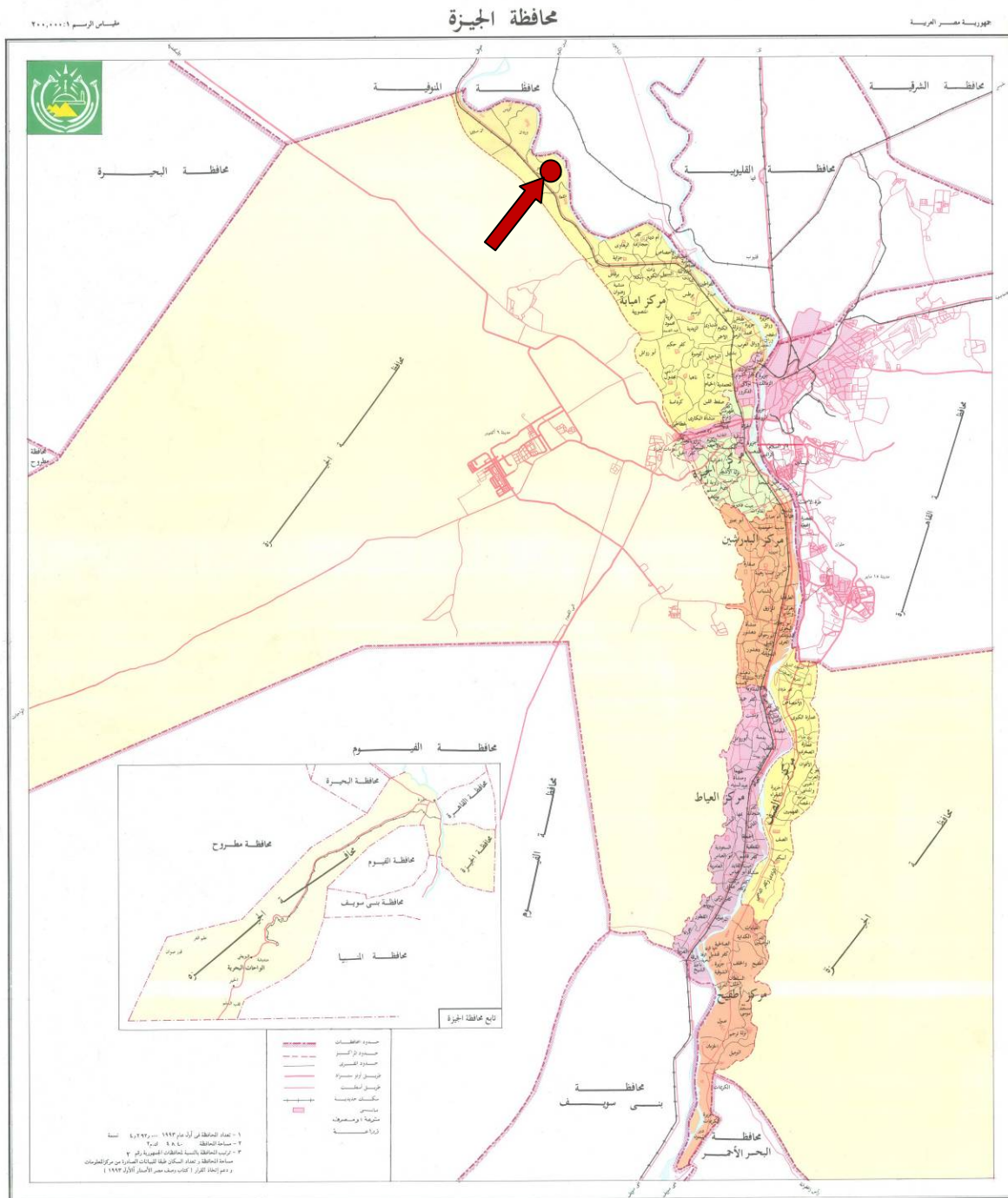
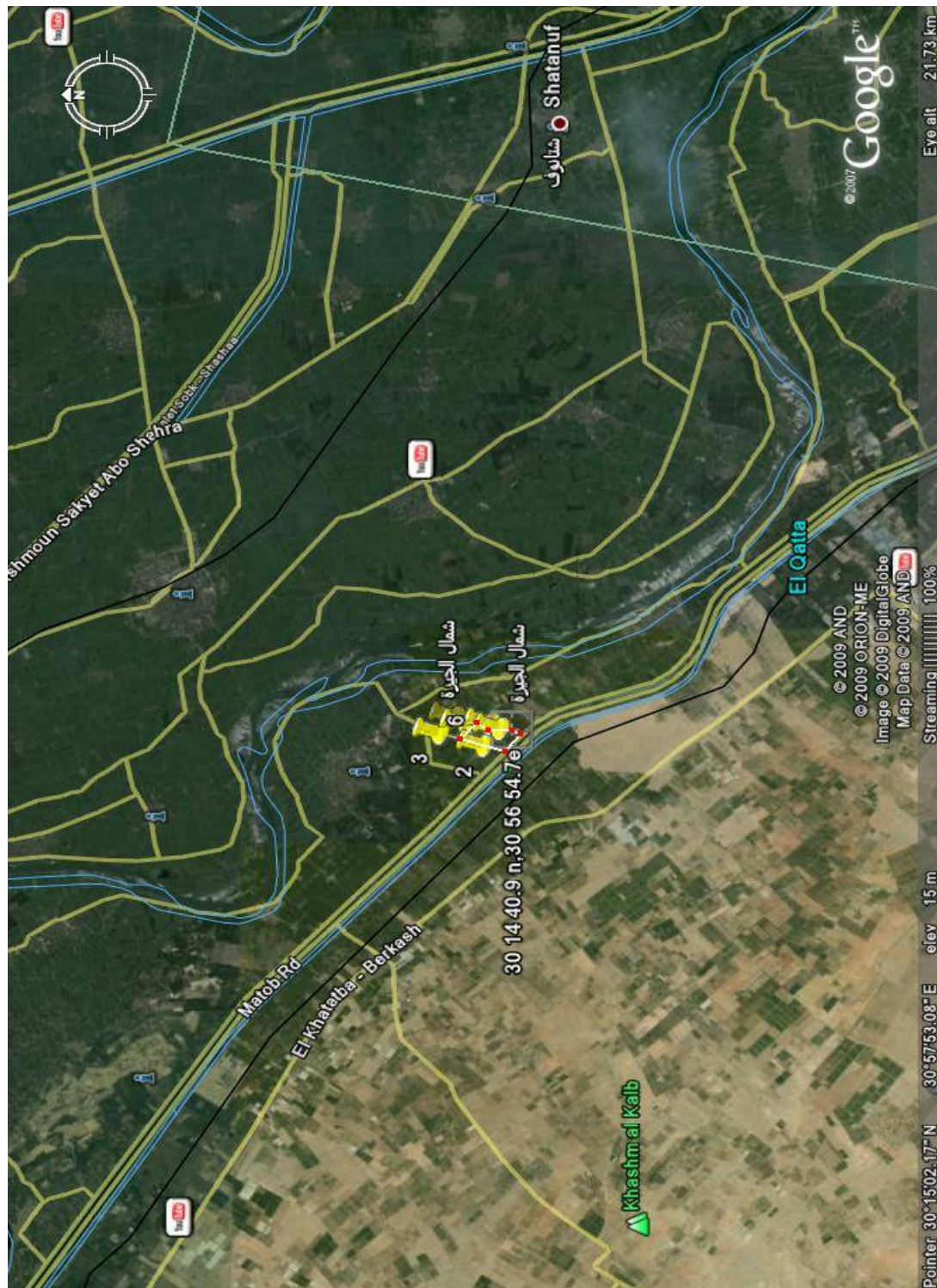


Figure 3

**Landsat Image of the Wider Delta Area  
Showing the Proposed Site of the Giza North Power Plant**



## 2. THE ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

### 2.1 Contributors to the EIA Report

14. The Environmental and Social Impact Assessment (ESIA) report is prepared by ECG, a private consulting firm (Egypt), based on many baseline studies undertaken by independent national and international consultants and on information provided by EEHC, CEPC and their sub-contractors. Public consultation activities are undertaken by ECG and EEHC in conjunction with CEPC. The ESIA report draws heavily on the environmental and social assessment documentation prepared by group of local and international multidisciplinary consultants and submitted to ECG, for preparing the ESIA report for local permitting purposes and financing requirements. All such documentations were reviewed by ECG and cleared for inclusion in this report. Most of the relevant local permits for the construction of the power plant have now been received (**Further details of the relevant local permits are available in Section 2.3.1 of the main ESIA report**).

### 2.2 Scope of the ESIA Report: Legal and Administrative Framework

#### 2.2.1 Government of Egypt Requirements

15. Beginning in the 1950s, the Government of Egypt has promulgated several laws and regulations concerning protection of the environment.

16. The Egyptian standards have been drawn from the range of provisions in the following documents:

- Law 4/1994 and the Prime Minister's Decree No. 338 of 1995, which promulgates the Executive Regulations of Law 4.
- Amendment to the Law 4/1994 promulgated by the Prime Minister's Decree No. 1741 of 2005 for modifying some executive regulations of the Decree No. 338 of 1995.
- Law 9/2009, which modifies some provisions of the Law 4/1994.
- Law No. 93 for 1962 regarding the drainage of liquid wastes, particularly sanitary drainage.
- Law of Labor No. 12/2003.
- Law No. 38/1967 amended by Law No. 31/1976 on public cleanliness and collection and disposal of solid waste.

17. Law 4/1994 and Law 9/2009 require that, for establishments requiring licenses, an environmental impact assessment must be prepared and submitted to the Egyptian Environmental Affairs Agency (EEAA) for review. The environmental impact assessment must be submitted to the EEAA by "the Competent Administrative Authority (CAA) or the licensing authority" for the project in question. For the Power Plant Project, the Competent Administrative Authority is the 6 of October Governorate.

18. The 6 of October Governorate will send the EIA to EEAA for review and provide its opinion within 60 days. Once EEAA has approved the project,

a license to proceed can be issued. No additional environmental or social clearances are required other than the EIA approval to proceed with the project activities. The law requires that any new project should comply with all the relevant articles pertinent to environmental attributes, which could be impacted from project activities.

19. Egyptian EEAA regulations specify the technical scope or contents of an environmental impact assessment. As a matter of practice, environmental impact assessments for power plant projects typically have a scope and organization similar to World Bank environmental assessments.

20. In addition to environmental impact assessment requirements, the Government of Egypt has established air pollution and water pollution limits applicable to the Power Plant project. These limits are discussed in Chapter 6, along with the actual air and water pollution levels expected from the Power Plant.

### **2.2.2 World Bank Guidelines and Safeguard Policies**

21. The World Bank includes environmental impact assessment as an integral part of the evaluations it performs before financing a proposed project. The World Bank's Operational Policy 4.01 (October 3, 1991 and its updates, 1999) provides guidance on the types of assessments that should be performed for different types of projects, and on the scope and content of those assessments. According to Operational Directive 4.01, thermal power plant projects require a full Environmental Assessment (EA).

22. World Bank Environmental Safeguard Policies provide 10 potential issues that may need to be considered in an EA, depending on the specific characteristics of each project. *Table 2* summarizes the expected triggerability of the potential Safeguard Policies for the Giza North Power Plant Project. The Safeguard Policies identified as "triggerable" are those which may be triggered and thus considered "Requiring Management". When the detailed design of the Giza North Power Plant has been determined, the CEPC should prepare project-specific plans to manage these potential impacts.

23. No safeguard policies were triggered except for the Environmental Impact Assessment and the Involuntary Resettlement. *Table 1* shows potential World Bank environmental Safeguard Policies and Giza North project triggerability. The table justifies the triggerability or lack thereof for WB Safeguard Policies.

24. Annex B to Operational Directive 4.01 provides an outline of the information that should be included in a full EA. This Environmental and Social Impact Assessment follows the scope of Annex B.

Table 2

**Potential World Bank Environmental Safeguard Policies  
and Giza North Power Project Triggerability**

No. Safeguard Policy	Policy Triggered?	Justification
1. Environmental Assessment	Yes	<ul style="list-style-type: none"> <li>This policy applies to all projects requiring a Category A Environmental Assessment Under OP 4.01.</li> <li>All environmental and Social aspects included in Giza North project are adequately examined.</li> <li>Giza North project is not likely to have significant potential (reverse) environmental risks &amp; impacts in its area of influence (impacts on the natural environment: air, water &amp; land; human health &amp; safety; physical cultural resources; and transboundary and global environment concerns).</li> </ul>
2. Forest	No	<ul style="list-style-type: none"> <li>No forest areas exist.</li> </ul>
3. Involuntary Resettlement	Yes	<ul style="list-style-type: none"> <li>This policy applies to all projects triggering OP 4.12.</li> <li>The final location of all sections of the transmission lines, which will evacuate power generated by the Giza North power plant is not yet fully firm. These transmission lines will extend to the west direction with a total length of approximately 12-16 km on high voltage 220 kV to connect the power plant to the existing 220 kV "Cairo 500/ Sadat double-circuit" transmission line with a length of about 11-15km and the existing 220 kV Menouf / Bassous double-circuit transmission line with a length of about 1 km. Also, the final location of the gas connection is not determined yet. Land take or resettlement may be associated to the power interconnecting lines as well as gas pipeline connection. The ESMP will be revised after exact routes for both the transmission lines and gas connection are available.</li> </ul>
4. Indigenous Peoples	No	<ul style="list-style-type: none"> <li>The project does not affect the indigenous peoples in the project area.</li> </ul>
5. Safety of Dams	No	<ul style="list-style-type: none"> <li>The project does not involve construction of a large dam.</li> <li>The project is not dependent upon an existing dam.</li> </ul>
6. Pest management	No	<ul style="list-style-type: none"> <li>Procurement of pesticides or pesticide application equipment is not envisaged.</li> <li>The project will not affect pest management in any way.</li> </ul>
7. Physical Cultural Resources	No	<ul style="list-style-type: none"> <li>Physical cultural resources are adequately examined.</li> <li>The Giza North project is not likely to have any significant impact on physical cultural resources.</li> </ul>
8. Natural Habitats	No	<ul style="list-style-type: none"> <li>Natural Habitats are adequately addressed and examined.</li> <li>The Giza North project is not likely to have any significant impacts on natural habitats.</li> </ul>

Table 2 (Contd.)

**Potential World Bank Environmental Safeguard Policies  
and Giza North Power Project Triggerability**

No. Safeguard Policy	Policy Triggered?	Justification
9. Projects in Disputed Areas	No	<ul style="list-style-type: none"> <li>The CEPC/EEHC is not involved in any disputes over an area with any of its neighbors.</li> <li>The project is not situated in a disputed area.</li> <li>Any component likely to be financed as part of the project is not situated in a disputed area.</li> </ul>
10. Projects on International Waterways	No	<ul style="list-style-type: none"> <li>Cooling water abstracted from the El-Rayyah El-Beheiry (27.2 m<sup>3</sup>/sec.) is returned totally back to it. Actual water consumption is less than 0.07% of the abstracted water.</li> <li>No disturbance to the El-Rayyah El-Beheiry waters is expected either upstream or downstream.</li> <li>Hydrological/hydraulic study is carried out and the study revealed that no impact is expected and the mixing zone is limited to &lt;100m distance with 5°C above ambient, which diluted to 3°C at a distance between 100 and 150 m in full compliance with the Egyptian Law 48/1982 and WB regulations.</li> <li>MWRI is in full agreement with EEHC regarding its plan for water abstraction.</li> </ul>

25. In addition to environmental impact assessment guidelines, the World Bank has established guidelines concerning air pollution and water pollution from thermal power plants (*Pollution Prevention and Abatement Handbook-Part III* (July 1998)). The guidelines were officially published in 1988; since then, several sets of revisions have been proposed, most recently on March 22, 1996. The 1988 and proposed 1996 guidelines are discussed in Chapter 6, along with the actual air and water pollution levels expected from the Power Plant. Also, the most recent updates of the World Bank Guidelines, issued in 2007 and in December 2008 have been considered.

26. World Bank's *Pollution Prevention and Abatement Handbook-Part III* (July 1998) also, provides with principles of industrial pollution management, monitoring and air emission & effluent discharge requirements presented in the industry Guidelines including Guidelines for New Thermal Power Plants.

27. Public Consultation Process has been designed in accordance with World Bank Guidance for the Preparation of a Public Consultation and Disclosure Plan (January 1996);

28. The ESIA has assessed the impacts of the construction and operation of the New Giza North Power Plant and has also considered the cumulative air quality impacts of the plant and other existing sources in the project area, including the small and medium sized local manufactures. Consideration has also been given to the operation of the transmission line and other outside

facilities, including natural gas pipeline, which will feed the power project with gas fuel. The ESMP will be revised after exact route of both transmission lines and gas connection are available. Permits will be required from the relevant Competent Administrative Authorities.

29. The ESIA report presents the full assessment of the environmental, social, health and safety impacts of the Giza North power plant. This Executive Summary presents a short resume of the findings of the ESIA report. For further details, reference should be made to the full ESIA report.

### 3. GENERAL SETTING OF THE SITE: DESCRIPTION OF THE ENVIRONMENT

30. The proposed power plant site is located on the eastern bank of the El-Rayyah (Canal) El-Beheiry, a main branch of the Rosetta Branch of the River Nile, approximately 40 km northwest of Cairo City, and at the kilometer 20 southeast El-Khatatba along the immediate side northeast the Mansheyyet El-Qanater/Itay El-Baroud Road, which runs parallel to the El-Rayyah El-Beheiry. The site is within the administrative boundary of the 6<sup>th</sup> of October governorate and its Markaz of Imbaba & Menshat El-Qanater. The site, also, is within the El-Kata agricultural complex, an area being developed for agricultural use. The area surrounding the site is locally known as the El-Kata area. The general site location is given in *Figure 4* (A, B & C-Landsat image of the El-Kata Region).

31. For the purpose of defining the study area for this ESIA, the assessment has focused on an area stretching 15km to the north, west and south of the site and across the El-Rayyah El-Beheiry, whilst also taking into consideration wider regional issues where relevant.

32. The site is situated in the heart of the cultivated lands. It forms the flat area which is a part from the Nile Delta plain. Many small villages (Ezzab / Kafr) are littered around the area.

33. The site is located a small distance to the immediate north of the existing poultry farm at km 22 El-Khatatba and 5 km north west Ezbet Sayyed Ibrahim, the nearest residential community to the site. The project site is owned by the Cairo Electricity Production Company (CPEC), an affiliate company to the Egyptian Electricity Holding Company (EEHC), and consists of flat land measuring approximately 337m by 876m with a total allocated area of 275,000m<sup>2</sup>. This includes land required for building the power plant. A large land area (about 60 Feddans) on the site is covered with fruit trees (mangoes, tangerine), palm trees and cultivation of wheat and vegetables. The site is flanked on three sides (west, north and east) by agriculture lands with similar land use. The main road runs parallel to the west southern side of the site connecting to the city, Sixth of October, which is 25km west with a reported population of over a million people. The site has a small office building currently being used as a rest house. The site is surrounded by a

barbed wire fence along the boundary and display boards announcing that the site is being proposed for construction of a power project. The site has a large ground water well, 50m deep, connected to a 75 HP pump, which reportedly runs 6 hrs every day to supplement water supply from the adjoining canal.

34. The entire land area reportedly belongs to one owner (Mr. Mohamed Galal Mohamed Kandil) from whom the CEPC purchased this land in February 2009 at a commercially negotiated value 37 Million Egyptian Pounds. To the north of the site, the nearest settlement is 5-6 km northwards at village El-Kata with a population of over 7000 people. The process of selecting the current site was based on consideration of 2 other alternative site options. The other site options were rejected for a variety of factors, including parcel size, price and proximity to road, water, transmission lines and gas. *Figure 5* shows localized map of the proposed site area and *Figure 6* presents the general layout of the Giza North power project. *Figures 7 & 8* give some photos for the power plant site.

35. The proposed site and the land to the surroundings is flat. The topography of the site is described in more detail in *Sections 5.2 and 5.8*.

36. The proposed site is situated about 5-6 km of Al-Kata Village and about 20km southeast of El-Khatatba City. The site covers around 70 Feddans and is delimited by:

- Latitudes 30 14 35 & 30 15 09 N; and
- Longitudes 30 56 39 & 30 56 59 E

37. The ground elevation ranges between 20 and 25 m and above sea level.

38. Geologically, Bilqas Formation represents the top most part of the Nile Delta sediments. It consists of alternating sands and clays with plant remains and peat deposits occurred most likely in lagoons and brackish swamps interrupted by beach sands. The average thickness is about 50 m.

39. Across the main regional road from the site there is the El-Beheiry Canal which will serve as a source for the power plant's condenser cooling water intake via a once-through cooling system and final discharge.

40. Potable water to the plant will be provided through the water supply network of the nearest village area reaching to the site, supplemented by new groundwater wells. Existing land uses surrounding the site are described in more detail in *Section 5.8*.

41. The area is dissected by a system of irrigation and drainage. The main irrigation canal is the El-Rayyah El-Beheiry Canal. The width of this canal is about 50 m and its depth ranges from 4.5 m to 5 m. The canal contains aquatic habitat as same as the river Nile in this regions.

42. The surface water system comprises the River Nile Rosetta Branch. The irrigation network generally starts from the Rosetta Branch, and El-

Rayyah El-Beheiry Canal.

43. The Rosetta Branch provides fresh water to El-Rayyah El-Beheiry Canal for domestic and irrigation demands. It also provides fresh water for various agricultural applications and discharges the rest of fresh water in the Mediterranean Sea for balancing pressures of erosion and salt water intrusion in the coastal region.

44. The water quality in Rosetta Branch is generally fair. It was estimated (by Awad and Yousef, 2002) that the Rosetta Branch receives more than 0.5 million m<sup>3</sup>/day of untreated or partially treated domestic and industrial wastes and huge amounts of agricultural drainage water.

45. The groundwater aquifer is highly productive. The aquifer is recharged by the infiltration from the irrigation systems and the excess irrigation water.

46. Land cover on the site consists primarily of green cultivation, with dense low and mid-rise growing vegetation. Scattered low-rise type housing residences, agricultural activities and other small-manufacturing and irrigation land uses are located on wider area around the site and in its immediate vicinity and the cultivable nature of the area provides great opportunity for agricultural production.

47. Agriculture activity found at and around the project site showed that only two types of land uses for agriculture purposes are present. The first type includes areas designated for some trees (orange and mango) cultivation which concentrated at the eastern side of the bank of El-Rayyah El-Beheiry canal. This areas are mainly dependent on the intensive mango and orange plantation trees without introducing any other type of plant in the off season period.

48. Most of these farms at the bank are small to medium size farm with a front on road at the canal ranged from 200 to about 2000 meters. All the drainage water from these farms is directed towards Rayyah El-behery canal. Another form of the cultivated land is used in traditional agriculture all year around. This type of agriculture includes several crops which are selected to tolerate the weather around the river Nile in different agricultural seasons. These crops include Winter crops dominated by wheat, berseem, tomatoes, and cabbage... etc, while the Summer crops include mainly maize, cotton, ... etc. Papyrus is now largely absent from the delta.

49. Crops in Giza and 6<sup>th</sup> of October governorates vary between field crops (Summer and Winter) and vegetables and fruits. The agricultural sector includes other related activities like poultry and cattle raising, in addition to some industries that depend on agricultural raw materials like food processing and textiles.

50. Field survey indicated that there are no significant terrestrial ecosystems on, or near, the proposed site. The ecosystems present are typical of those throughout the western part of the Delta, west of the Rosetta Branch. Moreover, no Beduin settlements or any indigenous groups were

observed in, or near to, the project location. A small number of scattered houses were observed in the lands of individual farmers or investors, approximately 3 km south east the project site, these homes are resided by few farmers.

51. Inside the cultivated lands around the site area some farm animals are present as donkey, cattle, sheep and cow. In the wider area around the site, there are some villages inhabited by several aggregations of fishermen and farmers. Most of the villages are concentrated on the eastern side of the El-Rayyah El-Beheiry canal.

52. The annual average surface water temperature in the the El-Rayyah El-Beheiry site area is 20.7°C, with a range of 12.5°C (recorded in February) to 29°C (recorded in August). The highest monthly average surface water temperatures are 27.5°C in July and 29°C in August.

53. The climate in the study region is one of the mildest climates in the Mediterranean Sea region. Winter temperatures are higher than in any other part of the Mediterranean coast. Generally, this climate, however, gradually changes as one moves south and at about 40 to 50 km inland, merges into Mediterranean Saharian climate. As far the area occupies a portion of the Mediterranean zone, it has a special climate which differs from the inland areas. It is characterized by a comparatively high humidity, frequent dew formation and small diurnal temperature variations.

54. The temperature data collected at Giza North for a 35 year period indicates a maximum monthly-average temperature of 35.3°C in July and a minimum monthly-average temperature of 6.9°C in January. Summertime high temperatures average 35.1°C while winter lows reach 8.1°C. The annual-average temperatures is 21.52°C with record highest and low temperatures of 48 and -1.1°C, respectively.

55. The average amounts of rainfall observed in Giza North site range between 0.0 mm and 4.9 mm. The annual rainfall precipitation is about 22.2 mm. The rainy season begins during the second half of October. December and January are the rainiest months with an average of 4.9 mm/month. Some showers are still observed in March, 2.9 mm/month.

56. Relative humidity does not vary greatly through the year, staying between 50% and 60% at noon and between 60% and 70% in the morning and in the evening.

57. Wind speeds are generally light to moderate with an annual-average speed of approximately 2.66 meters per second and rarely exceed 5.65 m/sec.

58. The Northwest winds prevail with a frequency of 30 – 40%. Winds in the Winter can be strong and stormy. A dry hot south west loaded with sands and dust (Khamasin wind) blows on occasions for three to four days during the Spring. During the Summer, the wind decreases steadily and in September there are many calm days.

59. No archaeological resources are known in this site. Local archaeological authorities have been consulted, where they confirmed that the near area around the site proved that no historic resources exist.

60. The main transport infrastructure linking the Giza North area to the country main ports facilities is principally based on road network. The site is accessible through a major Regional Road from Cairo to El-Khatatba via Delta Barrage. The Qanater / Khataba regional Road and the Cairo / Qanater Road are the main two roads linking the site with the national road network.

61. The main national roads connecting sea ports to the Giza North site are: Cairo/ Alexandria Desert Highway and Cairo Alexandria Agricultural Highway from Alexandria port and both of Cairo / Suez desert Highway and Port Said / Suez highway from Suez, Port Said and Damietta ports.

62. The site, also, is accessible via railways network through El-Manashy railway, in the immediate west of the El-Rayyah El-Beheiry canal, parallel to it.

63. The proposed site lies within the administrative boundary of the 6<sup>th</sup> of October Governorate, which is recently formed as a distinct Governorate, separated mainly from Giza Governorate, where most of its Kisms / Marakez / Districts / Cities were basically affiliated to Giza Governorate. The Governorate of the 6<sup>th</sup> of October has prepared an Urgent Development Plan (UDP) for land-use management and planning, in which it sets out its policy to control development in the the 6<sup>th</sup> of October region up to 2017.

64. The 6<sup>th</sup> of October Region Master Scheme, 2009 is shown in *Figures 9, (A) through (F)*. The proposed land uses around the project site include new urbanized and residential development areas, which discussed in more detail in *Section 5.8*.

Figure 4(A)

*Landsat Image of the Wider El-Kata Area  
Showing the Proposed Site of the Giza North Power Plant*

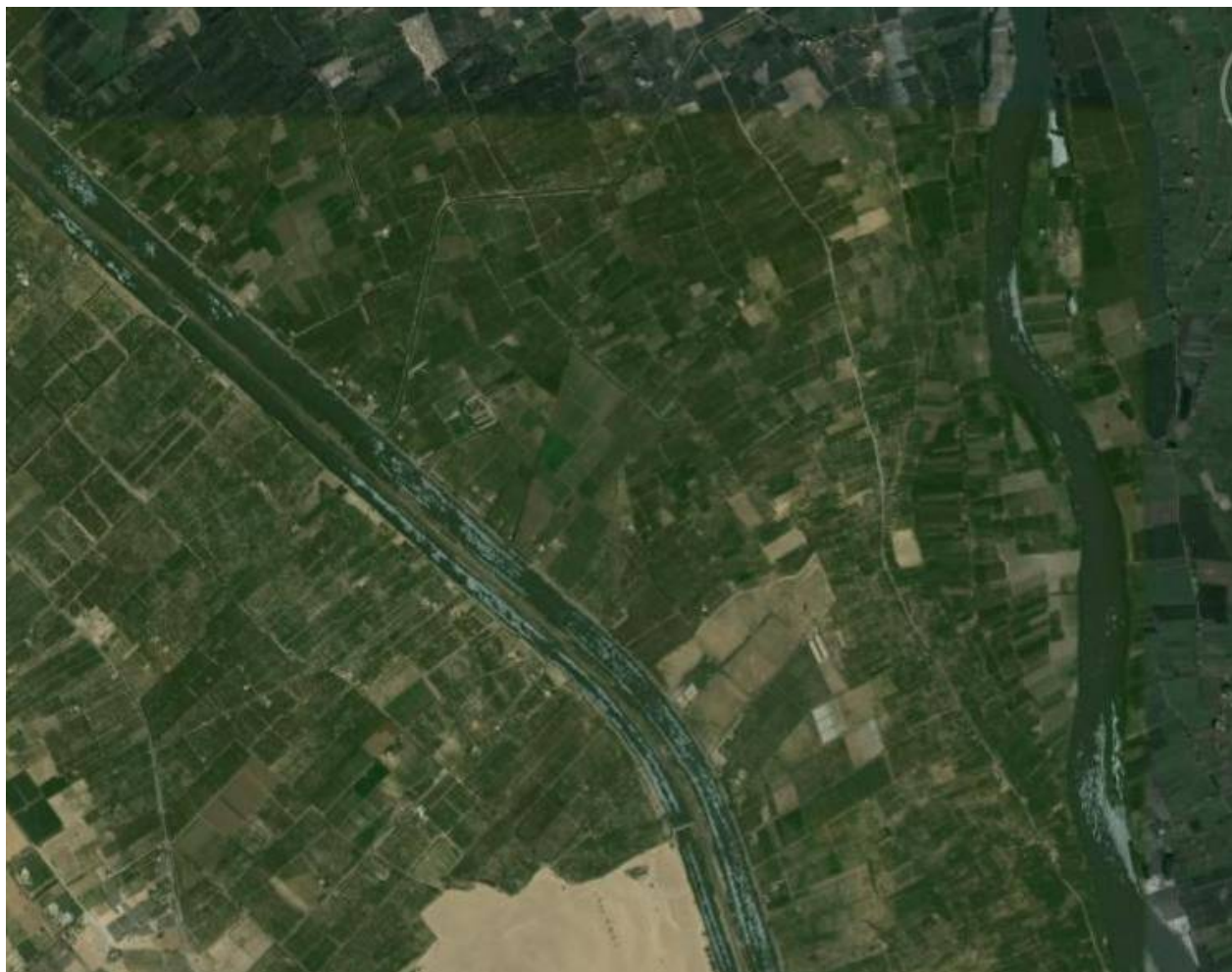


Figure 4 (B)

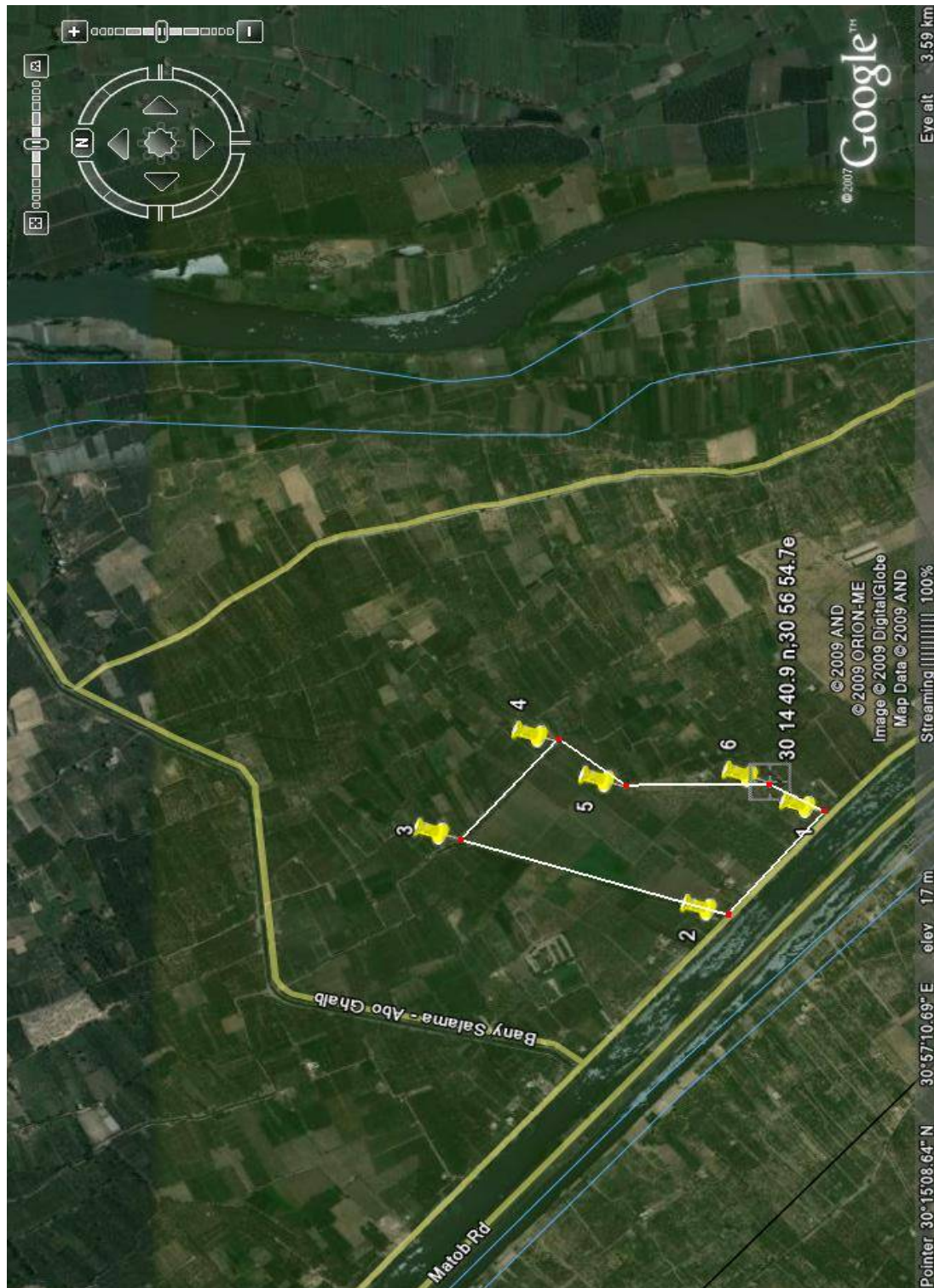
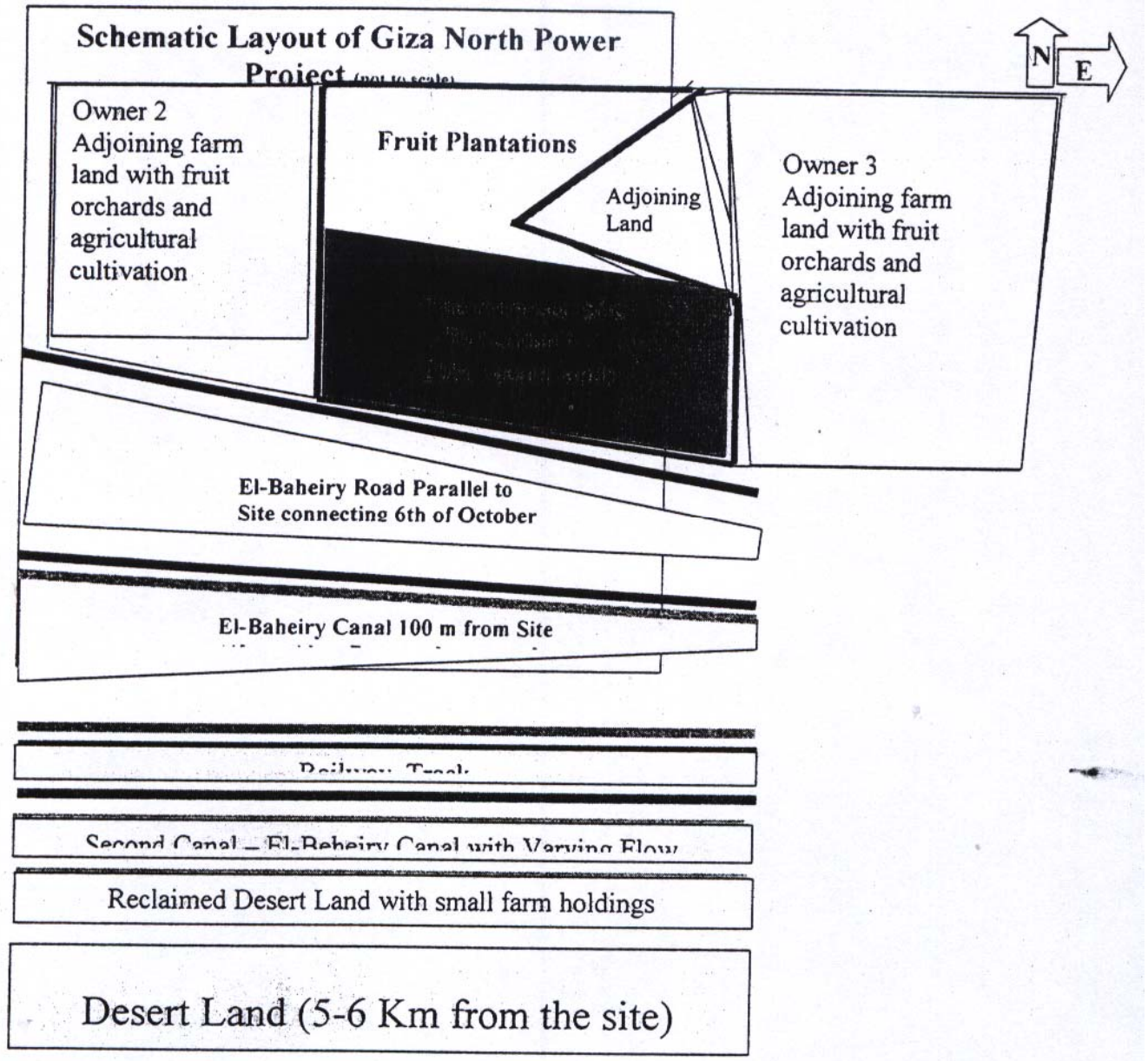
*Enlargement of the Giza North Power Plant Area*

Figure 4 (C)

**Schematic Layout Drawing of the Giza North Power Project**

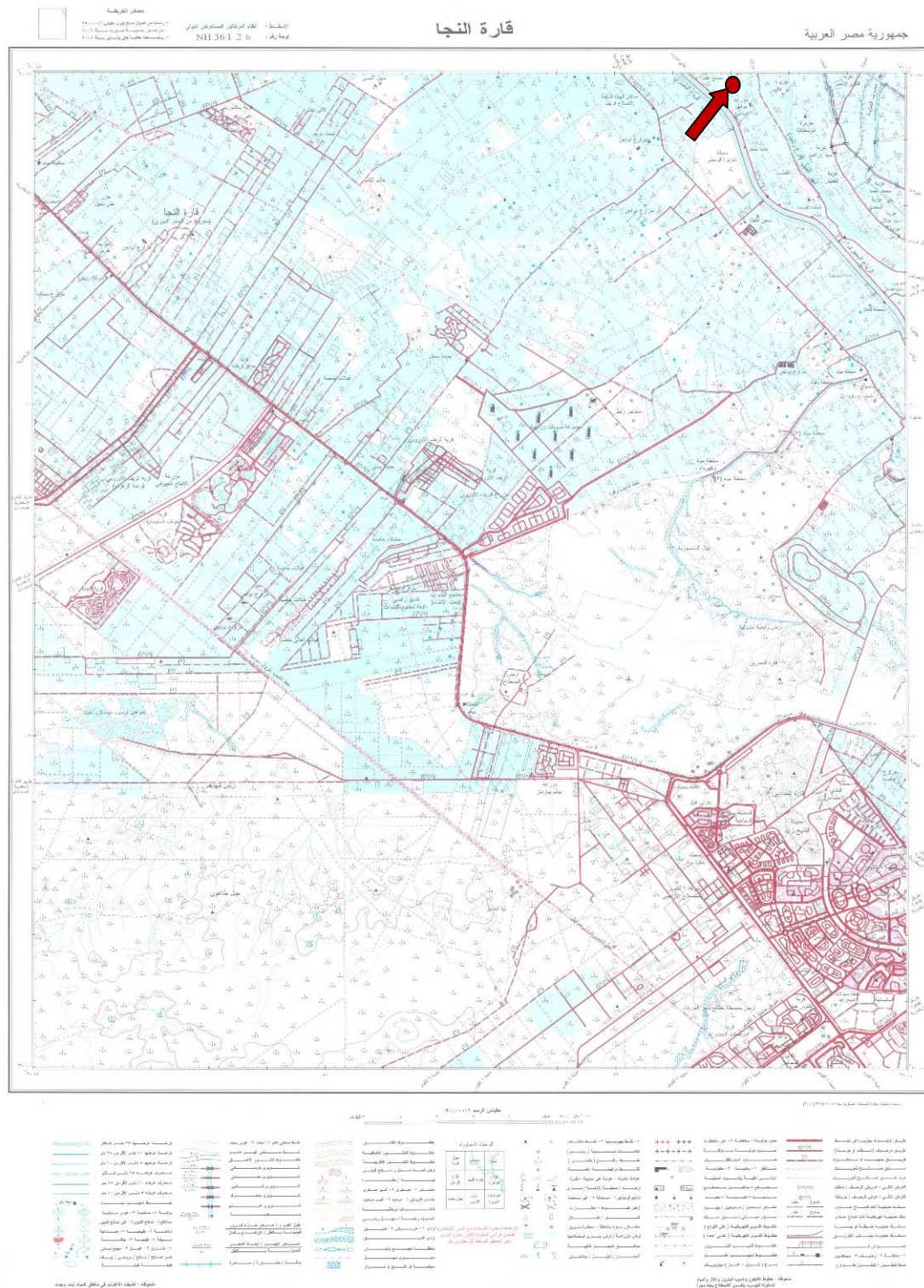
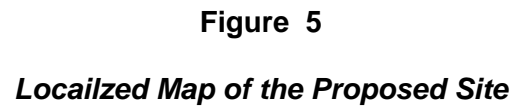


Figure 6

**General Area Map of the Giza North Power Plant  
with Locations of Permanent Control Points**



Figure 7 (A)

*Some Photos for the Power Plant Site*



Figure 7 (B)

*Some Photos for the Power Plant Site*



Figure 8 (A)

*Area Setteing of the Power Plant Site*



Figure 8 (B)

*Area Setteing of the Power Plant Site*



Figure 9 (A)

**Markaz Imbaba Region Master Scheme, 2009**  
**[The 6<sup>th</sup> of October Governorate is planned for developments,**  
**which enhance the need for electricity]**

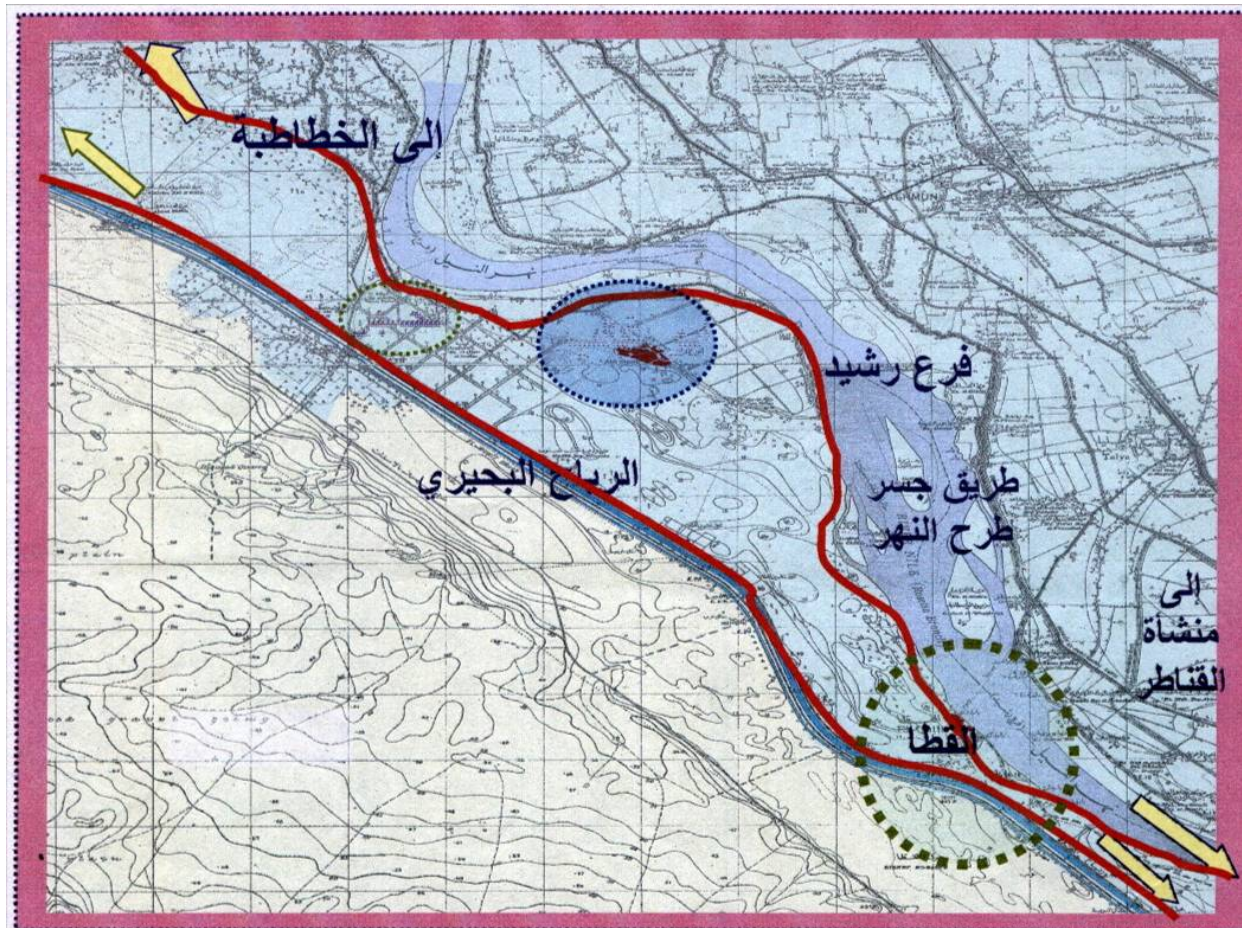
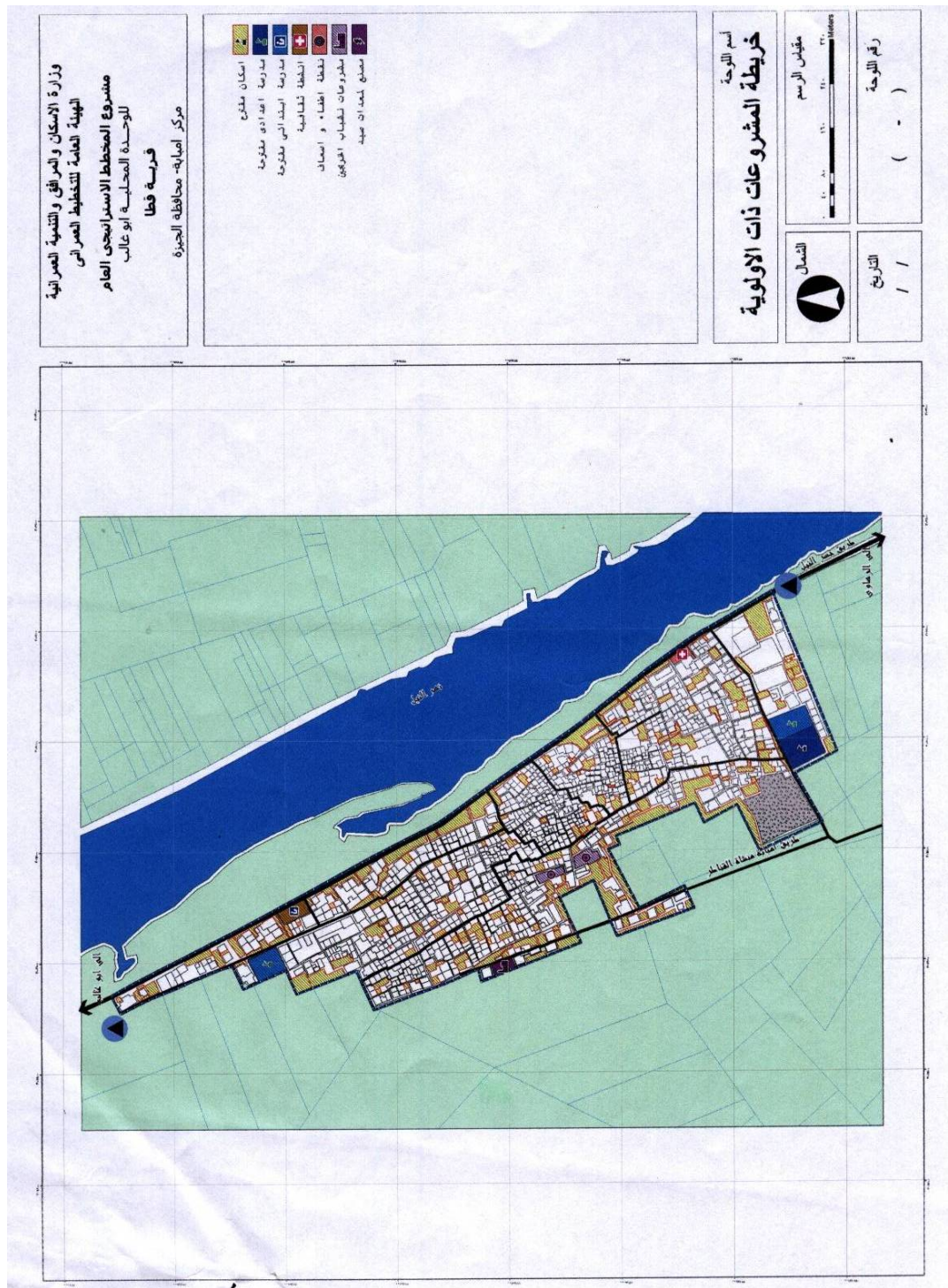


Figure 9 (B)

**Urban Development Plan for the El-Kata Zone, 2009**  
**[The El-Kata area is planned for developments, which enhance the need for electricity and accommodates the power plant project]**



***Urban Development Plan for Abu Ghaleb Village, 2009***  
***[The Abu Ghaleb Village, 6<sup>th</sup> of October Governorate area is planned for***  
***developments, which enhance the need for electricity]***

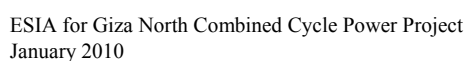


Figure 9 (D)

**Urban Development Plan for Wardan Village, 2009**  
**[The Wardan Village is planned for developments,**  
**which enhance the need for electricity]**

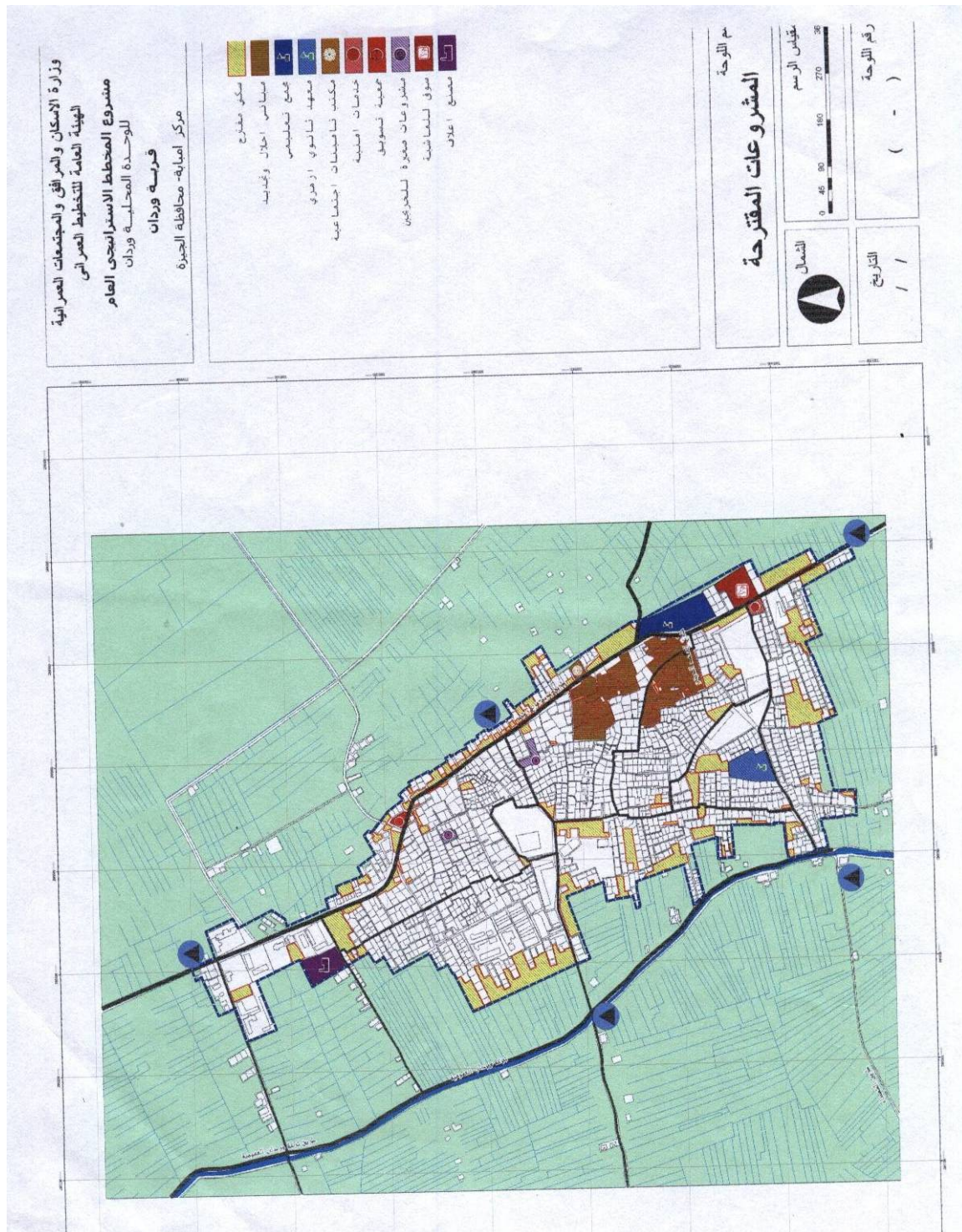


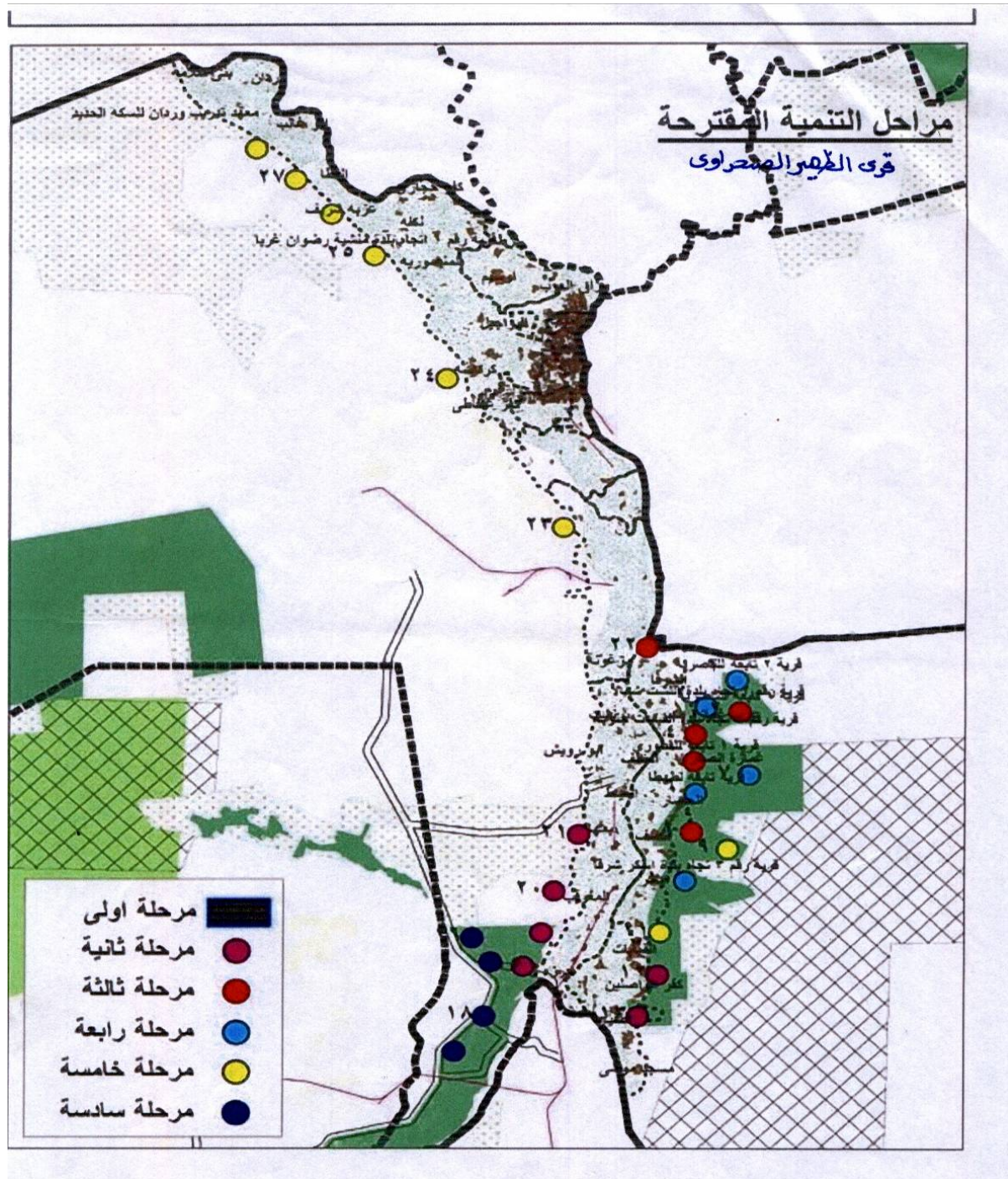
Figure 9 (E)

**Urban Development Plan for Bani-Salama Village, 2009**  
**[The Bani-Salama Village is planned for developments,**  
**which enhance the need for electricity]**



Figure 9 (F)

**Urban Development Plan for Villages  
of the Desert Rear, 2009**  
[The Desert Rear area is planned for developments,  
which enhance the need for electricity]



#### 4. PROJECT DESCRIPTION

##### 4.1 Overview of the Power Plant

65. The power plant site will occupy an area of approximately 125,000 m<sup>2</sup>, within a total allocated area of 275,000 m<sup>2</sup> trapizoide-shaped piece of land and will include the following main elements **for each 750 MWe module**:

- Two indoor combustion turbine generator (CTG) units.
- Two outdoor heat recovery steam generators (HRSGs) without supplementary firing.
- One indoor condensing steam turbine generator (STG) unit.
- The project is rated for 750 MWe (nominal) net power generation at ISO conditions of 15 °C ambient air temperature, and 60 percent relative humidity.
- Each CTG will feed exhaust gases to its respective HRSG. The steam produced from the two HRSGs will feed the STG.
- The primary fuel for the combustion turbines will be natural gas supplied by Owner at 26.0 barg guaranteed at the interface. The secondary fuel for the combustion turbines will be solar oil (Fuel oil No. 2).
- Power will be generated at the manufacturer's standard voltage and stepped up through main transformers to be connected to a 220 kV gas insulated switchgear (GIS).
- The power plant is designed to operate as a base load unit with the STG operating in sliding pressure mode.
- Cooling water supply will be provided by an extraction from, and discharge to, the Gulf of Aqaba.

66. The power plant will include the following main components **for each 750 MWe module**:

- Gas Turbine 1A.
- Gas Turbine 1B.
- HRSG Unit 2 A.
- HRSG Unit 2 B.
- Steam Turbine Unit 1 A.
- Elec. Bldg. Unit 1 A.
- Elec. Control Bldg. Unit 1 B.
- Main Transformers Unit 1 A.
- Main Transformers Unit 1 B.
- Aux. Transformers Unit 1 A.
- Aux. Transformers Unit 1 B.
- Switchyard Area.

- Diesel Generator.
- Switchgear Control Room.
- Stacks Module 1.
- Fuel Gas Receiving/Reducing Station.
- Sollar Oil Unloading Pumps.
- Sollar Oil Storage Tanks.
- Water Treatment Area.
- Circulating Water fire Water Pump House.
- Circulating Water Electrical Equipment Bldg.
- Chlorine Tank/Pump.
- Condensate Water Tank.
- Condensate Water Discharge Structure.
- Condensate Water Seal Well.
- Demineralized Water Storage Tank.
- Waste Water Treatment Plant.
- Administration Building.
- Warehouse/Work Shops.
- Security office.
- Fire Station.
- Hydrogen Generation Building.
- Bottled Gas Storage/Gen. Area.
- Foam Equipment.
- Black Start Facility.

67. The layout and main components for the power plant is presented in *Figure 10*.

## 4.2 Process Description

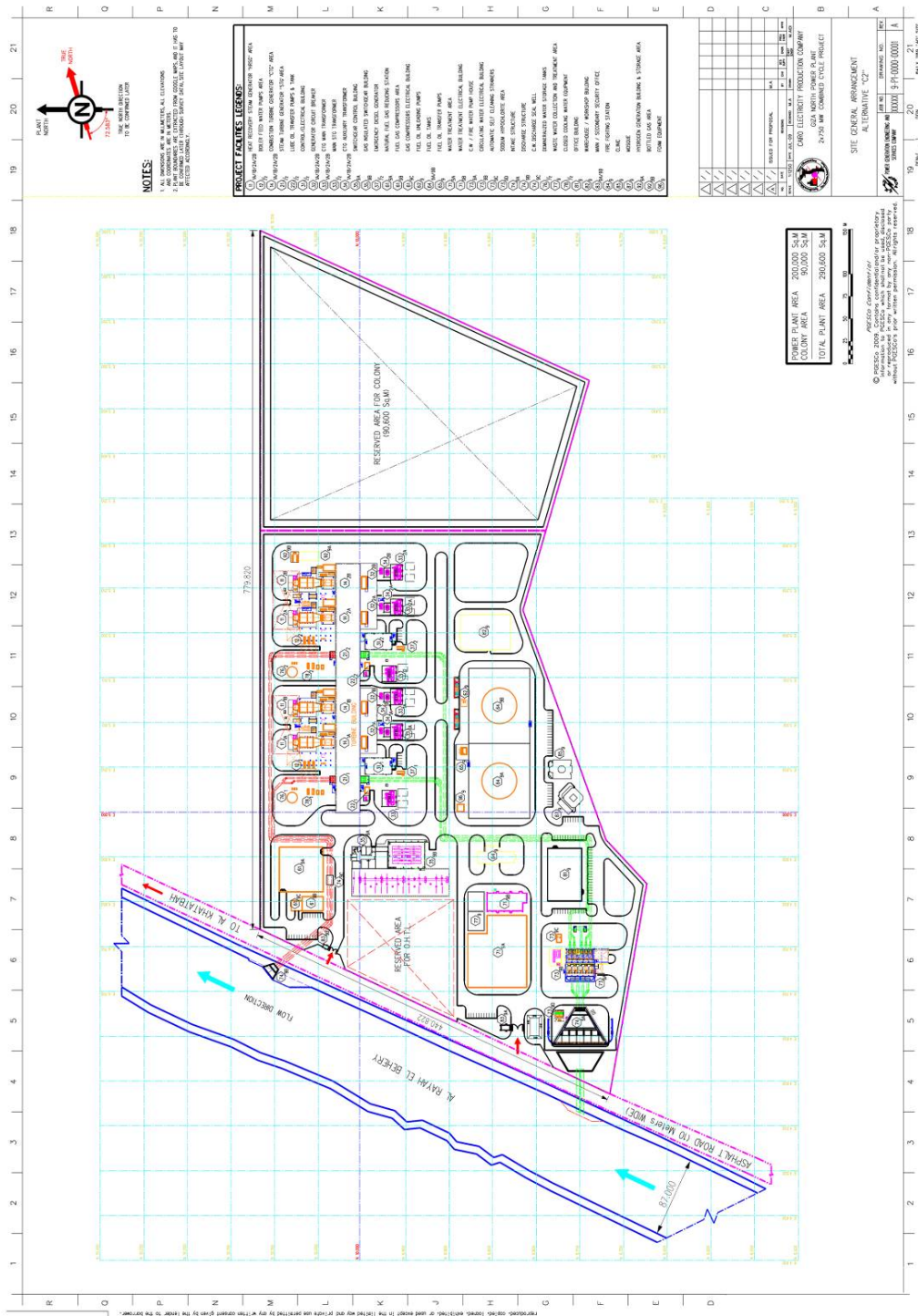
68. The key steps of the generating process of the proposed combined cycle power plant are as follows:

- The main inputs to the generating process consist of natural gas or sollar oil, which will be transported to the station via pipeline (gas) or by trucks (sollar oil).
- Natural gas (or sollar oil as a backup) will be mixed with air at the gas turbine unit compressor outlet and combusted to produce hot high-pressure flue gas, which drives the gas turbine electrical generator. Gas turbine exhaust will be used to generate steam from demineralized water to drive one steam turbine generator.

- The steam is cycled from the Heat Recovery Steam Generators through the turbine to a condenser. A direct, once through cooling system, extracting water from, and discharging to the El-Rayyah El-Beheiry, cool the condenser. The condensate is then returned for recirculation within the Heat Recovery Steam Generators.
- The final exhaust gases will be discharged to the atmosphere in accordance with emission standards set by the EEAA. The main by-products from combustion of natural gas are carbon dioxide (CO<sub>2</sub>), water vapour (H<sub>2</sub>O), carbon monoxide (CO) and nitrogen oxides (NO<sub>x</sub>). Sulfur dioxide (SO<sub>2</sub>) and particulates, which are typically associated with coal and oil combustion, will not be produced other than in trace quantities during natural gas firing. When solar oil is used instead of natural gas, SO<sub>2</sub> and particulates will also be key emissions from the power plant.

Figure 10

### General Layout of the Giza North Power Plant and its Easements



### 4.3 Operational Releases from the Power Plant

69. During operation, the key releases into the environment from the power plant will comprise the following:

- Exhaust gases, will be emitted into the atmosphere, normally from the Boilers' stack as a result of fuel combustion. Emissions from the combustion of natural gas are carbon dioxide (CO<sub>2</sub>), water vapor, carbon monoxide (CO) and nitrogen oxides (NO<sub>x</sub>). Sulfur dioxide (SO<sub>2</sub>) and particulates, which are typically associated with coal and oil combustion, will only be produced in trace quantities during natural gas firing. In emergencies when light fuel oil (sollar) is used instead of gas, SO<sub>2</sub> and particulates will however be key emissions from the power plant.
- Heated cooling water will be discharged into the El-Rayyah El-Beheiry via the cooling water discharge structure at a temperature of no more than 8 °C at the point of discharge. Process waste water will be treated and discharged into the discharge system, which includes two pathways: one to the circulating water discharge system (CWDS) and the other to the plantation irrigation network. Any oil and residual solids will be removed before discharge and the pH of discharged water maintained at between 6 and 9.
- Chlorine will be added to the cooling water system to control bacterial and algal growth on various surfaces and in the cooling water intake. The cooling water discharge will contain residual quantities of chlorine at concentrations below the World Bank standard for free chlorine of 0.2 mg/l.
- Small volumes of solid wastes will be segregated, collected and disposed of by licensed waste disposal contractors.

70. The power plant incorporates a rang of measures to eliminate or reduce operational releases within its design and layout, such as low NO<sub>x</sub> combustors in the gas turbines, oil interceptors fitted to the site drainage system and effluent treatment facilities to treat wastewater prior to discharge. As a result, the power plant is designed to meet high environmental standards and comply with the emission limits of the Arab Republic of Egypt and the international / World Bank.

## 5. ANALYSIS OF ALTERNATIVES

### 5.1 Current Situation ("No Action" Option)

71. The no action alternative will result in the demand for electricity exceeding supply, with an increasing deficit as demand increases in future years. A lack of a secure and reliable electricity generation and supply system has significant social and economic implications, since it will:

- constrain existing and future economic development and investment through lack of energy resources to meet industrial and social demand;

- restrict socio-economic development through lack of electricity supply, or poor reliability and shortages in electricity supply for domestic users, community and other public facilities and public services;
- inhibit provision of social services, including public health and poverty eradication.

72. As a result, the "no action" option is not a viable or acceptable alternative to the proposed project.

## 5.2 Alternative Technologies and Fuels

### 5.2.1 Selection of the Proposed Technology

73. The EEHC has an objective to provide a secure, reliable electricity generation and distribution system for Egypt. A key element in meeting this objective is to establish a diverse range of technologies to avoid over-reliance on any particular fuel or technology, which may adversely affect the ability to provide electricity or meet the fluctuations in demand which occur on a day-to-day or seasonal basis.

74. The EEHC generation expansion plan includes provision of the following:

- gas/oil-fired steam units;
- gas/oil-fired combined cycle units;
- gas/oil-fired simple cycle combustion turbine units;
- pumped storage;
- wind farms; and
- integrated solar-combined cycle generating units.

75. Other possible options include "importing electricity", "rehabilitation of existing power plants", "transmission and distribution investment" and "IPPs".

#### ***These technological alternatives constrained by the following:***

- ***Importing electricity:*** Egypt is interconnected to Libya and Jordan and is exporting electricity to both countries. Interconnection to Libya has a capacity of 300 MWe, and that of Jordan has a capacity of 350 MWe, which was increased to 450 MWe in 2006. Libya and Jordan are currently paying 4 US\$/kWh for the Egyptian power supply. As they are net importers, there is currently not much scope for electricity imports to Egypt from the interconnected networks. In addition, the cost of electricity in both countries is much higher than that of Egypt, making it an uncompetitive alternative. There is currently no south border connection to Sudan, although there is an ongoing activities in the context of the Nile Basin Initiative (NBI), whereby Egypt could potentially import hydroelectric power starting approximately in 2012, if the price is competitive. However, considering the abundance of natural gas and thus the low cost electricity provision in Egypt, it will be difficult for imported electricity to be

competitive. The same situation stands as for completion of the Syrian interconnection, which entered into operation since Jordanian-Syrian interconnection on 8 March 2000.

- **Renewable energy:** Current world market cost of wind based electricity is 5.9-7.38 US¢/kWh, whilst is 3.75 US¢/kWh with current grant financing for wind projects, which is higher than the cost from natural gas combined cycle plants (as estimated for the Giza North power project for only 2.249 US¢/kWh). Therefore, renewable energy is not competitive unless further subsidies are provided.
- **Rehabilitation of existing power plants:** EEHC has concluded that the rehabilitation option is cost effective in seven of its existing power plants, and these sites have already been or will be rehabilitated. However, these efforts are not enough to cope with the growing demand for electricity.
- **Transmission and distribution investments:** EEHC has developed a transmission and distribution (T&D) development plan and the T&D system is optimized for the current load requirements and generation capacity. To meet the demand growth for the fast track period and medium term expansion, a T&D investment plan has been developed. New electricity generation capacity is required in the network; therefore, strengthening of T&D capacity alone will not replace the need for the generation capacity. Furthermore, T&D losses are at a relatively low level, around 10% on average, and reducing the losses further would not free up the amount of electricity supply required.
- **BOOTs/PPs:** Three BOOT projects (650 MWe each) have been built in Egypt in late 1990's and early 2000's. The government is encouraging private sector participation in order to attract private investment. However, given the worldwide reduction in investor's interest in the power sector, private financing for power generation in the near term is still unlikely.

76. ***Consistent with the generation expansion plan, the EEHC has stipulated that the Giza North should be gas/oil-fired combined cycle units of a net 2x750 MWe generating capacity. The reasons for the selection of this technology are as follows:***

77. The steam cycle (SC) technology, which fires natural gas as a main fuel and mazout as a back-up fuel, has been used for decades in Egypt. The plant efficiency is around 42% with 600 MWe size. The investment cost of Steam Cycle Plant, based on recent worldwide market experience, is around \$ 1100-1300/kWe (EPC basis with multiple packages). The application of large scale (750MWe) gas turbine combined cycle (CC) technology, which fires natural gas as a main fuel and diesel fuel as a back-up fuel, has been operational since 2004. Plant efficiency exceeds 55% and the investment cost, based on recent worldwide market experience, is around \$760-810/kWe (EPC basis with multiple packages). Given that CC plants show lower investment cost and higher plant efficiency, this is considered a distinguished rationale to justify why the CC technology has been selected for the proposed project.

78. Given this rationale, existing and planned generating capacity using gas/oil-fired steam cycle units is already considered sufficient by the EEHC and further reliance on this particular technology is not preferred –for the time being- for reasons of security of supply, response to demand and economics. As shown in Table 3-1, almost 26% of installed capacity in 2007/2008 was provided by combined cycle technology and considered able to accommodate more CC capacities. Also, declared combined cycle additions of Nuweiba on the Gulf of Aqaba has been delayed for unforeseen period of time, which means that the power generation system actually needs to increase the combined cycle capacity by another 750 MWe within the same period.

79. Hence, with the current policy to increase CC to 30-35% in the generation mix (as identified by EGEAS), and with urgent need of supply capacity with load following capability, CC technology has been identified as the most viable option for the Giza North project. This will ensure operational flexibility, network stability, fuel flexibility and local job creation.

### 5.2.2 *Alternative Fuels*

80. Natural gas has been selected as the main fuel for the power plant. Compared to other fossil fuel generating technologies, gas-fired combustion turbine generators have a relatively low emissions of carbon dioxide (CO<sub>2</sub>), moderate emission levels of nitrogen oxides (NO<sub>x</sub>) and the lowest emission levels (almost traces) of sulfur dioxide (SO<sub>2</sub>) and particulates.

## 5.3 **Power Plant Design**

81. There are a wide variety of potential designs for the proposed power plant. On the basis of the key design features selected for the power plant, together with the adoption of general good practices within its overall design and layout, fuel and chemical storage facilities and pollution monitoring equipment, the power plant minimizes its potential impacts on the environment whilst ensuring safe, secure and efficient operation. Key aspects of the design, which have been compared with alternatives, are as follows:

- the stack has been designed to maximize buoyancy and dispersion of emissions and its height (82 m) exceeds good engineering practice;
- the Gas Turbines will be equipped with low NO<sub>x</sub> combustors, minimizing emissions of NO<sub>x</sub> which is the key pollutant associated with combustion of natural gas;
- direct cooling water will be used to maximize generating efficiency, minimizing visual impact, noise emissions and the potential for visible vapor plumes or ground fogging. Alternatives such as cooling towers and air cooled condensers (open, whilst using less water, result in lower generating efficiencies and also result in impacts such as vapor plumes, visual and noise impacts). The availability of water is not considered an issue for this project given the use of water from the El-Rayyah El-Beheiry;

- cooling water will be supplied from a sustainable water supply, namely the El-Rayyah El-Beheiry, and the intake and outfall structures can be constructed and operated without significant impacts.

## 5.4 Alternative Sites

### 5.4.1 Identification of Candidate Sites

82. Three sites were considered for the proposed project, namely Nubaryyah, Kom Hamada and Giza North. Relatively, the Giza North was preferred to Nubaryyah and Kom Hamada sites mainly because of the higher cost for connection to cooling water, make-up water and the gas network, in addition to difficulty of connecting the power plant to the electricity grid due to the distance densely covered with green cultivations to the load centers.

83. The key criteria used in the evaluation of the alternative sites by the EEHC/CEPC were as follows:

- *Economic factors:*
  - capital costs;
  - operation and maintenance costs;
  - requirement for natural gas;
  - requirement for cooling water;
  - demand loads for electricity; and
  - requirement for electricity transmission lines/sub-stations.
- *non-economic factors:*
  - potential environmental impacts; and
  - site development.

84. Potential environmental impacts have been examined for all sites. Screening level assessment during feasibility study indicated that the level of environmental impacts will be relatively constant for all the three sites.

85. According to the Land-use Map of 6 of October Governorate, the site area of the El-Kata has been designated in early 2009 for some urbanizational developments. Part of the land around has already been assigned to the developed of El-Kata village. As a result, the Giza North on the El-Kata area has been identified eligible as an appropriate location for current and future electricity production facility.

86. Compared to other alternative sites, the Giza North on the El-Rayyah El-Beheiry site was found to be the most effective site for the following reasons:

- Minimal additional infrastructure requirements are needed.

- A workers colony is not required during construction as the power plant will use the local workforce from 6 of October and Giza Governorates and the surrounding towns and villages.
- Desirable benefits for development of the site area.

87. In addition, the power plant will be constructed and operated on a land originally intended to be sold for an activity other than agriculture activity, thus it will not include any land take. Also, the power plant site will bring socio-economic benefits to the wider 6 of October and Giza Region, through employment opportunities, supply contracts and the effects of project expenditure within the local economy.

88. The key findings of the consideration of alternative sites are summarized in *Table 3*. The consideration of alternative sites by the EEHC/CEPC indicated that Giza North has no significant disadvantages and has several beneficial aspects for other developments in the 6 of October, Giza and Greater Cairo area, and desirable site development characteristics. Therefore, Giza North was selected as the preferred site for the power plant.

Table 3

**Key Findings of the Consideration of Alternative Sites**

Site	Key Findings
Nubaryyah	<p>"Greenfield" site, hence a new colony for workers would be required with potential socio-economic conflicts.</p> <p>Extensive infrastructure requirements needed, resulting in higher costs and potential environmental impacts.</p> <p>High Difficulty for interconnection to the national electrical grid due to dense cultivated land all along the proposed routings.</p> <p>High difficulty with connection to the gas network.</p> <p>High purchase cost for the land to be bought for the project site area.</p>
Kom Hamada	<p>Relative to Giza North site, significant infrastructure requirements needed, resulting in higher costs and potential environmental impacts.</p> <p>Relative to the other two sites, the area available is considerably small and the price is considerably high.</p> <p>High difficulty with connection to the gas network.</p>
Giza North	<p>Minimal additional infrastructure would be required.</p> <p>Cost-effective site for development (first lowest of the three alternative sites).</p> <p>A workers colony is NOT required as the project will use the local workforce from wider Suez area.</p> <p>No problem at all with gas connection and electrical interconnection.</p>

## 6. KEY FINDINGS OF THE ENVIRONMENTAL IMPACT ASSESSMENT

### 6.1 Introduction

89. A thorough assessment of the impacts of the proposed plant has been carried out based on information provided by EEHC, CEPC and their sub-consultants. A combination of quantitative and qualitative assessment techniques, ranging from computer and/or physical modeling for air, water, noise and traffic impacts to ecological and aquatic surveys and visual evaluation, have been undertaken. The results of the assessment work have been compared with the environmental standards set by the Government of the Arab Republic of Egypt and the World Bank, whichever is the more stringent.

90. The following items are examined in the corresponding sub-sections of the ESIA Study Report:

- Air Quality;
- Aquatic Environment;
- Noise and Vibration;

- Flora and Fauna;
- Land use, Landscape and Visual Impacts;
- Soils, Geology and Hydrology;
- Traffic;
- Socio-economics and Socio-cultural Effects;
- Archaeology, Historical and Cultural Heritage;
- Natural Disaster Risks;
- Major Accident Hazards;
- Solid Waste Management;
- Public Health Effects;
- Occupational Health and Safety; and
- Associated Infrastructure.

91. For each of these items, a concise description and evaluation of the significance of potential impacts of the project is presented in the ESIA study report. Where modeling has been undertaken, a description of the model as well as corresponding maps summarizing the results of the assessment are provided.

92. Where potentially significant adverse impacts are identified, possible mitigation measures are suggested wherever possible, to ameliorate the impact to an acceptable level. Where identified, beneficial or positive impacts/effects of the project are also highlighted.

93. The conclusions of the assessment (see *Table 4*) are that (with suitable mitigation measures described in *Tables 5, 6, 7, 8 and 9*) the project is in compliance with the environmental requirements of both the Government of Egypt and the World Bank with respect to stack emissions of the new power plant, ambient air quality, discharge quality and noise. *Table 1* provides with a summary of anticipated impacts in relation to the Egyptian and World Bank environmental guidelines for stack emissions, ambient air quality, liquid effluent and noise. The following discussion highlights some of the key considerations and results of the assessment.

## 6.2 Air Quality

### **Construction Dust**

94. Construction activities will result in locally high levels of dust. This may affect nearest receptors or sensitive environments which lie in the immediate boundaries of the power plant. Existing concentrations of airborne dust are already high in this rural area. Potential impacts from dust emissions on site will be significantly reduced by careful management and the implementation of mitigation measures to reduce dust generation.

### **Stack Emissions and Background Air Quality**

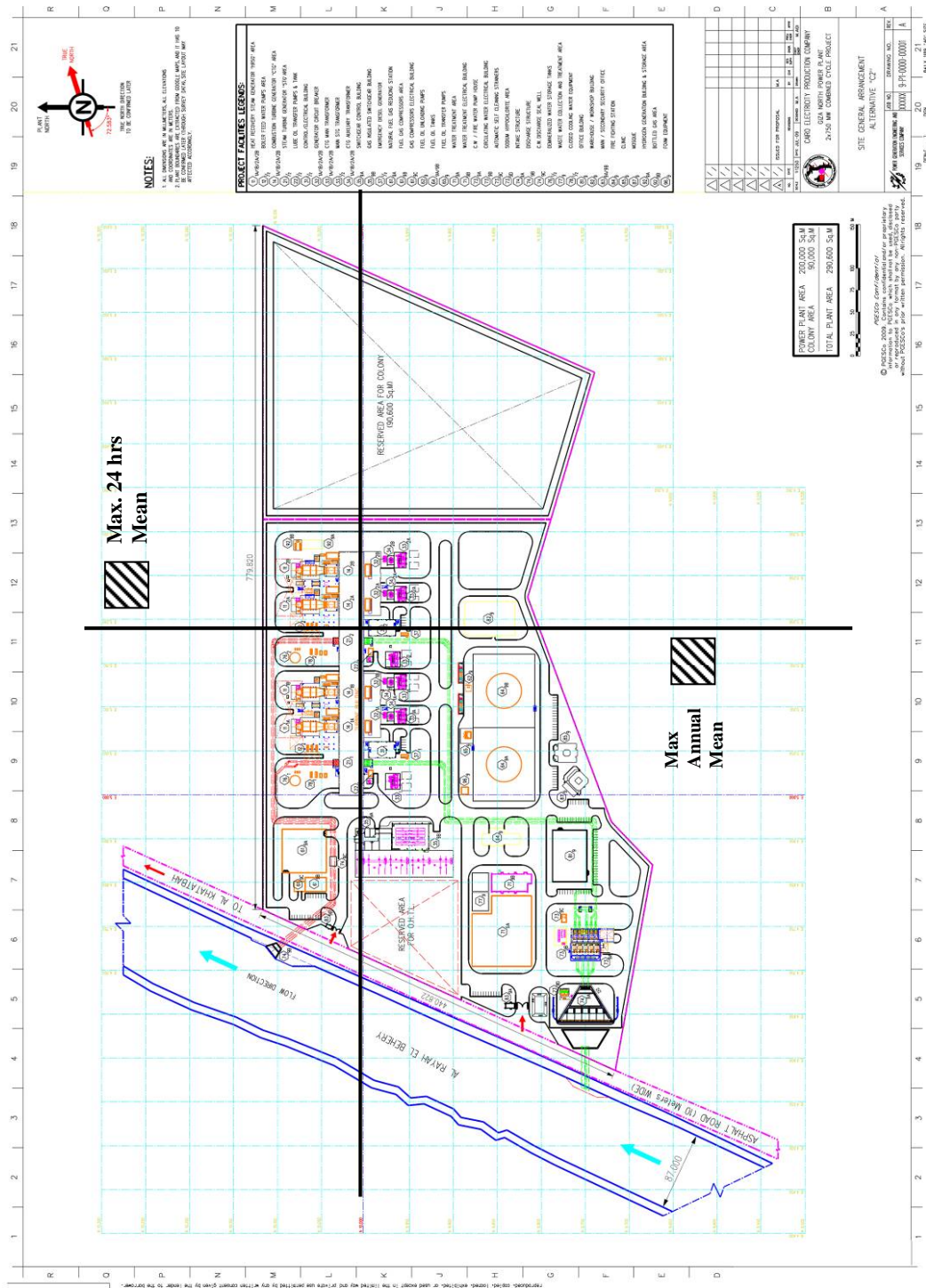
95. The power plant will burn natural gas as its primary fuel. As a result, the principle pollutant during normal operation will be NO<sub>x</sub>. During emergency operation (and for not more than 2% of operating time), the burning of light fuel oil will result in emissions of particulate matter and SO<sub>2</sub> along with trace amounts of other pollutants. Emissions from the plant will meet Egyptian and World Bank Guidelines.

96. In order to analyze the potential impacts of the plant's emissions during normal operation (firing gas) on ambient air quality in the project area, dispersion modeling has been undertaken.

97. The assessment indicates that the highest concentrations for each of the averaging periods under consideration (hourly, daily, annual) are found to the north-east, north, and south of the site, respectively. This is because the winds are exposed to the atmospheric prevailing conditions, although they are overwhelmingly from the north and northwest for most of the time. The maximum hourly average value is 256.9 µg/m<sup>3</sup> at 271.6 meters (206.0 m, 177.0 m), the maximum 24-Hours average is 115.2 µg/m<sup>3</sup> at 267.1 meters (-4.0 m, 267.0 m) and the maximum annual average is 28.6 µg/m<sup>3</sup> at 363.0 meters (-4.0 m, -363.0 m). The ambient existing levels of pollutants are dominating the wider area of the Giza North site. Combined effects from the proposed Giza North power project and the surrounding sources for nitrogen oxides (NO<sub>x</sub>) have been obtained using the background NO<sub>x</sub> measurements recorded for the Giza North area via the NRC. The maximum total combined 24-hour impact level (126.18 µg/m<sup>3</sup>, including the background level) is under the Egyptian 24-hour limit of 150 µg/m<sup>3</sup>. The maximum 24-hour impact level of the Giza North power project is 115.2 µg/m<sup>3</sup> (excluding the background level). The maximum combined 1-hour impact level, including the highest value during 2007, is 284.35 µg/m<sup>3</sup>. The Giza North plant contributed 256.9 µg/m<sup>3</sup> at this location. (see Figure 11). ***It is recommended that an air quality monitoring system composed of 2 or 3 monitoring stations will be utilized. The monitoring station equipped with meteorological monitoring system will be located near to, or within, the power plant site, the other one or two stations will be located one down wind within the designated area of maximum predicted pollutant concentration and the other (if any) upwind.***

Figure 11

## Giza North Air Quality Monitoring Locations



**Table 4**  
**Environmental Impacts and Environmental Guidelines**

Impact Area	Predicted Max. Concentration from Giza North Power Plant	Existing Ambient Air Quality (Effect of All Surrounding Facilities) <sup>(2)</sup>	Cumulative Air Quality Impact of both the Giza North Power Plant and Surrounding Facilities	Egyptian Standard	World Bank Guideline
<b>Stack emissions (70% load) (when firing Natural Gas)</b>					
NO <sub>x</sub> <sup>(1)</sup>	< 50 mg m <sup>-3</sup>			300 mg m <sup>-3</sup> <sup>(1)</sup>	51 mg m <sup>-3</sup>
SO <sub>2</sub>	negligible			not specified	not specified
TSP – General (all sizes)	< 5 mg m <sup>-3</sup>			200 mg m <sup>-3</sup>	50 mg m <sup>-3</sup>
<b>Stack emissions (70% load) when firing Light Fuel Oil (&lt;2% of total annual operating time)</b>					
NO <sub>x</sub> – oil firing	≤ 70 mg m <sup>-3</sup>			300 mg m <sup>-3</sup> <sup>(1)</sup>	152 mg m <sup>-3</sup>
SO <sub>2</sub> – oil firing	≤ 700 mg m <sup>-3</sup>			3,600 mg m <sup>-3</sup>	N/A
TSP – General (all sizes)	< 5 mg m <sup>-3</sup>			200 mg m <sup>-3</sup>	50 mg m <sup>-3</sup>
<b>Ground Level Concentration (when firing Natural Gas)</b>					
NO <sub>x</sub> – 1 hour	256.9 µgm <sup>-3</sup>	27.45 µgm <sup>-3</sup>	284.35 µgm <sup>-3</sup>	400 µgm <sup>-3</sup>	-
NO <sub>x</sub> – 24 hours	115.2 µgm <sup>-3</sup>	10.98 µgm <sup>-3</sup>	126.18 µgm <sup>-3</sup>	150 µgm <sup>-3</sup>	150 µgm <sup>-3</sup>
NO <sub>x</sub> – 1 year	28.6 µgm <sup>-3</sup>	2.19 µgm <sup>-3</sup>	30.79 µgm <sup>-3</sup>	-	100 µgm <sup>-3</sup>
SO <sub>2</sub> – 1 hour	Trace	4.25 µgm <sup>-3</sup>	4.25 µgm <sup>-3</sup>	350 µgm <sup>-3</sup>	-
SO <sub>2</sub> – 24 hours	Trace	1.70 µgm <sup>-3</sup>	1.70 µgm <sup>-3</sup>	150 µgm <sup>-3</sup>	150 µgm <sup>-3</sup>
SO <sub>2</sub> – 1 year	Trace	0.34 µgm <sup>-3</sup>	0.34 µgm <sup>-3</sup>	60 µgm <sup>-3</sup>	80 µgm <sup>-3</sup>
PM <sub>10</sub> – 24 hours <sup>(3)</sup>	Trace	210 µgm <sup>-3</sup> <sup>(3)</sup>	210 µgm <sup>-3</sup>	150 µgm <sup>-3</sup>	150 µgm <sup>-3</sup>
PM <sub>10</sub> – 1 year	Trace	42 µgm <sup>-3</sup>	42 µgm <sup>-3</sup>	70 µgm <sup>-3</sup>	50 µgm <sup>-3</sup>
<b>Liquid Effluent</b>					
pH	6-9			6-9	6-9
BOD	<30 mg/l			30 mg/l	-
Chromium	-			0.50 mg/l	0.5 mg/l
Copper	<0.5 mg/l			1 mg/l	0.5 mg/l
Iron	<1 mg/l			1 mg/l	1.0 mg/l
Zinc	<1 mg/l			1 mg/l	1.0 mg/l
Oil and Grease	<5 mg/l			5 mg/l	10 mg/l
Total Suspended Solids (TSS)	<30 mg/l			30 mg/l	50 mg/l
Residual Chlorine (total) <sup>(4)</sup>	<0.2 mg/l			-	0.2 mg/l <sup>(4)</sup>
Temperature Increase (°C)	≤8°C at the point of discharge and ≤3°C within 100 m.			(max. absolute temp 35°C at the point of discharge. Mixing zone up to 5°C above ambient.	≤3°C at edge of mixing zone <sup>(5)</sup>
<b>Noise<sup>(6)</sup></b>					
Daytime (max.)	Max. <54.6 dB(A)			65 dB(A)	55 dB(A)
Night time (max.)	Max. <54.6 dB(A)			55 dB(A)	45 dB(A)

(1) Egyptian standards for NO<sub>x</sub> are expressed in terms of NO<sub>2</sub>.

(2) Ambient air quality monitoring results measured by the NRC air quality monitoring equipment in Giza North area during September 2009.

(3) The PM<sub>10</sub> concentrations resulting from the power plant itself only is traces.

(4) "Chlorine shocking" may be preferable in certain circumstances, which involves using high chlorine levels for a few seconds rather than a continuous low level release. The maximum value is 2 mg/l<sup>1</sup> for up to 2 hours, which must not be more frequent than once in 24 hours (and the 24 hour average should be 0.2 mg/l).

(5) The effluent should result in a temperature increase of no more than 5°C at a distance less than 100m from the point of discharge where initial mixing and dilution take place. Where this zone is not defined 3°C at a distance, 100 m from the point of discharge is used when there are no sensitive aquatic ecosystems within this distance.

(6) There are no sensitive receptors for noise within 150m of the power plant. The area has been categorised as "Residential-Commercial area" with respect to Egyptian ambient noise standards and "commercial" with respect to World Bank guidelines.

### 6.3 Aquatic Environment

98. Cooling water and process water for power plant operation will be drawn from the El-Rayyah El-Beheiry via an intake structure. The quantity of the cooling water that will be returned back to the El-Rayyah El-Beheiry is about 27.2 m<sup>3</sup>/sec. Process water that will be abstracted from the El-Rayyah El-Beheiry is about 0.07% of this quantity. Potable water will be supplied to the power plant via the El-Kata local potable water system. Cooling water will be returned to the El-Rayyah El-Beheiry via a discharge structure whilst waste process water will be disposed of the El-Kata local sewer system or after treatment via discharge system, which includes two pathways: plantation irrigation network and Circulating Water Discharge System (CWDS). Sanitary waste water will be disposed of through the El-Kata local sewer system or after treatment- via plantation irrigation network. No ground water or other surface water will be used during power plant construction and operation. The Contractors will be responsible for relevant water/toilet facilities during construction and the need to provide appropriate services will be specified in their contracts. The key potential impacts of the power plant on the aquatic environment will therefore be impacts to the aquatic flora and fauna during power plant construction and operation.

99. The aquatic environment surrounding the project site is characterized by generally fair water quality. The aquatic flora is characterized by poor biodiversity and no sensitive ecosystems. No commercial fishing occurs in the vicinity of the project, but very limited fishing activity.

100. During construction of the power plant dredging and construction of the intake and discharge structures could lead to potential impacts on physical aquagraphy, water quality and removal of, or disturbance to, aquatic habitats, flora and fauna. Given that the area of impact is very localised, losses are in many cases temporary and field survey data available do not indicate significant or sensitive habitats, the impacts of power plant construction on the aquatic environment are not considered to be significant. In addition, good site management and engineering practices during construction will ensure that any residual impacts are reduced to a minimum.

101. Power plant operation will result in a heated plume of waste cooling water being discharged into the El-Rayyah El-Beheiry. Process water will be disposed of to the discharge system (identified above). All discharges of process water will be treated prior to discharge to ensure that the Egyptian and World Bank waste water quality guidelines are met. Treatment includes neutralization, oil separation, flocculation and filtration.

102. The returned cooling water will be released at a temperature of no more than 8°C at the point of discharge. Thermal modeling of the discharge plume shows that, at max. operational conditions, the point at which the plume has decreased in temperature to 3°C above ambient, lies at approximately within 100 m from the point of discharge. The mixing zone has been defined by the HRI/MWRI to be 150 m from the point of discharge.

103. The temperature of the returned cooling water at the point of discharge conforms to the Egyptian Standard, and the discharge as modeled satisfies the World Bank standard of a maximum increase of 3°C above ambient at the edge of the mixing zone (100 m from the point of discharge). In addition, the area affected by the highest temperature increases and therefore where aquatic ecology is likely to be most affected, is localized and the aquatic habitats in this area have been found to already be relatively impoverished. Outside this area, more marginal increases in the El-Rayyah El-Beheiry water temperature are likely to create new or improved habitats for flora and fauna.

104. Physical aquagraphy, Giza North El-Rayyah El-Beheiry bankline access, fishing and navigation are not predicted to be significantly affected by the presence of the intake and discharge structures.

#### 6.4 Noise Impacts

105. The construction of the Giza North power plant is expected to generate a maximum noise level of 59 dB(A) during the day at the fence of the power plant and 57 dB(A) at night. These worst-case construction noise levels are both within Egyptian and World Bank<sup>(1)</sup> guidelines, and for most of the construction periods, the noise levels will be lower than these values. There are no residential receptors within 1000 m of the plant.

106. Construction traffic on local roads will also generate additional noise, however noise levels on local roads predicted for peak construction activity (during 2011-2013) is expected to be only 0.3dB(A) above ambient levels. This magnitude of increase is generally not perceptible to the human ear, consequently no construction traffic impacts are predicted.

107. The potential noise emissions from the Giza North plant during operation have been modeled to provide noise contours in the area around the site. The predicted operational noise levels at the site boundary and at all receptors are below the Egyptian and World Bank guidelines during daytime and night-time.

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(1) There are no World Bank Guidelines for demolition and construction noise, therefore Operational noise guidelines are applied here.

## 6.5 Flora and Fauna

108. No areas protected for their conservation value are located on, or in the vicinity of, the project area. The proposed site itself and the surrounding land is agricultural vegetated with much of the area having been dominated by common cultivars. Given that the potential impacts of construction and operation on power plant area likely to be localized and good site management practices will be implemented, no significant effects are predicted.

## 6.6 Land Use, Landscape and Visual Impacts

109. The land use at the project site is agricultural land. There is no loss of this land to the power plant development, as this land is offered for sale by its owner, either, for other purposes or for a power generation activity, therefore there is not significant land use impacts due to the Giza North power project.

110. The surrounding land use is generally agricultural. As the land is dominantly cultivated, all existing views will be insignificantly influenced by the power plant and given the surrounding context, the visual intrusion of the power plant could be accommodated.

111. Visual impacts of the power plant from the residential areas to the northwest and southeast are also not expected to be significant given the long distance of their locations from the site and orientation of the facilities. The potential landscape and visual impacts of the project are therefore expected to be properly accommodated.

## 6.7 Soils, Geology and Hydrology

112. Due to the characteristics of the soils and geology of the site, in particular the lack of any sensitive features, and the mitigation measures proposed as part of the construction and operation of the power plant, no significant impacts are predicted to occur. In addition, preliminary land surface investigations confirmed the site as being uncontaminated.

## 6.8 Traffic

113. The assessment of traffic and transport covers the changes in traffic conditions in terms of delay and congestion during construction and operation.

114. The greatest potential for traffic impacts to occur arises during a short period at peak construction. There is some potential for increased congestion on the main roads to the power plant, however the impacts will only occur during the peak construction phase and during peak hours. The overall impact is therefore predicted to be insignificant. Mitigation measures will be put in place to reduce the potential for impacts to arise.

115. During operation, a small number of workers and HGVs are associated with operating the power plant and no impacts are predicted to occur.

## 6.9 Socio-economics and Socio-cultural effects

116. It is anticipated that the power plant will provide a net positive socio-economic impact through the provision of employment opportunities and attraction of economic investment into the area. In addition, the use of local labor (95% during construction), will maximize these positive impacts through the development of the local skill base and will also generate increased demand for local services, materials and products.

117. In addition to the area specifically designated for the plant, there are large empty spaces next to the power plant site. All activities related to the construction of the new plant will therefore take place within the area belonging to the CEPC, i.e. there will be no off-site activities or associated land acquisition during construction.

118. As indicated in the main document, scientific research has shown that certain species of the fish grow considerably faster in warmer water.

119. The effects on the fisheries of warmer water returned to the El-Rayyah El-Beheiry from similar power plants along the Nile banks are well known. Experience from more than 10 other power plants located on the banklines of both of the River Nile and its branches that have operated in Egypt for a number of years indicates that the overall impacts on fisheries of slightly warmer water actually are positive, and consultations with the fishermen indicate that the catches in these areas have increased rather than decreased. Since this is part-time, small-scale fisheries no statistics are available, but after many years the warmer water around the various points of discharge, is clearly perceived by the fishermen to have positive effects (**More details are presented in "consultation with the fishermen" given in Volume III, Annex C**).

120. In line with this recognition, discussions have already been initiated between the EEHC and the General Authority for Fishery Development with a view to jointly take advantage of this, e.g. establishing a fry collection station near the edge of the mixing zone.

121. Land expropriation is not likely for the sub-projects, including interconnecting transmission lines and gas pipeline. However, in order to handle any potential future changes, a Resettlement Policy Framework (RPF) is prepared by ECG separately in a stand alone document to be attached with this ESIA report. Fair compensation, if any, will be paid for the right of way according to the *Law 63 of the Year 1974 and the recommendations set out in the RPF*. The ESMP will be revised after exact routes for both of the gas connection and transmission lines are available.

## 6.10 Archaeology, Historic and Cultural Heritage

122. No available information was found which identified any archaeological, historic or cultural remains on the site or in the surrounding area. Consequently, no impact is predicted to occur on any known archaeological, historic or cultural resources.

123. CEPC have incorporated mitigation measures into the construction program to ensure that any potential finds of significance are recorded and are accorded the required protection in consultation with Supreme Council for Antiquities.

#### **6.11 Natural Disaster Risks**

124. An assessment of the risks to the power plant from seismic activity has concluded that given the engineering measures incorporated into the design of the power plant, the potential environmental impacts of a seismic event during power plant operation are not anticipated to be significant.

125. Furthermore the power plant will be designed to conform to the Uniform Building Code Zone 2 seismic criteria, according to US regulations for earthquake. These design criteria are therefore considered sufficient to withstand the level of seismic activity experienced in the area.

126. The risks of flooding during power plant construction and operation were also examined. However, site drainage will be constructed to minimize any risks of contaminated water reaching the surroundings and to properly drain the site, no significant flood risk impacts are anticipated.

#### **6.12 Major Accident Hazards**

127. Given the wider land surrounding the Giza North power plant and the measures incorporated into the design of the plant to minimize the risk from fire and explosion, the plant is not anticipated to pose a potential risk of any significance to any third party facilities.

#### **6.13 Solid and Hazardous Waste Management**

128. The management of wastes during construction and operation of the power plant will include mitigation measures to collect and store waste on-site, record all consignments of solid or contaminated waste for disposal and periodically audit waste contractors and disposal sites to ensure that disposal is undertaken in a safe and environmentally acceptable manner according to the rules set by Law 4/1994 and the Governorate of the 6 of October.

129. Private sector contractor will be assigned via general bidding process and the contract will include detailed environmental procedures, according to Law 4/1994 and Governorate of the 6 of October regulations, for disposing debris materials. The contract covers all fees required.

130. During construction and operation, all wastes including debris waste, general waste, packaging waste, commercial wastes, raw-water pre-treatment sludge, tank sludge and interceptor sludge will be disposed of by licensed waste contractors according to the rules set by Law 4/1994 and the Governorate of the 6 of October.

131. Solid and hazardous waste management is not predicted to cause any significant impacts.

#### **6.14 Occupational Health and Safety**

132. With the provision of a high standard of health and safety management on site, construction and operation of the power plant in accordance with good industry practice, the occupational health and safety risks associated with construction and operation of the power plant will be minimized and are not significant.

#### **6.15 Associated Infrastructure**

133. All construction related activities will take place within the area belonging to the East Delta Electricity Production Company. The total area is 297,250 square meters have, already, designated for the new plant. In addition to the area specifically designated for the plant, there is large empty space inside the purchased land next to the power plant designated area. All activities related to the construction of the new plant will therefore take place within the area belonging to the Cairo Electricity Production Company, i.e. there will be no off-site activities or associated land acquisition during construction.

134. Transmission lines which will evacuate power generated by the Giza North power plant will add connecting transmission lines to the Egyptian network. Some limited distance (11-15 km on 220kV and 1 km on 220 kV, too) transmission lines will connect the power plant to existing substations following new routes. Very small pieces of land will be taken against compensation.

135. The power plant will be connected through a 8 circuit lines, with 4 each connecting to two separate 2x220 kV network interconnected to the National Unified Power System (NUPS). The length of the proposed transmission line route is estimated to be 11-15 km long. A shorter connection had also been discussed, but has not been found acceptable as it will likely go through a number of orchards as well as cultivated lands. The proposed option seems to be less intrusive, both in terms of adverse socio-economic impacts and land acquisition challenges.

136. The proposed transmission route of 11-15 km with an estimated 69 transmission towers would be footed mostly (at least 80%) on dry, unproductive land. The majority of affected land owners seem to have fairly large farms, with average land holdings estimated at 8-10 Feddans. The land required for each tower footing is expected to be maximum 20x20 meters. (this requirement will be almost half for angle towers compared to suspension towers).

The final information related to the location of the associated infrastructure (i.e., transmission lines and substations) is to be determined by EEHC/EETC/CEPC.

137. Also, a new gas pipeline route will have to be identified from the nearest point of supply within the gas network in consultation with EGAS.

Gas connection will be implemented, where gas pipelines will be buried underground along the identified route.

138. However, since the transmission lines and gas pipelines are likely to require some land acquisition (and possibly resettlement), a Resettlement Policy Framework (RPF) is prepared separately, as part of this ESIA work.

The ESMP will be revised after exact routes for both of the gas connection and transmission lines are available.

139. EETC and CEPC will submit Screening Form B to the EEAA concerning the electrical interconnection. No significant impacts are anticipated.

## 6.16

### Global Impacts

140. Natural gas has been selected as the main fuel for the power plant. Compared to other fossil fuel generating technologies, gas fired steam generators have a relatively low emissions of carbon dioxide (CO<sub>2</sub>), moderate emission levels of nitrogen oxides (NO<sub>x</sub>) and the lowest emission levels (almost traces) of sulfur dioxide (SO<sub>2</sub>) and particulates.

141. The greenhouse effect is caused by the build-up of carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O) and chlorofluorocarbons (CFCs) in the atmosphere. Water vapor and ozone (O<sub>3</sub>) can also act as greenhouse gases. For power generation processes, CO<sub>2</sub> is the key emission of concern, as methane and CFCs are not emitted by power plants and none of the other greenhouse gases are emitted in sufficient quantities from power generation to be considered important in terms of the greenhouse effect.

142. The efficiency of the proposed combined cycle power plant is 55-58% with natural gas, with associated CO<sub>2</sub> emissions of about 360-420 g/kWh. This compares with the efficiency of a typical steam cycle power plant of 36-45% and CO<sub>2</sub> emissions of about 500-520 g/kWh.

143. Emissions of carbon dioxide are estimated to be up to 5,000 kilotonnes per year (expressed as CO<sub>2</sub>). This assumes that the plant operates for the whole year and consumes around 6 millions m<sup>3</sup> of gas per day. The emissions of CO<sub>2</sub> from fuel burning in Egypt amounted to around 160,000 kilotonnes in 2008 (Ref: EEAA: Egypt's Second National Communication, still to be published). Fuel combustion will account for most of Egypt's CO<sub>2</sub> emissions

from all sources. Hence, the power plant as proposed will emit up to around 3% of the total Egyptian CO<sub>2</sub> emissions in 2008. This is an upper estimate as the plant will not operate 100% of the year or at full load 100% of the time.

144. Natural gas, which is the main fuel to be used in the Giza North plant, contains very low concentrations of sulfur or particulate matter, therefore the potential for emissions of SO<sub>2</sub> and particulates from the electricity generating process are also very low. Fuel oil however, leads to greater emissions of SO<sub>2</sub> and particulates, due to the relatively high sulfur content of these fuels and the generation of ash during their combustion.

145. Natural gas fuel also has the significant benefit over fuel oil of being able to be delivered by an existing pipeline, whereas oil requires delivery to the power plant by road, rail and/or Nile river. The use of a pipeline avoids the potentially significant environmental impacts of road, rail or waterborne traffic and fuel unloading operations at a power plant. The very limited use of fuel oil at the proposed plant does not justify use of a pipeline for this fuel.

## **7. ENVIRONMENTAL MITIGATION AND MONITORING: THE ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)**

### **7.1 Enhancement and Mitigation Plan**

146. The Environmental and Social Management Plan (ESMP) includes mitigation measures, design of monitoring programs where appropriate, and specification of management measures (including institutional responsibility and training requirements).

147. The mitigation measures represent a synthesis of those measures which are part of the basic power plant design and those that have been recommended in Section 6 of the ESIA report for both the construction and operational phases of the power plant. The mitigation measures discussed in this section are summarized in the following Five Tables, together with respective environmental monitoring and management arrangements. It should be noted that many of the mitigation measures presented below for the construction phase, will be carried forward into plant Operation.

148. All the mitigation, monitoring and management measures proposed below and in Section 8 of the ESIA report (the Environmental and Social Management Plan (ESMP)), will be adopted by the Project Company and imposed as conditions of contract on the contractor and any sub-contractors employed to build or operate any part of the power plant. Since many of the mitigation measures presented are considered an essential, integrated component of the construction and operation works, it is not possible to separate the specific costs of their implementation from the overall construction and operation costs.

149. Mitigation measures introduced into the design and construction

phase of the power plant will be carried forward into the operational phase by the CEPC Company. Many of the mitigation measures, as described in Sections 4 and 6 of the ESIA report, have already been integrated into the design of the power plant in order to minimize any operational impacts on the environment. Mitigation measures such as low NOx burners, noise silencers and water discharge controls are for example integral to the design of the power plant.

150. The key features of the ESMP relate to air quality, aquatic discharge and implementation of good site management practice. The ESMP is summarized in *Tables 5, 6, 7, 8 and 9* which relate to construction and operational phases respectively. *Table 10* summarizes the cost of ESMP which will require to be included in the project financial plan.

**Table 5**  
**Institutional Arrangements for Giza North Power Project**

Issue/Impact	Mitigation Measures	Implementation Schedule	Type and Frequency of Reporting / Monitoring	Responsibility		Monitoring Indicators	Budget in US\$
				Implementation	Supervision		
Construction Phase							
Institutional capacity to address environmental and social issues	Establishment of the Project Management Unit (PMU), including the Environmental Management Staff (EMS) (will include 3-4 staff members, B.Sc. and/or 5 years high technical education), construction phase. Basic training of persons employed to operate the monitoring activities. Basic induction training for all employees on good construction and site management practice.	Prior to starting construction.	Quarterly to EEHC Environmental Management (EEM) and EEHC Chairman	PMU / EMS	CEPC Project Manager in collaboration with the Consultant Site Manager	Training programs	Environmental Quality quarterly monitoring will start with the commencement of construction phase.
		Ongoing training				Compliance with ESMP	Basic Training Basic Induction Training
							Air quality continuous monitoring will start 6 months ahead of commissioning. Training since that time is included in air quality monitoring package
							Training time and cost (included in construction cost) (around US\$ 155 k)
							CEPC responsibility
Operation Phase							
Institutional capacity to address environmental and social issues	Establishment of the Project Management Unit (PMU), including the Environmental Management Staff (EMS) (will include 3-4 staff members, B.Sc. and/or 5 years high technical education), operation phase. Basic training of persons employed to operate the monitoring activities. Induction, specific and refresher training for all employees on good operation management practice. Training methods, facilities & manuals	Prior to starting operation.	Quarterly to EEHC & EEHC Environmental Management (EEM)	PMU / EMS	CEPC Project Manager in collaboration with the Consultant Site Manager	Training programs	Included in air quality monitoring package
		Ongoing training				Compliance with ESMP	Training time and cost (included in operation cost) (around US\$ 20 k)
							CEPC responsibility

**Notes:**

(\*) CEPC responsibility: means that training and capacity building activities are included in the company organizational structure and budget.

Table 6

**Construction Impact Mitigation, Monitoring and Management Measures<sup>(\*)</sup>**

Issue/Impact	Mitigation Measures	Implementation on Schedule	Monitoring	Responsibility		Monitoring Indicators	Type and Frequency of Reporting/monitoring	Management and Training	Indicative Cost Estimate (US\$)
				Implementation	Supervision				
<b>Air Quality</b> Dust emissions caused by construction activities, construction vehicle movements, and transport of friable construction materials.	Implementation of good site practices including: <ul style="list-style-type: none"> <li>appropriate siting and maintenance of stockpiles of friable materials so as to minimize dust blow;</li> <li>minimizing drop heights for material transfer activities such as unloading of friable materials;</li> <li>construction phase to begin with construction of access roads;</li> <li>roads will be kept damp via a water bowser;</li> <li>roads will be compacted and graveled if necessary;</li> <li>site roads will be maintained in good order;</li> <li>regulation of site access;</li> <li>sheeting of lorries transporting friable construction materials and spoil;</li> <li>enforcement of vehicle speed limits on unmetalled roads to &lt;35 km/h.</li> </ul>	Before construction and during construction	<p><u>Before Construction and during Construction until 6 Months ahead of Commissioning:</u> Initiate baseline air quality survey of main pollutants, particularly NO<sub>2</sub>, SO<sub>2</sub>, CO, TSP and PM<sub>10</sub> using third party measurements on a quarterly basis.</p> <p><u>During Construction, 6 Months ahead of Commissioning:</u> Initiate baseline air quality survey of NO<sub>2</sub>, SO<sub>2</sub>, CO, TSP and PM<sub>10</sub> using air quality monitors and continue during 6 months.</p> <p>Two analyzer stations will be electronically connected to the EEAA ambient monitoring system.</p> <p>Measurements and analysis of these pollutants to be made on a continuous basis by a trained staff assigned by CEPC/GNPP and submitted to EEHC for reporting to any concerned authority.</p>	Implementation of Good Site Management practices shall be the responsibility of all contractors on site under supervision of the PMU / EMS and the Assistant Plant Manager.	CEPC Project Manager in collaboration with the Consultant Site Manager	Dust levels (TSP, PM <sub>10</sub> )  NO <sub>2</sub> , SO <sub>2</sub> , CO levels.	Quarterly reporting of summary results (or more if requested) and submitted to the EEHC and any other concerned authority. (e.g. EEAA, WB, etc.).	<p>CEPC/PMU responsible for management of the air quality monitoring system. Submission of annual summary reports to EEHC and any other concerned authority.</p> <p>Basic training of persons employed to operate and maintain the monitoring system.</p> <p>CEPC/PMU to ensure all contractors and subcontractors working on site are aware of ESMP and all employees are given basic induction training on good construction and site management practice.</p>	<p>Mitigation Measures, Management time and costs (included in construction costs)</p> <p>Baseline Air Quality Monitoring:</p> <p>First construction period; third party monitoring (e.g. National Research Center), four times a year until using continuous monitoring: US\$70K</p> <p>Second construction period; 6 months ahead of commissioning: Permanent Continuous Monitoring System-approx. US\$ 1000-1500K plus management time &amp; reporting.</p>

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Table 6 (Contd.)

**Construction Impact Mitigation, Monitoring and Management Measures<sup>(\*)</sup>**

Issue/Impact	Mitigation Measures	Implementation Schedule	Monitoring	Responsibility		Monitoring Indicators	Type and Frequency of Reporting / monitoring	Management and Training	Indicative Cost Estimate (US\$)
				Implementation	Supervision				
<b>Aquatic Environment</b> Dredging and construction of the intake structure and water discharge structure.  Increased suspended sediment and pollutant loads, permanent loss and disturbance to aquatic flora and fauna.	The following measures will be taken: <ul style="list-style-type: none"> <li>Construction Method Statement to be produced by the Contractor;</li> <li>dredged areas limited to minimum area required;</li> <li>disposal of dredged sediments to an agreed site;</li> <li>all works will be made clearly visible using flags, beacons and/or signals;</li> <li>bank area will be reinstated following construction.</li> </ul>	During construction of intake and discharge structures	Off bankline survey undertaken September 2009 along 5 profiles fronting the site.  Report to be maintained for later monitoring and evaluation during operation.  Continuous visual inspection  During dredging sediment and surface water will be monitored at four locations (two downstream of the intake and two upstream of the discharge) twice a month.  During construction sampling will be conducted at two sites, unless preliminary monitoring campaign shows strong variations in water quality.  Water samples will be tested for temp., PH, COD, BOD, TOC, DO, TSS, oil & grease, residual chlorine and light metals .  Sediment will be tested for oil & grease and light metals.	Implementation of Good Site Management practices shall be the responsibility of all contractors on site under supervision of the PMU / EMS and the Assistant Plant Manager.	CEPC Project Manager in collaboration with the Consultant Site Manager.	Actual parameters to be measured.	Quarterly reporting of summary results (or more if requested) and submitted to the EEHC and any other concerned authority. (e.g. EEAA, WB, etc.).	CEPC/PMU to ensure all contractors and subcontractors working on site are aware of ESMP and all employees are given basic induction training on good construction and site management practice.  These mitigation measures must be a condition of any construction contracts commissioned.	Mitigation Measures: Management time and costs (included in construction cost).  Water quality measurement costs (between US\$ 30-45K)

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Table 6 (Contd.)

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				Implementation	Supervision				
Contamination of the aquatic environment as a result of construction activities on land e.g. spillages, disposal of liquid wastes; surface run-off, exposure of contaminated soils (see also under "Soils and Hydrology").	Mitigation activities will include the following: <ul style="list-style-type: none"> <li>no discharge of effluents into the El-Rayyah El-Beheiry - all effluents shall be collected and removed off site for treatment by approved firms;</li> <li>development of a site drainage plan which reduces flow velocity and sediment load;</li> <li>protection of temporary stockpiles of soil from erosion by using a reduced slope angle where practical, sheeting and by incorporating sediment traps in drainage ditches;</li> <li>maintenance of well kept construction site.</li> </ul>	During construction	Continuous visual inspection will be conducted.	Implementation of Good Site Management practices shall be the responsibility of all contractors on site under supervision of the PMU/EMS and the Assistant Plant Manager.	CEPC Project Manager in collaboration with the Consultant Site Manager.	Fluid effluents within the site.  Soil erosion.  Surface water run-off.  Sewage effluents.  Earth, mud and debris depositions on roads.	Quarterly reporting of summary results (or more if requested) and submitted to the EEHC and any other concerned authority (e.g. EEAA, WB, etc.), if required.	CEPC/PMU to ensure all contractors and subcontractors working on site are aware of ESMP and all employees are given basic induction training on good construction and site management practices.	Management time and costs (included in construction cost).

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Table 6 (Contd.)

**Construction Impact Mitigation, Monitoring and Management Measures<sup>(\*)</sup>**

Issue/Impact	Mitigation Measures	Implementation Schedule	Monitoring	Responsibility		Monitoring Indicators	Type and Frequency of Reporting/monitoring	Management and Training	Indicative Cost Estimate (US\$)
				Implementation	Supervision				
<b>Noise</b> Increased noise in the project area as a result of the use of noisy machinery and increased vehicle movements.	Implementation of good site practices including: <ul style="list-style-type: none"> <li>enforcement of vehicle speed limits;</li> <li>strict controls of vehicle routing;</li> <li>diesel engine construction plant equipment to be fitted with silencers;</li> <li>limited noisy construction activities at night;</li> <li>prohibition of light vehicle movements at night;</li> <li>use of protective hearing equipment for workers.</li> </ul>	During construction	Monthly monitoring and supervision by CEPC is required to ensure the implementation of good site management practices by all contractors during construction.  Third party audit, conducted every 4 month.	Implementation of Good Site Management practices shall be the responsibility of all contractors on site under supervision of the PMU/EMS and the Assistant Plant Manager.  Auditor (Noise Expert)	CEPC Project Manager in collaboration with the Consultant Site Manager.	Noise complaints register to identify concerns.  Check validity using noise measuring devices.	PMU/EMS will produce a Quarterly log of valid complaints and actions taken to EEHC.  Quarterly reporting of summary results (or more if requested) and submitted to the EEHC and any other concerned authority (e.g. EEA, WB etc.), if required.	CEPC/PMU to ensure all contractors and subcontractors working on site are aware of ESMP and all employees are given basic induction training on good construction and site management practices.	Management time and costs (included in construction cost).  Third party noise measurement costs (about US\$ 23K) .
<b>Flora and Fauna</b> Site Clearance- Vegetation removal and habitat disturbance.	<ul style="list-style-type: none"> <li>Good site management practices will be observed to ensure that disturbance of habitats off-site are minimized.</li> <li>Specific mitigation measures include restricting personnel and vehicles to within construction site boundaries, lay down areas and access roads.</li> </ul>	During construction.	Periodic inspection and supervision by CEPC is required to ensure the implementation of good site management practices by all contractors during construction.	Implementation of Good Site Management practices shall be the responsibility of all contractors on site under supervision of the PMU/EMS and the Assistant Plant Manager.	CEPC Project Manager in collaboration with the Consultant Site Manager.	Good conservation of floral wealth.	Quarterly reporting No. of floral species conserved or planted, if any.	CEPC/PMU to ensure all contractors and subcontractors working on site are aware of ESMP and all employees are given basic induction training on good construction and site management practices.	Management time and costs (included in construction cost)

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Table 6 (Contd.)

**Construction Impact Mitigation, Monitoring and Management Measures<sup>(\*)</sup>**

Issue/Impact	Mitigation Measures	Implementation Schedule	Monitoring	Responsibility		Monitoring Indicators	Type and Frequency of Reporting/monitoring	Management and Training	Indicative Cost Estimate (US\$)
				Implementation	Supervision				
<b>Soils and Hydrology</b> Site clearance, excavation and disposal of material, exposure of potentially contaminated soils, spillage or leakage of substances on land, movement of equipment and vehicles on site.	The potential for impacts are largely dependent on management of the construction site and activities. The following mitigation measures will be implemented: <ul style="list-style-type: none"> <li>• development of effective site drainage systems;</li> <li>• restriction of access only to construction site areas;</li> <li>• monitoring and control of spoil;</li> <li>• disposal of waste materials unsuitable for reuse on-site, (e.g. for landscaping) at appropriately licensed sites;</li> <li>• provision of oil and suspended solid interceptors;</li> <li>• management of excavations during construction to avoid the generation of drainage pathways to underlying aquifers;</li> <li>• provision of impermeable bases in operational areas to prevent absorption of spillages.</li> </ul>	During construction.	Daily visual inspection is required to ensure the implementation of good management practices during construction.	Implementation of Good Site Management practices shall be the responsibility of all contractors on site under supervision of the PMU/EMS and the Assistant Plant Manager.	CEPC Project Manager in collaboration with the Consultant Site Manager.	<ul style="list-style-type: none"> <li>• site drainage.</li> <li>• access only to construction site areas.</li> <li>• spoils.</li> <li>• waste materials.</li> <li>• oily waters.</li> <li>• drainage pathways.</li> <li>• potential spillage in operational areas.</li> </ul>	Quarterly reporting of summary results (or more if requested) and submitted to the EEHC and any other concerned authority (e.g. EEAA, WB etc.), if required.	CEPC/PMU to ensure all contractors and subcontractors working on site are aware of ESMP and all employees are given basic induction training on good construction and site management practices.	Costs for mitigation measures and management time included in construction costs.  Any additional features (e.g. bunding, interceptors etc.) may incur additional costs of between US\$ 30-50K dependent on the measure.

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				Implementation	Supervision				
<b>Traffic and Transport</b> Disruption, noise and increased air pollution due to increased traffic, light loads and abnormal loads.	Standard good practice measures will be implemented as follows: <ul style="list-style-type: none"> <li>● adherence of abnormal load movements to prescribed routes, outside peak hours and advance publication of movements if required;</li> <li>● construction shifts will be staggered;</li> <li>● scheduling of traffic to avoid peak hours on local roads;</li> <li>● transportation of construction workers by contract bus.</li> </ul>	During construction.	Monitoring traffic entering the site during morning & evening peaks to ensure the implementation of good site management practices by all contractors during construction.	Implementation of Good Site Management practices shall be the responsibility of all contractors on site under supervision of the PMU / EMS and the Assistant Plant Manager.	CEPC Project Manager in collaboration with the Consultant Site Manager.	Increased congestion  Travel time (compared to reasonable daily commute)	Three times per month  Quarterly reporting of summary results (or more if requested) and submitted to the EEHC and any other concerned authority (e.g. EEAA, WB etc.), if required.	CEPC/PMU to ensure all contractors and subcontractors working on site are aware of ESMP and all employees are given basic induction training on good construction and site management practices.	Management time

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Table 6 (Contd.)  
Construction Impact Mitigation, Monitoring and Management Measures<sup>(\*)</sup>

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				Implementation	Supervision				
<b>Socio-Economic Environment</b> Positive impacts identified.	<p>All activities related to the construction of the new plant will take place within the area belonging to CEPC, i.e. there will be no off-site activities or associated land acquisition during construction.</p> <p><i>Transmission lines will connect the power plant to existing substations following new routes. Also, a new gas pipeline route will have to be identified from the nearest point of supply within the gas network.</i></p> <p><i>However, since the transmission lines and gas pipeline are likely to require some land acquisition (and possibly resettlement), a Resettlement Policy Framework (RPF) is prepared separately, as part of this ESIA work.</i></p> <p>The entire labor force will be daily commuters, thus no worker housing or associated facilities will be erected on site during construction.</p> <p>The contractors will be responsible for relevant temporary water / toilet facilities during construction and the need to provide appropriate services will be specified in their contracts.</p> <p>Public and Industry Relations will be maximized through open dialogue between CEPC (through the Assistant Plant Manager who has direct responsibility for EHS Liaison) and local authority, public and industry representatives.</p>	During construction.	Record local employment provided by the project.	PMU/EMS and the Assistant Plant Manager	CEPC Project Manager in collaboration with the Consultant Site Manager.	Workers satisfaction as measured by staff interviews and complaints submitted.	Editing a special report	Responsibility of CEPC/PMU.	Responsibility of CEPC.

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Table 6 (Contd.)

**Construction Impact Mitigation, Monitoring and Management Measures<sup>(\*)</sup>**

Issue/Impact	Mitigation Measures	Implementation Schedule	Monitoring	Responsibility		Monitoring Indicators	Type and Frequency of Reporting/monitoring	Management and Training	Indicative Cost Estimate (US\$)
				Implementation	Supervision				
<b>Archaeology</b> Potential chance finds of archaeological remains during construction.	The project site does not lie on, or in the immediate vicinity of any known archaeological areas of interest.  If remains are found CEPC is committed to: <ul style="list-style-type: none"> <li>● cease activities and consult Antiquities authority;</li> <li>● protection in situ if possible;</li> <li>● excavation of areas where protection not feasible;</li> <li>● preparation of a Chance Finds Procedure and Method Statement.</li> </ul>	During construction.	Supervision of construction activities.	Construction contractors  PMU/EMS and the Assistant Plant Manager will allocate responsibilities in accordance with the Chance Finds Procedure.	CEPC Project Manager in collaboration with the Consultant Site Manager.	Chance finds (see annex II)	Daily inspection  Quarterly reporting of summary results (or more if requested) and submitted to the EEHC and any other concerned authority (e.g. EEAA, WB etc.), if required.	CEPC/PMU to ensure that all workers on site are aware of the importance of archaeological remains and must report any potential finds immediately.  Immediate liaison with Competent Administrative Authority should a potential find be uncovered.	Mitigation measures require management time.  Should chance finds occur, protection & excavation could add significantly to the cost.
<b>Natural Disasters</b> Flash flooding.	Good engineering design will incorporate the following mitigation measures: <ul style="list-style-type: none"> <li>● drainage system designed to direct flood water from main plant areas into the sea and direct potentially contaminated waters through the oil interceptor.</li> </ul>	During construction.	No monitoring measures are envisaged.	PMU/EMS and the Assistant Plant Manager	CEPC Project Manager in collaboration with the Consultant Site Manager.		Quarterly reporting of summary results (or more if requested) and submitted to the EEHC and any other concerned authority (e.g. EEAA, WB etc.), if required.	CEPC/PMU to ensure that all workers on site receive training in emergency preparedness and response procedures.	Relevant costs are included within the construction costs

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**Construction Impact Mitigation, Monitoring and Management Measures<sup>(\*)</sup>**

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				Implementation	Supervision				
<b>Solid Waste Management</b>	<p>Good practice measures such as the following:</p> <ol style="list-style-type: none"> <li>(1) all waste taken off-site will be undertaken by a licensed contractor and CEPC will audit disposal procedure;</li> <li>(2) collection and segregation of wastes and safe storage;</li> <li>(3) recording of consignments for disposal;</li> <li>(4) prior agreement of standards for storage, management and disposal with relevant authorities.</li> </ol> <p><b>It is of highest importance that final disposal of wastes shall be strictly adhered to environment friendly disposal Contract.</b></p>	During construction.	Periodic inspection is required to ensure the implementation of good management practices during construction.	Implementation of Good Site Management practices shall be the responsibility of all contractors on site under supervision of the PMU/EMS and the Assistant Plant Manager.	CEPC Project Manager in collaboration with the Consultant Site Manager.	<p>Management contract in place</p> <p>Functional transfer station.</p>	<p>Quarterly reports from management contractor to CEPC and then to EEHC.</p> <p>These reports are to be submitted to any other concerned authority (e.g. EEAA, WB, etc.), if required.</p>	CEPC/PMU to ensure all contractors and subcontractors working on site are aware of ESMP and all employees are given basic induction training on good construction and site management practices.	Management time plus costs (< US\$ 20K)

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Table 6 (Contd.)

**Construction Impact Mitigation, Monitoring and Management Measures<sup>(\*)</sup>**

Issue/Impact	Mitigation Measures	Implementation Schedule	Monitoring	Responsibility		Monitoring Indicators	Type and Frequency of Reporting / monitoring	Management and Training	Indicative Cost Estimate (US\$)
				Implementation	Supervision				
<b>Occupational Health &amp; Safety</b>	<p>Good local and international construction practice in Environment, Health and Safety (EHS) will be applied at all times and account will be taken of local customs, practices and attitudes. Measures include:</p> <ul style="list-style-type: none"> <li>• implementation of EHS procedures as a condition of contract all contractors and sub-contractors;</li> <li>• clear definition of the EHS roles and responsibilities of all construction companies and staff;</li> <li>• management, supervision, monitoring and record-keeping as set out in plant's operational manual;</li> <li>• pre-construction and operation assessment of the EHS risks and hazards;</li> <li>• completion and implementation of Fire Safety Plan prior to commissioning any part of the plant;</li> <li>• provision of appropriate training on EHS issues for all workers;</li> <li>• provision of health and safety information;</li> <li>• regular inspection, review and recording of EHS performance; and</li> <li>• maintenance of a high standard of housekeeping at all times.</li> </ul>	During construction.	Daily inspection is required to ensure the implementation of EHS Policies, plans and practices during construction.	Implementation of Good Site Management practices and the EHS policies shall be the responsibility of all contractors on site under supervision of the PMU/EMS and the Assistant Plant Manager.	CEPC Project Manager in collaboration with the Consultant Site Manager.	<p>Management procedures in place.</p> <p>Workers health and safety as measured by no. of incidents.</p>	<p>Daily inspection</p> <p>Quarterly reporting of summary results (or more if requested) and submitted to the EEHC and any other concerned authority (e.g. EEAA, WB, etc.), if required.</p>	<p>CEPC/PMU to ensure all contractors and sub-contractors for workers on site include reference to the requirements of the ESMP and are aware of the EHS policies and plants. All employees will be given basic induction training on EHS policies and practices.</p> <p>Contractors are responsible for ensuring that a Fire Safety Plan, which conforms to NFPA 850, is prepared and implemented prior to commissioning of any part of the plant under supervision of PMU/EMS and the Assistant Plant Manager.</p>	Mitigation measures will require management time plus costs of up to US\$ 50K for implementation of EHS Plans.

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**Table 7**  
**Operational Impact Mitigation, Monitoring and Management**

Issue/Impact	Mitigation Measures	Implementation Schedule	Monitoring	Responsibility		Monitoring Indicators	Type and Frequency of Reporting/monitoring	Management and Training	Indicative Cost Estimate (US\$)
				Implementation	Supervision				
<p><b>Air Quality</b> Emissions from stack are not expected to exceed standards.</p> <p>Ambient air quality affected by emissions from the power plant.</p>	<p>Mitigation measures have already been included in the design of the plant and, given CEPC/GNPP's strict commitment to use solar fuel oil for &lt;2% of operating time, no further mitigation measures are proposed.</p> <p>CEPC/GNPP will however demonstrate the validity of the conclusions drawn in the ESIA report.</p> <p>CEPC/GNPP will demonstrate the validity of the conclusions drawn in the ESIA report. If ground level concentrations are found to be above local and World Bank standards options for further mitigation will be discussed.</p>	During first three years of operation.	<p><b>Automatic monitoring</b> of stack emissions for NO<sub>x</sub>, SO<sub>2</sub>, particulate matter and carbon monoxide (CO) via test ports installed in the main stacks.</p> <p><b>Install two continuous</b> NO<sub>x</sub>, SO<sub>2</sub>, CO, PM<sub>10</sub> &amp; TSP <b>monitoring stations</b> to monitor short-term concentrations in the area predicted to have the highest impacts on humans (as there are no other sensitive environments). The analyzer station near or within the site boundaries will include a <b>continuous monitor</b> of meteorological conditions (temperature, wind speed, wind direction and mixing heights).</p> <p>The analyzer stations will be electronically connected to the EEAA ambient monitoring system.</p>	<p>The analyzer stations will be owned and operated by CEPC/GNPP/EMS.</p> <p>Assistant Plant Manager</p>	<p>CEPC Top Management</p> <p>EEHC Environmental Management &amp; Studies Sector.</p> <p>Report introduced to EEAA as requested.</p> <p>Third party inspection.</p>	<p>Stack emissions (at least PM<sub>10</sub>, NO<sub>x</sub>, SO<sub>x</sub> and CO).</p> <p>Ambient air pollutants concentrations (at least TSP, PM<sub>10</sub>, NO<sub>x</sub>, SO<sub>x</sub> and CO).</p>	<p>Continuous Hourly data acquisition.</p> <p>Quarterly reporting to EEHC.</p> <p>Reports are to be available to any of the concerning authorities (EEAA, WB, etc.).</p>	<p>Records must be kept and summary data (including any deviations from Egyptian and World bank standards) will be submitted to the Government and WB on annual basis (or more frequently if required).</p> <p>Annual reporting by CEPC/GNPP/EMS to Government and WB etc. (or more frequently if required) highlighting key features and comparing results with air quality standards and prediction in ESIA report</p>	<p>Automatic stack monitors: included in the project cost.</p> <p>Management time for compilation of reports and performance monitoring: included in operation cost.</p> <p>Purchase of Continuous Monitors (see construction management table).</p> <p>Annual servicing, calibration &amp; running costs: included in operation cost.</p>

Table 7 (Contd.)

## Operational Impact Mitigation, Monitoring and Management

Issue/Impact	Mitigation Measures	Implementation Schedule	Monitoring	Responsibility		Monitoring Indicators	Type and Frequency of Reporting/monitoring	Management and Training	Indicative Cost Estimate (US\$)
				Implementation	Supervision				
<b>Aquatic Environment</b> Discharge of process and cooling water.	<p>The design of the intake and cooling water structures have already incorporated measures to reduce impacts. In addition, good site management practices including the following will be implemented:</p> <ol style="list-style-type: none"> <li>1) neutralization, oil separation, flocculation and filtration of any contaminated water before discharge to either plantation irrigation network or the El-Kata sewer network (if close to the site);</li> <li>2) no disposal of solid wastes or waste water into the discharge structure;</li> <li>3) regular maintenance of site drainage system to ensure efficient operation;</li> <li>4) all discharges will comply with local Egyptian and World Bank guidelines.</li> </ol> <p>In addition, CEPC/GNPP will demonstrate the validity of the conclusions drawn in the ESIA report. If pollutant concentrations in the discharge or impacts to the surrounding aquatic environment are found to be above local and World Bank standards or unacceptable, options for further mitigation will be discussed.</p>	Lifetime of the plant	<p>Prepare regular water quality monitoring program including:</p> <ol style="list-style-type: none"> <li>1) quality of all water prior to discharge (<b>continuous monitoring</b> of all discharged water for temperature and pH, daily monitoring of process water for COD, TSS, oil &amp; grease and residual chlorine and <b>monthly monitoring</b> of light metals and other pollutants)</li> <li>2) ambient water quality in the area affected by the discharge plume (<b>3-monthly monitoring</b> of temperature, pH, COD, BOD, TOC, DO, TSS, oil &amp; grease, residual chlorine, light metals and other pollutants.</li> </ol> <p><b>Annual monitoring</b> of benthic environment within a 2 km radius of the discharge point (<b>over a 3 year period</b>)</p> <p><b>Weekly monitoring</b> of fish catches on intake screens including species, numbers and size (<b>over a 1 year period</b>).</p>	CEPC/GNPP/EMS  Assistant Plant Manager.	CEPC Top Management  EEHC Environmental Management & Studies Sector.	Basic parameters as per the Law 48/1982 and Law 93/1962	<p>Monthly reports from CEPC/GNPP/EMS to EEHC</p> <p>Continuous monitoring of water quality etc.</p> <p>Monthly monitoring of light metals and other pollutants.</p> <p>3-monthly monitoring of the plume.</p> <p>Annual monitoring of benthic environment (over a 3 year period).</p> <p>Weekly monitoring of Fish Catches on intake screens (over a 1 year period).</p> <p>Reports are to be available to any of the concerning authorities (EEAA, WB, etc.).</p>	<p>Records will be kept and compared on regular basis against Egyptian and World Bank standards and impacts predicted in ESIA.</p> <p>Summary reports (with any exceptions identified) will be submitted to the Government and WB etc. on annual review basis (or more frequently if required).</p> <p>CEPC/GNPP/EMS to ensure that all employees are given basic induction training on the requirements of the ESMP, good site management practices and H&amp;S procedures. The Assistant Plant Manager will ensure implementation of procedures.</p>	<p>Management time for implementation of site management practices. included in operation cost</p> <p>All costs are included in operation cost.</p>

Table 7 (Contd.)

**Operational Impact Mitigation, Monitoring and Management**

Issue/Impact	Mitigation Measures	Implementation Schedule	Monitoring	Responsibility		Monitoring Indicators	Type and Frequency of Reporting/monitoring	Management and Training	Indicative Cost Estimate (US\$)
				Implementation	Supervision				
<b>Noise</b>	<p>Specific design mitigation measures to minimize noise impacts include:</p> <ul style="list-style-type: none"> <li>gas turbines, steam turbine generators; air compressors, pumps and emergency diesel engines are enclosed in buildings;</li> <li>air compressors are equipped with silencers;</li> <li>noisy outdoor equipment are designed to a noise limit of 90 dB (A) at 1 m.</li> </ul> <p>In addition, plant workers will be provided with protective wear in plant areas with high noise levels.</p> <p>The plant will operate in accordance with internationally accepted health and safety measures.</p>	During first year of operation.	When the plant is fully operational, noise audit measurements are to be carried out at noise sources and at the fence of the power plant as well as at noise receptors around the plant.	CEPC/GNPP/EMS  Third party audit supervised by Assistant Plant Manager	CEPC Top Management  EEHC Environmental Management & Studies Sector.	Power plant compliance with ESMP.	<p>Quarterly to CEPC and EEHC.</p> <p>Monthly reporting of summary results (or more if requested) and submitted to the EEHC and any other concerned authority (e.g. EEAA, WB, etc.), if required.</p>	<p>Should any complaints be received regarding noise, these will be logged and the Assistant Plant Manager will investigate problem.</p> <p>CEPC/GNPP/EMS to ensure that all employees are given basic induction training on the requirements of the ESMP, good site management practices and H&amp;S procedures. The Assistant Plant Manager will ensure implementation of procedures.</p>	<p>Minimal costs (up to US\$ 10K per annum) required for provision of protective wear (included in operation cost).</p> <p>No further mitigation or monitoring costs envisaged with the exception of management time.</p> <p>Noise audit US\$ 10-20K (included in operation cost).</p>

Table 7 (Contd.)

**Operational Impact Mitigation, Monitoring and Management**

Issue/Impact	Mitigation Measures	Implementation Schedule	Monitoring	Responsibility		Monitoring Indicators	Type and Frequency of Reporting/monitoring	Management and Training	Indicative Cost Estimate (US\$)
				Implementation	Supervision				
<b>Flora and Fauna</b> Disturbance to habitats as a result of noise, vehicle and personnel movements.	The following mitigation measures will be implemented: <ul style="list-style-type: none"> <li>restrict personnel and vehicle movements to access roads and within boundaries of site only; and</li> <li>control of noise during operation.</li> </ul>	Lifetime of the plant.	No monitoring is envisaged.	CEPC/GNPP/EMS Assistant Plant Manager	CEPC Top Management  EEHC Environmental Management & Studies Sector.	Good plantation	Yearly	CEPC/GNPP/EMS to ensure that all employees are given basic induction training on the requirements of the ESMP, good site management practices and H&S procedures. The Assistant Plant Manager will ensure implementation of procedures.	Management time
<b>Visual Impact</b> Visual image of power plant from surrounding areas.	The visual effect of the power plant will be improved through: <ul style="list-style-type: none"> <li>creation of landscaped boundary along the fence of the power plant.</li> <li><i>Ficus elastica var decora</i> and <i>Ficus nitida</i> will be propagated and the resulting plants will be used for decorating and landscaping the site when completing the new power plant. One may obtain 200-300 individual plants from a single tree.</li> </ul>	Lifetime of the plant.	No monitoring is envisaged.	CEPC/GNPP/EMS Assistant Plant Manager	CEPC Top Management  EEHC Environmental Management & Studies Sector.	Improved visual image		Considered management of landscaped areas to maximize visual image and habitat creation.  CEPC/GNPP/EMS to contract a suitable firm to manage landscaped areas.	Approx. US\$ 20-35K for landscaping measures (included in operation cost)

Table 7 (Contd.)

**Operational Impact Mitigation, Monitoring and Management**

Issue/Impact	Mitigation Measures	Implementation Schedule	Monitoring	Responsibility		Monitoring Indicators	Type and Frequency of Reporting/monitoring	Management and Training	Indicative Cost Estimate (US\$)
				Implementation	Supervision				
<b>Soil and Hydrology</b> Spillage of oils, chemicals or fuels on site.	Good site management measures as <b>described under Aquatic Environment</b> will minimize any potential risks. As part of this, regular checks of bunds and drainage systems will be undertaken to ensure containment and efficient operation.	Lifetime of the plant	The Assistant Plant Manager will continuously monitor application of ESMP and good site management practices and take corrective action if required.	CEPC/GNPP Assistant Plant Manager	CEPC Top Management EEHC Environmental Management & Studies Sector.	Quality of bunds and drainage systems.  Efficiency of operation.	6-monthly reports from management to EEHC.  Annual reporting of summary results (or more if requested) and submitted to the EEHC and any other concerned authority (e.g. EEAA, WB, etc.), if required.	CEPC/GNPP, through the Assistant Plant Manager, will implement a Spills Response Plan and all employees will receive corresponding training.	Management time
<b>Solid Waste</b>	Good practice measures <b>undertaken during the construction phase</b> will be continued into the operation phase (see Table 6).  <b>It is of highest importance that final disposal of wastes shall be strictly adhered to environment friendly disposal Contract.</b>	Lifetime of the plant	Continuous monitoring is required to ensure the implementation of good management practices during operation.	CEPC/GNPP Implementation of Good Site Management practices shall be conducted under supervision of the Assistant Plant Manager.	CEPC Top Management EEHC Environmental Management & Studies Sector.	Management contract in place.  Functional transfer station.	3-monthly reports from management to EEHC.  Annual reporting of summary results (or more if requested) and submitted to the EEHC and any other concerned authority (e.g. EEAA, WB, etc.), if required.	CEPC/GNPP to ensure all employees are given basic induction training on good operation and site management practices.	Management time and costs (<US\$ 10K per annum) (included in operation cost)

Table 7 (Contd.)

**Operational Impact Mitigation, Monitoring and Management**

Issue/Impact	Mitigation Measures	Implementation Schedule	Monitoring	Responsibility		Monitoring Indicators	Type and Frequency of Reporting/monitoring	Management and Training	Indicative Cost Estimate (US\$)
				Implementation	Supervision				
<b>Occupational Health and Safety, Risks and Hazards</b>	<p>Standard international practice on EHS issues shall be employed on site. The mitigation measures summarized in construction management Table apply.</p> <p>In addition, the following measures will be undertaken:</p> <ol style="list-style-type: none"> <li>(1) Provision of training in use of protection equipment and chemical handling.</li> <li>(2) Use of protective equipment.</li> <li>(3) Clear marking of work site hazards and training in recognition of hazard symbols.</li> <li>(4) Installation of vapour detection equipment and control systems.</li> <li>(5) Development of site emergency response plans.</li> </ol>	Lifetime of the plant	<p>Regular on-site training.</p> <p>Regular staff checks, system checks and field tests of emergency procedures by on-site management.</p>	CEPC/GNPP/EMS Assistant Plant Manager	<p>CEPC Top Management</p> <p>EEHC Environmental Management &amp; Studies Sector.</p>	<p>Management procedures in place.</p> <p>Workers health and safety measured by incidents, injuries and illnesses.</p>	<p>Monthly reports from management to EEHC</p> <p>Annual reporting of summary results (or more if requested) and submitted to the EEHC and any other concerned authority (e.g. EEAA, WB, etc.), if required.</p>	<p>CEPC/GNPP/EMS to ensure that all employees are given basic induction training on H&amp;S policies and procedures, Emergency Preparedness and Response Plan and a Spills Response Plan. The Assistant Plant Manager is to ensure implementation of procedures.</p> <p>CEPC/GNPP/EMS is responsible for ensuring that the site emergency response plan is complete and implemented prior to commissioning any part of the power plant.</p>	Management time and costs (< US\$ 15K per annum) (included in operation cost)

Table 7 (Contd.)

**Operational Impact Mitigation, Monitoring and Management**

Issue/Impact	Mitigation Measures	Implementation Schedule	Monitoring	Responsibility		Monitoring Indicators	Type and Frequency of Reporting/monitoring	Management and Training	Indicative Cost Estimate (US\$)
				Implementation	Supervision				
<b>Socio-Economic Environment</b> Positive impacts identified	Fish Catch: based upon experience with similar plants elsewhere along the Nile River and its branches and the opinions of the fishermen, impacts are very likely to be positive.	First year of operation.  (possibly 2 other years)	In collaboration with the Fishery Authorities, monitor any changes to the fish catch	CEPC/GNPP/EMS  Assistant Plant Manager	CEPC Top Management  EEHC Environmental Management & Studies Sector.	Fish catch no. & quality	Monthly reports from management to EEHC		Included in operation costs.

**Table 8**  
**Transmission System Impact Mitigation, Monitoring and Management**

Issue/Impact	Mitigation Measures	Implementation Schedule	Monitoring	Responsibility		Monitoring Indicators	Type and Frequency of Reporting/monitoring	Management and Training	Indicative Cost Estimate (US\$)
				Implementation	Supervision				
<b>Direct</b>  Vegetation damage, habitat loss, and invasion by exotic species along the ROW and access roads and around substation sites.  Habitat fragmentation or disturbance.  Increased access to sensitive lands.	<ul style="list-style-type: none"> <li>Utilize appropriate clearing techniques, (e.g., hand clearing versus mechanized clearing).</li> <li>Maintain native ground cover beneath lines.</li> <li>Replant disturbed sites.</li> <li>Manage ROWs to maximize wildlife benefits.</li> </ul> <ul style="list-style-type: none"> <li>Select ROW to avoid important natural areas such as sensitive habitats.</li> <li>Maintain habitat (i.e., native vegetation) beneath lines.</li> <li>Make provisions to avoid interfering with natural fire regimes.</li> </ul> <ul style="list-style-type: none"> <li>Select ROW to avoid sensitive lands.</li> <li>Develop protection and management plans for these areas.</li> <li>Use discontinuous maintenance roads.</li> </ul>	During Construction and Operation	Visual inspections of the materials being used, the construction practices and mitigation measures.  Short-term monitoring to assure that negative land use and/or ecological impacts are avoided and proper mitigation measures are employed.  Occurs along the line as it is constructed.  Monitoring of ROW maintenance activities to assure proper control methods.	Egyptian Electricity Transmission Company (EETC)  CEPC / PMU / EMS	EEHC management  EETC management  CEPC Project Manager in collaboration with the Consultant Site Manager.	Effects on environmental and human resources involved (negative land uses, ecological damage)  Degree to which they are affected.	Weekly (during construction).  Maintenance time (during operation)	Environmental training and management will be warranted for ROW maintenance techniques, including the proper use of chemical and mechanical clearing methods.  Training will be conducted by EETC and CEPC/PMU with assistance from environmental consultant.  Staff workers should have an understanding of the rationale for the recommended mitigation and monitoring that they may be implementing.	Included in construction and operation cost.

Table 8 (Contd.)

**Transmission System Impact Mitigation, Monitoring and Management**

Issue/Impact	Mitigation Measures	Implementation Schedule	Monitoring	Responsibility		Monitoring Indicators	Type and Frequency of Reporting/monitoring	Management and Training	Indicative Cost Estimate (US\$)
				Implementation	Supervision				
Runoff and sedimentation from grading for access roads, tower pads, and substation facilities, and alteration of hydrological patterns due to maintenance roads.	<ul style="list-style-type: none"> <li>Select ROW to avoid impacts to water bodies, floodplains, and wetlands.</li> <li>Install sediment traps or screens to control runoff and sedimentation.</li> <li>Minimize use of fill dirt.</li> <li>Use ample culverts.</li> <li>Design drainage ditches to avoid affecting nearby lands.</li> </ul>	During Construction and Operation	Visual inspections of the materials being used, the construction practices and mitigation measures.	Egyptian Electricity Transmission Company (EETC)  CEPC / PMU / EMS	EEHC management  EETC management  CEPC Project Manager in collaboration with the Consultant Site Manager.	Effects on environmental and human resources involved (negative land uses, ecological damage)  Degree to which they are affected.	Weekly (during construction).  Maintenance time (during operation)	Environmental training and management will be warranted for ROW maintenance techniques, including the proper use of chemical and mechanical clearing methods.  Training will be conducted by EETC and CEPC/PMU with assistance from environmental consultant.  Staff workers should have an understanding of the rationale for the recommended mitigation and monitoring that they may be implementing.	Included in construction and operation cost.
Loss of land use and population relocation due to placement of towers and substations.	<ul style="list-style-type: none"> <li>Select ROW to avoid important social, agricultural, and cultural resources.</li> <li>Utilize alternative tower designs to reduce ROW width requirements and minimize land use impacts.</li> <li>Adjust the length of the span to avoid site-specific tower pad impacts.</li> <li>Manage resettlement in accordance with World Bank &amp; AfDB procedures.</li> </ul>		Short-term monitoring to assure that negative land use and/or ecological impacts are avoided and proper mitigation measures are employed.						
Chemical contamination from chemical maintenance techniques.	<ul style="list-style-type: none"> <li>Utilize mechanical clearing techniques, grazing and/or selective chemical applications.</li> <li>Select herbicides with minimal undesired effects.</li> <li>Do not apply herbicides with broadcast aerial spraying.</li> <li>Maintain naturally low-growing vegetation along ROW.</li> </ul>		Occurs along the line as it is constructed.  Monitoring of ROW maintenance activities to assure proper control methods.						

Table 8 (Contd.)

*Transmission System Impact Mitigation, Monitoring and Management*

Issue/Impact	Mitigation Measures	Implementation Schedule	Monitoring	Responsibility		Monitoring Indicators	Type and Frequency of Reporting/monitoring	Management and Training	Indicative Cost Estimate (US\$)
				Implementation	Supervision				
Avian hazards from transmission lines and towers.	<ul style="list-style-type: none"> <li>Select ROW to avoid important bird habitats and flight routes.</li> <li>Install towers and lines to minimize risk for avian hazards.</li> <li>Install deflectors on lines in areas with potential for bird collisions.</li> </ul>	During Construction and Operation	Visual inspections of the materials being used, the construction practices and mitigation measures.	Egyptian Electricity Transmission Company (EETC)  CEPC / PMU / EMS	EEHC management  EETC management  CEPC Project Manager in collaboration with the Consultant Site Manager.	Effects on environmental and human resources involved (negative land uses, ecological damage)	Weekly (during construction).  Maintenance time (during operation)	Environmental training and management will be warranted for ROW maintenance techniques, including the proper use of chemical and mechanical clearing methods.  Training will be conducted by EETC and CEPC/PMU with assistance from environmental consultant.  Staff workers should have an understanding of the rationale for the recommended mitigation and monitoring that they may be implementing.	Included in construction and operation cost.
Aircraft hazards from transmission lines and towers.	<ul style="list-style-type: none"> <li>Select ROW to avoid airport flight paths.</li> <li>Install markers to minimize risk of low-flying aircraft.</li> </ul>		Short-term monitoring to assure that negative land use and/or ecological impacts are avoided and proper mitigation measures are employed.			Degree to which they are affected.			
Induced effects from electromagnetic fields.	<ul style="list-style-type: none"> <li>Select ROW to avoid areas of human activity.</li> </ul>		Occurs along the line as it is constructed.						
Impaired cultural or aesthetic resources because of visual impacts.	<ul style="list-style-type: none"> <li>Select ROW to avoid sensitive areas, including tourist sites and vistas.</li> <li>Construct visual buffers.</li> <li>Select appropriate support structure design, materials, and finishes.</li> <li>Use lower voltage, DC system, or underground cable to reduce or eliminate visual impacts of lines, structures, and ROWs.</li> </ul>		Monitoring of ROW maintenance activities to assure proper control methods.						

Table 8 (Contd.)

*Transmission System Impact Mitigation, Monitoring and Management*

Issue/Impact	Mitigation Measures	Implementation Schedule	Monitoring	Responsibility		Monitoring Indicators	Type and Frequency of Reporting/monitoring	Management and Training	Indicative Cost Estimate (US\$)
				Implementation	Supervision				
<b>Indirect</b>  Induced secondary development during construction in the surrounding area.  Increased access to sensitive lands.	<ul style="list-style-type: none"> <li>Provide comprehensive plans for handling induced development.</li> <li>Construct facilities to reduce demand.</li> <li>Provide technical assistance in land use planning and control to local governments.</li> </ul> <ul style="list-style-type: none"> <li>Route ROW away from sensitive lands.</li> <li>Provide access control.</li> </ul>	During Construction and Operation	Visual inspections of the materials being used, the construction practices and mitigation measures.  Short-term monitoring to assure that negative land use and/or ecological impacts are avoided and proper mitigation measures are employed.  Occurs along the line as it is constructed.  Monitoring of ROW maintenance activities to assure proper control methods.	Egyptian Electricity Transmission Company (EETC)  CEPC / PMU / EMS	EEHC management  EETC management  CEPC Project Manager in collaboration with the Consultant Site Manager.	Effects on environmental and human resources involved (negative land uses, ecological damage)  Degree to which they are affected.	Weekly (during construction).  Maintenance time (during operation)	Environmental training and management will be warranted for ROW maintenance techniques, including the proper use of chemical and mechanical clearing methods.  Training will be conducted by EETC and CEPC/PMU with assistance from environmental consultant.  Staff workers should have an understanding of the rationale for the recommended mitigation and monitoring that they may be implementing.	Included in construction and operation cost.

**Table 9 (A)**  
**Gas Pipeline System Impact Mitigation**

Impact	Mitigation Measures	Project Phase	Responsibility		Means of Supervision	Estimated Cost
			Implementation	Supervision		
1. During Construction						
Reduction Traffic Flow	- Construction during off peak periods	Preconstruction and Construction	Traffic department to grant conditional license and Contractor to implement	Town Gas HSE + Traffic Department	Ensure contractor has valid conditional permit+ Filed supervision	- Contractor management costs that shall be included in normal bid price. - Town Gas management costs
	- Signage and marking	Tender and Construction	Contractor	Town Gas HSE + Traffic Department	Ensure inclusion in tender+ Filed supervision	- Contractor management costs that shall be included in normal bid price. - Town Gas management costs
	- Traffic detour	Preconstruction and Construction	Traffic Department	Traffic Department	Ensure detouring efficiency	- Cost by Traffic Department
	- Road restricting	Construction	Traffic Department	Traffic Department	Ensure adequate traffic flow	- Cost by Traffic Department
Air Emission	- Sound storage, transportation and disposal of stockpiles	Construction	Contractor	Town Gas HSE supervisor	Field supervision	- Contractor management costs that shall be included in normal bid price. - Town Gas management costs
	- Ensure that air emissions of construction machinery within legal standards	Tender and preconstruction	Contractor	Town Gas HSE	Review vehicle exhaust certificate	- Contractor management costs that shall be included in normal bid price. - Town Gas management costs
Noise	- Protect construction workers on site	Tender and Construction	Contractor	Town Gas HSE	Ensure inclusion in tender+ Field supervision	- Contractor management costs that shall be included in normal bid price. - Town Gas management costs
	- Avoid night noisy works whenever possible	Construction	Contractor	Town Gas HSE	Field supervision	- Contractor management costs that shall be included in normal bid price. - Town Gas management costs
Risk of Damaging Infrastructure	- Collect infrastructure maps and site tracing	Construction	Town Gas HSE Department and Governorate Information Center	Town Gas HSE Manger	Review HSE site report	- Town Gas management costs
	- Use trial pits	Tender and Construction	Contractor	Town Gas HSE Supervisor	Ensure inclusion in tender+ Field supervision	- Contractor management costs that shall be included in normal bid price.
	- Prepare and Analyze accident reports	Construction	Town Gas HSE Research	Town Gas HSE Manger	Review periodic HSE reports	- Town Gas management costs

Table 9 (A) "Contd."

*Gas Pipeline System Impact Mitigation*

Impact	Mitigation Measures	Project Phase	Responsibility		Means of Supervision	Estimated Cost
			Implementation	Supervision		
<i>Effect on Structures by Dewatering Activities</i>	- Screening of areas / Sectors	Design	Town Gas Technical Committee	Town Gas Design Manager + HSE Manager	Review committee's reports	- Town gas management costs
	- Tight dewatering schedule	Construction	Contractor	Town Gas HSE Supervision	Field supervision	- Contractor responsibility: Included in normal contractor bid. - Town gas management costs
<i>Effects on Monuments</i>	- Locate problematic areas of the network	Design	Supreme Council for Antiquities through permitting procedure of Local Council	Town Gas HSE Manager	Review permitting procedures and ensure review of Council	- Cost by supreme council for antiquities
	- Supervise construction	Construction	Expert from Supreme Council of Antiquities	Town Gas HSE Manager + HSE supervision	Review field reports+ site supervision	- L.E. 3,000 / site for supervision and measurement of vibration.
	- Control dewatering process	Construction	Contractor	Supreme Council Expert + Town Gas HSE supervision	Field supervision	- Town gas management costs - L.E. 15,000 / site above normal contractor bid price.
	- Reduce vibrations	Tender + Construction	Contractor	Supreme Council Expert + HSE supervision	Ensure inclusion in tender + Field supervision	- Town gas management costs - L.E. 10,000 / site above normal contractor bid price.
	- Preserve architecturally valuable sites	Construction	Contractor	Town Gas HSE supervisor	Field supervision	- Town gas management costs - Normal contractor bid price
	- Preserve any found antiquity	Construction	Town Gas HSE supervisor	Town Gas HSE manager	Review field reports	- Town gas management costs - Normal contractor bid price

Table 9 (A) "Contd."

*Gas Pipeline System Impact Mitigation*

Impact	Mitigation Measures	Project Phase	Responsibility		Means of Supervision	Estimated Cost
			Implementation	Supervision		
<i>Waste Disposal</i>	<ul style="list-style-type: none"> <li>- Control over construction waste</li> <li>- Prevent fueling, lubricating and any activity that would entail production of hazardous materials empty contains</li> <li>- Transfer empty hazardous waste containers, if generated under unusual circumstances, to Governorate's landfill</li> <li>- Adequate management of asbestos and any possible hazardous waste</li> <li>- Arrange effective drainage during dewatering</li> <li>- Transfer any contaminated water resulting from dewatering to an adequate facility such as Governorate's Landfill</li> </ul>	Construction	Contractor	Town Gas HSE supervisor	Field supervision	- Contractor responsibility: Included in normal contractor bid
		Construction	Contractor	Town Gas HSE supervisor	Field supervision	- Contractor responsibility: Included in normal contractor bid
		Construction	Construction	Town Gas HSE supervisor	Field supervision and review manifest documents	- About L.E. 1,300 / yr above normal contractors bid <sup>(1)</sup>
		Construction	Water Authority	Town Gas HSE supervisor + HSE Manager	Field supervision + review of Water authority manifests	- Costs by Water Authority - Town gas management costs
		Construction	Construction	Town Gas HSE supervisor	Field supervision	- Contractor responsibility: Included in normal contractor bid
		Construction	Construction	Town Gas HSE supervisor	Field supervision	- About L.E. 1,000/yr above normal contractors bid <sup>(2)</sup>

**Notes:**

- (1) This figure has been derived assuming 2 loads of contains are generated each load is 0.5 ton which costs L.E. 650 including shipment and landfill fee. (landfill fee is L.E. 300/ton and rent of peak-up vehicle is about L.E. 500/trip)
- (2) This figure has been derived assuming 1 load of contaminated water barrels is transferred each year weighing 1 ton at a cost of L.E. 1,000 including transportation and landfill fee in addition to supervision and administrative costs.

Table 9 (A) "Contd."

## Gas Pipeline System Impact Mitigation

Impact	Mitigation Measures	Project Phase	Responsibility		Means of Supervision	Estimated Cost
			Implementation	Supervision		
2. During Operation						
Improper management of odorant during operation	- Evacuating of odorant in holding tank and send empty contains to Governorate's hazardous waste facility on the same day	Operation	Pressure Reducing Station (PRS) staff	Town Gas HSE staff	Quarterly auditing for each PRS	- L.E. 16,300/yr for transportation and disposal of waste
Noise of PRS operation	- Locate noisy pressure reducers away from PRS borders in residential areas - Build barrier walls between reducers and sensitive receptors when needed.	Design	Town Gas Design Department	Town Gas HSE Manager	Review of PRS layout	- Town Gas management costs
		Design and construction	Contractor	Town Gas HSE Manager	Field supervision of PRS construction	- Contractor costs which shall be included in normal bid price
Potential safety risks due to PRS Operation	- Remote actuation of isolation and slam-shut valves by Town Gas for different PRS's as well as the transmission pipelines. - Produce hazardous area classification drawings for all pressure reduction station - Preventive maintenance policy and station manual - Proper design of control room exit	Design	Designer	Project Department	Document Review	- Design Phase
		Design	Designer	Eng. / Elect. Department	Document Review	- Design Phase
		Design	Town Gas	Engineering Department		- Preventive maintenance program and operating manual
		Design	Designer	Projects Department	Document Review	

Table 9 (A) "Contd."

*Gas Pipeline System Impact Mitigation*

Impact	Mitigation Measures	Project Phase	Responsibility		Means of Supervision	Estimated Cost
			Implementation	Supervision		
	<ul style="list-style-type: none"> <li>- Provision of self contained breathing apparatus (2 pieces for each station) for handling odorant leaks</li> <li>- Apply jet fire rated passive fire protection system to all critical safety shutdown valves ESDVs or solenoid valves (as applicable)</li> <li>- Place marking signs indicating in Arabic and in English "Do Not Dig" and "High Pressure Pipeline Underneath"</li> <li>- Install an elevated wind sock and provision of portable gas detectors</li> <li>- The design should fully comply with IGE TD/3 code requirements</li> </ul>	Operation	Town Gas	HSE Department	By Operators	- \$ 4000 each
		Design	Designer	Projects Department	Document Review	
		Operation	Town Gas & GASCO	Engineering Department	Document Review	
		Operation	Town Gas	HSE Department		- \$ 3000 each
		Designer	Designer	Projects Department		- Town Gas management costs
<i>Social Impacts</i>	- Raising the level of awareness of the people in PRS areas.	Construction	NGOs in the districts	EGAS	Supervise awareness undertaken by NGO	- About L.E. 5,000/PRS area

Table 9 (B)

**Gas Pipeline System Monitoring Matrix**

Impact	Monitoring Indicators	Responsibility	Duration	Location	Methods	Estimated Cost
<b>1. During Construction</b>						
<i>Reduction Traffic Flow</i>	- Comments and notifications from traffic department	Town Gas HSE department	During construction reporting in monthly reports	Construction site	Documentation in HSE monthly reports	- Town Gas management costs
<i>Air Emission</i>	- HC, CO% and opacity	Contractor	Once before construction + once quarterly for each vehicle	Vehicles licensing department	Measuring exhaust emissions in an authorized institution	- L>e> 200/ Vehicles
<i>Noise</i>	- Noise intensity, exposure durations and noise impacts  - Complaints from residents	Town Gas HSE department	Once quarterly during construction, with at least one measurement per contractor per sector During construction reporting in monthly reports	Construction site	Noise meter	- Town Gas management costs
		Town Gas HSE supervisor		Construction site	Documentation in HSE monthly reports	- Town Gas management costs
<i>Risk of Damaging Infrastructure</i>	- Accidents Documentation	Town Gas HSE department	During construction reporting in monthly reports	Construction site	Documentation in HSE monthly reports	- Town Gas management costs
<i>Effect on Structures by Dewatering Activities</i>	- Duration of dewatering and lowered water level	Town Gas HSE department	During dewatering activities. Reported in monthly reports	Construction site	Documentation in HSE monthly reports	- Town Gas management costs
<i>Effects on Monuments</i>	- Vibration	Supreme council for antiquities	During construction near sites identified by the council	Construction site	Vibration test	- Including in supreme council expert's input
	- Buried antiquities	Supreme council for antiquities	Once before construction if required by the council	Streets identified by the council	Geophysical survey	- L.E. 3000/km of street
	- Documentation	Town Gas HSE supervisor	During construction. Reporting in monthly reports	Construction site	Documentation in HSE monthly reports	- Town Gas management costs
<i>Waste Management</i>	- Accumulated waste	Town Gas HSE supervisor	During construction. Reporting in monthly reports	Construction site	Observation and documentation	- Town Gas management costs
	- Existence of hazardous waste in waste piles or at site	Town Gas HSE supervisor	During construction. Reporting in monthly reports	Construction site	Observation and documentation	- Town Gas management costs
	- Existence of water ponds from dewatering	Town Gas HSE supervisor	During construction. Reporting in monthly reports	Construction site	Observation and documentation	- Town Gas management costs

Table 9 (B) "Contd."

*Gas Pipeline System Monitoring Matrix*

Impact	Monitoring Indicators	Responsibility	Duration	Location	Methods	Estimated Cost
<b>2. During Operation</b>						
<i>Improper management of odorant during operation</i>	- Number of treated containers	Town Gas HSE department	Quarterly for each PRS	PRSs	Reviewing environmental Register, compare with odorant delivery forms, observation of site	- Town Gas management costs
<i>Noise of PRS operation</i>	- Noise intensity	Town Gas HSE department	Quarterly for each PRS	PRSs	Noise meter	- Town Gas management costs

Table 10

**Summary of Implementation Cost of the ESMP**

No.	Phase of Implementation	Cost in US\$		Source of Funding
		Measures	Monitoring	
1	Construction Phase <ul style="list-style-type: none"><li>Pre-commissioning Monitoring (ambient air quality monitoring equipment)</li><li>All others</li><li>Training</li></ul>	120 K	1325 K	CEPC CEPC (with possible support from the Arab Funds)
			138 K	CEPC
		155 K		CEPC
2	Operation Phase <ul style="list-style-type: none"><li>Training</li></ul>	70	20	CEPC
		20 K		CEPC
Sub. Total		190 K	1658 K	
Grand Total		1848 K		

**Notes:**

(\*) Excluding gas pipeline system cost.

151. Table 10 shows that the total implementation cost of the environmental and Social Management Plan is about US\$ 1.848 million, which amounts to about 0.15% of the total project cost.

**7.2****MONITORING PROGRAM****Stack Emissions**

152. Stack emissions will be monitored continuously during plant operation at a representative point in the stack. Operational monitoring of stack emissions shall comprise monitoring the levels of: Oxides of Nitrogen; Sulfur Dioxide; Carbon Monoxide; and Total Suspended Particles and PM<sub>10</sub>.

153. The automatic monitoring system used will be linked in the controlling room to an alarm system to warn when emission limits (as stated in Section 2) for each pollutant are being approached.

154. Concentrations will be recorded as hourly rolling averages and reports on stack emissions monitoring will compare recorded emissions against predicted levels and Egyptian and WB guidelines (as given in Section 2). Reports will be submitted to the EEAA, the WB and any other concerned authority on an annual basis (or as required).

**Ambient Air Quality - Validation of Modeling Predictions Using Continuous NO<sub>x</sub>, SO<sub>2</sub> and TSP Analyzer**

155. The use of a continuous NO<sub>x</sub>, SO<sub>2</sub>, CO and TSP analyzer allows for baseline air quality monitoring on a continuous basis. The provision of two continuous monitors (or three: one at the site, one upwind and the third

downwind) will provide the basis for “validating” the predictions made in the ESIA. The monitors will also include a weather station providing data on air temperature, wind speed, wind direction and mixing heights on a continuous basis. These monitors shall, also, be connected electronically, if possible, to the EEAA ambient monitoring system.

156. The construction and operational monitoring of air quality around the Giza North power project will include the parameters summarized in *Table 11*. Also, Figure 11 (see page 54 of this E.S-Report) depicts the maximum impact locations derived in Section 6.2 presented by the conventional x-y coordinates.

### ***Aquatic Environment***

157. Monitoring of impacts of the power plant on the aquatic environment will include monitoring of the quality of the discharge water, El-Rayyah El-Beheiry bankline and benthic sediments, ambient water quality and the impact on aquatic flora and fauna. The survey techniques and areas will be comparable to the survey undertaken by both of the Hydraulics Research Institute and the National Research Center during September-October 2009. The survey will include the area affected by the thermal plume (i.e. 75-150 m from the discharge point).

Table 11

**Monitoring Program for Ambient Air Quality, Noise and Vibration**

Item	Monitoring Parameters	Sampling Frequency	Monitoring Locations	Indicative Cost Estimate (US\$)
<b>Construction Phase</b>				
<b>Air Quality</b> Dust emissions caused by construction activities, construction vehicle movements, and transport of friable construction materials.	NO <sub>2</sub> , SO <sub>2</sub> , CO, TSP and PM <sub>10</sub> .	Quarterly during most of the construction period.  Continuous monitoring during 6 months ahead of commissioning.	On site of the project and its surroundings.  2 locations minimum: at maximum predicted pollution concentration of 24-hours & annual averages. Third location, if any, will be 1 km upwind.	Measurement cost: US\$70K  Approx. US\$ 1000-1500K
<b>Noise</b>	Decibels (dB) A	Quarterly	6 locations minimum: at nearest residences	Third party noise measurement costs (~US\$ 23k)
<b>Operation Phase</b>				
<b>Air Quality</b> Emissions from stack are not expected to exceed standards.  Ambient air quality affected by emissions from the power plant.	<b>Automatic monitoring</b> of stack emissions for NO <sub>x</sub> , SO <sub>2</sub> , particulate matter and carbon monoxide (CO) via test ports installed in the main stack.  In addition, conduct surrogate <b>performance monitoring</b> .  <b>Install (at least) two continuous NO<sub>x</sub>, SO<sub>2</sub>, CO, PM<sub>10</sub> &amp; TSP monitoring stations</b> to monitor short-term concentrations in the area predicted to have the highest impacts on humans (as there are sensitive environments). The analyzer station near or within the site boundaries will include a <b>continuous monitor</b> of meteorological conditions (temperature, wind speed, wind direction and mixing heights).	Continuous and/or 24 hour average Continuous and/or passive samples every 2/4 weeks  The analyzer stations will be electronically connected to the plant controlling room and CEPC Chairman's office.	2 locations minimum: at maximum predicted pollution concentration of 24-hours & annual averages. Third location, if any, will be 1 km upwind.	Included in the plant operation
<b>Noise</b>		Bi-annually to annually	6-10 sites at nearest receptors and fence around the plant	Noise audit US\$ 10-20K (included in operation cost)  Third party (e.g. NRC) Measuring instruments and equipment.

158. The operational monitoring of cooling water and effluent discharge will

include the parameters summarized in *Table 12* below.

**Table 12**  
***Monitoring of the Aquatic Environment During Operation***

Issue	Parameter	Method	Frequency of measurements
Water Quality	Temperature & pH of all discharged water	Continuous automatic monitor in discharge structure	Continuous
	COD, TSS, Oil & Grease, residual chlorine of effluent	Sample taken from water in discharge structure and submitted for lab. Analysis	Daily
	Heavy metals & other pollutants of effluent	As above	Monthly
Ambient Water Quality	Temperature, pH, COD, BOD, TOC, DO, TSS, oil & grease, residual chlorine, heavy metals & other pollutants	Grab sampling and analysis within the area predicted to be affected by the discharge plume	3-monthly
Flora & Fauna <sup>(1)</sup>	Benthic flora & fauna	Transect sampling (following same method as in baseline monitoring) within a 2 km radius of the discharge point	Annual
Entrainment <sup>(2)</sup>	Fish entrainment on screens	Removal and analysis of any debris caught in intake screens	Weekly

**Notes:**

(5) To be undertaken for the first 3 years of plant operation.

(6) To be undertaken for the first year of plant operation.

**Abbreviations:**

COD: Chemical Oxygen Demand

BOD: Biological Oxygen Demand

TOC: Total Organic Carbon

DO: Dissolved Oxygen

TSS: Total Suspended Solids

159. Monitoring data will be analyzed and reviewed at regular intervals and compared with Egyptian and World Bank guidelines (as given in Section 2). Records of monitoring results will be kept in a suitable format and will be reported (in summary format with any exceptions identified) to the responsible government authorities, the WB or any other concerned authority as required. As a result, the project company, in discussion with the EEAA, EEHC, the WB or any other concerned authority, will review the need to implement any additional mitigation features, such as provision of further water treatment facilities on site and also on the need to continue monitoring.

### ***Waste Monitoring***

160. Wastes generated on site and collected for disposal by skilled firms will be referenced, weighed and recorded. Environmental audits will be undertaken which will assess the quality and suitability of on- and off-site waste management procedures.

## 8. PUBLIC CONSULTATION AND DISCLOSURE

161. In order to ensure that the views and interests of all project stakeholders are taken into accounts, public consultation has been carried out according to the EEAA guidelines which require coordination with other government agencies involved in the EIA, obtaining views of local people and affected groups. This consultation has been undertaken as part of the Environmental Impact Assessment process.

162. The objectives of consultation and disclosure are to ensure that all stakeholders and interested parties, are fully informed of the proposed project, have the opportunity to voice their concerns and that any issues resulting from this process are addressed in the EIA and incorporated into the design and implementation of the project.

163. The adopted methodology for the public consultation comprises two phases, including four elements, namely:

### Phase I

- discussions with local stakeholders and interested parties during preparation of the environmental documents for local permitting requirements;
- discussions with local stakeholders during scoping and preparation of this ESIA-Report, including the organization of a Public Scoping Meeting on 21 October 2009, in the 6<sup>th</sup> of October Governorate;

164. As far as public disclosure is concerned, major activities to inform the public and interested parties about the Giza North project include the following:

- press advertisement in Al-Ahram Newspaper (on 7 October 2009) describing the project and inviting interested parties to attend the scoping meeting.
- distribution of an invitation and a copy of summary leaflet about the main concerns of ESIA study (in Arabic).

### Phase II

- the organization of a Public Consultation Meeting on 11 January 2010, in the 6<sup>th</sup> of October Governorate, and
- on-going consultation through an “open-door” policy during construction and operation of the power plant.

165. Again, as far as public disclosure is concerned, major initiatives to inform the public and interested parties about the Giza North Power project include the following:

- press advertisement in Al-Ahram Newspaper (on 30 December 2009) describing the project and inviting interested parties to attend the public meeting and review the Draft Final ESIA Report;

- distribution of an invitation and copy of the Non Technical Summary (in Arabic) describing the context of the power plant, the technology employed, the impact on the environment, the mitigation measures and the ESMP; and
- disclosure of the Draft Final ESIA Report, including the Executive Summary, locally and via the World Bank Infoshop.

166. A Public Consultation and Disclosure Activities (PCDA) are designed and implemented in accordance with World Bank guidelines. The purpose of the Activities is to establish the process by which CEPC/GNPP will consult and involve stakeholders in the planning, development, construction and operation of the power plant.

## 8.1 PHASE 1 CONSULTATION

### ***Consultation Undertaken by ECG, EEHC and CEPC***

167. During the preparation of an ESIA-Report for local permitting requirements, ECG, EEHC and CEPC undertook consultations with a variety of organizations to assist them in the identification of environmental and social concerns and the overall development of the project. These stakeholders included the Egyptian Electricity Holding Company (EEHC), Cairo Electricity Production Company (CEPC), Egyptian Environmental Affairs Agency (EEAA), the 6<sup>th</sup> of October Governorate and the District Council of the 6<sup>th</sup> of October, including Imbaba & Menshat El-Qanater zone, Egyptian General Authority for Shore Protection, Hydraulics Research Institute and local population leaders.

168. The purpose of these consultations was primarily to provide information regarding the project, identify published and non-published sources of relevant data and information relating to the site and surrounding area, obtain views on the scope of the project, and open channels for ongoing discussions.

169. The key environmental and social issues raised during this consultation process are summarized in *Table 13* and these issues were subsequently taken into account in the preparation of ESIA documentation both for local permitting requirements and this ESIA report.

### ***Consultation during the ESIA Process***

170. A scoping session for this ESIA undertaken by ECG in collaboration with the EEHC and CEPC, took place on Wednesday, 21 October 2009 during which a wide selection of personnel from different orientations contributed actively to its activities.

171. The key objectives of this consultation were to identify primary and

secondary stakeholders, ensure that they had received sufficient information about the project during earlier consultation activities and to identify their immediate concerns.

172. The session was organized to include the following activities:

- Presentation of the ESIA scope as per the TOR, including the RPF;
- Breakdown of the activities to highlight the issues that the attendees might comment on;
- Explain the environmental issues and invite the participants to raise their concerns about possible negative impacts; and
- Conduct the discussions and invite the owner, local authorities and agencies to participate in the discussions.

The full documentation for the scoping meeting is presented in Annex B. The issues raised during the scoping session are summarized in *Table 13* below.

#### ***Mini-meetings with Affected Stakeholders***

173. In addition to the scoping meeting, several mini-meetings were held with some particular affected stakeholders for taking their viewpoints into consideration.

174. The purpose of taking these viewpoints into account was to improve project viability. The World Bank (1991) has found that where such views are seriously considered and incorporated in the EA process, projects are likely to be more successful. The Bank provides some useful guidance regarding the extent and level of stakeholder involvement in the EA process in its Sourcebooks (World Bank, 1991-Chapter 7).

175. Mini-meetings were held with fishermen along the El-Rayyah El-Beheiry at about 5 km to the north west of the proposed site, the El-Kata area representatives, Imbaba and Menshat El-Qanater District Administration, General Authority for Fishery Development and two active NGOs in the 6<sup>th</sup> of October zone, "October for Environment & Development", 6 of October City, and "Youth and Environment Friends", Siqil, Ossim.

176. These mini-meetings were seen important for:

- informing interested groups and individuals about the proposed development, its potential impacts, and measures which will lessen impacts and protect the environment;
- providing opportunities for timely feedback;
- identifying problems, needs and values;
- minimizing misunderstandings about the scope and impacts of the project and increase public confidence in the proposed development; and

- contributing to an increased awareness and understanding of project plans and activities.

Memorandums of Mini-meetings that were held with some affected groups are given in Annex C.

### ***Conclusions from Phase 1 Consultations***

177. The main results of Phase I consultation was to successfully raise the level of local awareness about the plant, to identify the immediate local concerns and to seek stakeholder involvement in the implementation of the project.

178. The three issues of key concern to the stakeholders consulted were the impact of the plant on pollutant loads in the El-Kata zone air shed, compliance with environmental standards, particularly with regard to air and wastewater discharge quality and the potential economic impacts on the local community. These concerns have been addressed within the ESIA process and measures to ensure compliance are incorporated into the Environmental and Social Management Plan (ESMP). The ESMP will be implemented by CEPC/GNPP as a condition of compliance with the EEAA regulations and of financing from the World Bank.

## **8.2 PHASE II CONSULTATION AND DISCLOSURE**

179. Phase II of the public consultation and disclosure process included the disclosure of information about the project (advertisement, invitation including a copy of the Non-Technical Summary (in Arabic) and public access to the Draft Final ESIA Report) and organization of a public meeting.

180. The Draft Final ESIA report, together with the Non-Technical Summary in Arabic, have been disclosed locally for 30 days at the offices of the CEPC at the Giza North power plant, EEHC offices and at the offices of the local environmental consultant in Cairo.

181. In order to make people aware of the disclosure of the Draft Final ESIA Report, an advertisement was placed in the national newspaper Al Ahram in Arabic on the Wednesday, 30 December 2009. The advertisement also drew readers attention to the date and venue of the proposed public meeting.

182. Finally, a public meeting was held in the 6<sup>th</sup> of October Governorate on Monday, 11 January 2010. The aim of the meeting was to present and explain the results of the Draft Final ESIA Report to local stakeholders, to provide them with the opportunity to raise any further or additional concerns that will be and to ensure that all issues are taken into account in the Final ESIA Report and corresponding ESMP. Further concerns that were raised during Public Consultation Meeting are summarized in Table 13 below.

Phase II Consultation and Disclosure activities and Public Consultation Meeting Report are reported in Annex D.

### ***Ongoing Consultation and Disclosure***

183. Giza North Power Plant's (GNPP's) Assistant Plant Manager, who is responsible for the Environment, Safety and Quality Assurance program for the plant, will have full responsibility for implementing and supervising the ESMP. This role includes ongoing communication with local industrial and commercial interests, local authorities and other interested parties. An "open door" policy will be adopted to allow stakeholders to voice ongoing concerns.

184. The process and results of the public consultation activities held to date are documented in the EISA, Chapter 9 and Annexes A, B, C and D.

185. All issues have been taken into account and addressed in the ESIA and RPF through assessment and the inclusion of mitigation, management and monitoring requirements which are detailed within the ESMP.

## **9. RESPONSIBILITIES AND INSTITUTIONAL ARRANGEMENTS**

### **9.1 Environmental Management Organization**

#### ***During Design and Construction***

186. Suitably qualified and experienced contractors will be responsible for the detailed design and construction of the power plant. Construction workers will be required to demonstrate appropriate skills, qualifications and/or experience prior to employment.

187. During construction, Project Management Unit / Environmental Management Staff (PMU/EMS) and the Assistant Plant Manager in collaboration with PGESCO Site Manager will ensure that all contracts with Contractors and sub-contractors stipulate all construction management measures (as given in this ESMP), operational design criteria and environment, health and safety standards which must be implemented at the project site.

188. Implementation of these measures will be enforced by PMU/EMS and the Assistant Plant Manager and supervised by the Assistant Plant Manager, supported by CEPC Project Manager in collaboration with PGESCO Site Manager, who will have direct responsibility for the Environment, Safety and

Table 13

**Key Environmental Issues Associated with the Development of the Proposed Power Plant Identified During Local ESIA and RPF Scoping and Consultation**

Key issue discussed	Comments
Overall Project	All parties consulted expressed their overall approval for the project. Local Stakeholders commented that the power plant will be central to securing power supply for the industrial and commercial activities in the area and will benefit the local economy through labor opportunities.
Social and Economic Impact	Local stakeholders and council leaders considered the social and economic impact of the plant to be wholly positive.
Land Acquisition/ Compensation	There was a clear and common appreciation when fair compensation rules were explained.
Waste water discharge and the aquatic environment	All local stakeholders expressed concern about the quality and quantity of water in the El-Rayyah El-Beheiry segment and the quality of water which will be discharged from the power plant. It was however acknowledged that there are no significant aquatic ecosystems close to the power plant. The suggestion was made that treated sanitary wastewater, if not discharged to the area's sewer system, could be used for irrigation of landscaped areas and treated industrial wastewater would be directed to the circulating water discharge system.
Air Quality	There was big concern over the following issues: <ul style="list-style-type: none"> <li>• compliance with air quality standards and the effect that non-compliance and subsequent plant closure could have on security of employment in the area;</li> <li>• accumulated effects of the air quality in the El-Kata atmosphere and the impact of the power project;</li> <li>• back-up light fuel oil usage in agricultural areas.</li> </ul>
Ecology of the Site	A big concern was raised about keeping the surrounding cultivated areas without harm. There was significant attention to keeping a landscape area inside the power plant fence.
Bankline & Canalbed Morphology	Some parties expressed their fears of causing damaging effects due to sedimentation and erosion processes associated with cooling water abstraction and discharge.

Environmental Compliance	An underlying concern expressed by all local stakeholders was compliance with environmental regulations. Assurances from CEPC are sought to the effect that CEPC will guarantee implementation of the environmental compliance measures which will be stated in the Environmental and Social Management Plan.
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Quality Assurance program on site during construction and operation. The Assistant Plant Manager is responsible for ensuring that construction works comply with the requirements of the ESMP and all environmental permits. His key roles will be to:

- assume the interface with authorities for environmental authorizations and permits;
- act as the Assistant Plant Manager for local authorities, industrial and commercial interests and any other interested parties;
- ensure that mitigation measures to reduce impacts during the construction phases are implemented;
- ensure that monitoring to be undertaken during construction is implemented;
- ensure compliance with the environmental and social management plan; and
- ensure that health and safety requirements are respected.

#### ***During Power Plant Operation***

189. During operation, direct responsibility for environmental compliance and the implementation of the mitigation, management and monitoring measures described in this Summary and in Section 7 of the Main Report, will continue to be with the Plant Environmental Staff under direct supervision of the Assistant Plant Manager. This position, will report directly to the Chairman/General Manager of CEPC/GNPP.

190. The Assistant Plant Manager will be based at the site and will be responsible for recruiting, training and managing his staff. He will be responsible for implementing the mitigation and management measures described above and for monitoring and record keeping of the following:

- stack emissions;
- air quality;
- noise emissions;
- quality of water discharge; and
- waste management.

191. In his role, the Assistant Plant Manager will also be responsible for maintaining any pollution control equipment and for developing and implementing procedures for safe handling and storage of any hazardous materials used on site.

192. Chemicals used during plant operation are process-related. Hazardous chemicals to be used include chlorine (5500 kg/hr), sulfuric acid (7000 kg/day infrequency once per day). Handling, storage and application of these chemicals will be used under strict regulations of handling hazardous materials stipulated by Law 4/1994.

193. The Assistant Plant Manager will also have lead responsibility for maintaining a written Environmental Register with respect to environmental impacts as required under Egyptian and World Bank guidelines. The written records will identify the characteristics of discharges and emissions, details of periodic testing including results, procedures for follow-up environmental safety actions and the person in charge of this follow-up. Should any prescribed standards be breached, PMU/EMS, through the Assistant Plant Manager, will immediately inform the EEAA and disclose the procedures being taken to rectify non-conformity.

194. Results of environmental monitoring as described above, shall be recorded and submitted to the EEAA, EEHC and to any other party (i.e. WB, .. etc.) as required. The EEAA and WB are entitled to audit the project company in order to ensure conformity with environmental standards and requirements.

195. In addition, the project company must keep a record of any significant environmental incidents occurring at the plant including accidents and occupational illnesses, spills, fires and other emergencies. The Assistant Plant Manager will be responsible for ensuring that these records are maintained up to date and are available on site.

196. The Assistant Plant Manager will supervise and lead the Environmental Department (ED) and the Environmental Management Staff (EMS) directed by the ED. *Figure 12* illustrates the environmental department within the organizational structure of the Giza North power plant and *Figure 13* gives the organization of the EMS.

## 9.2 Environmental Training

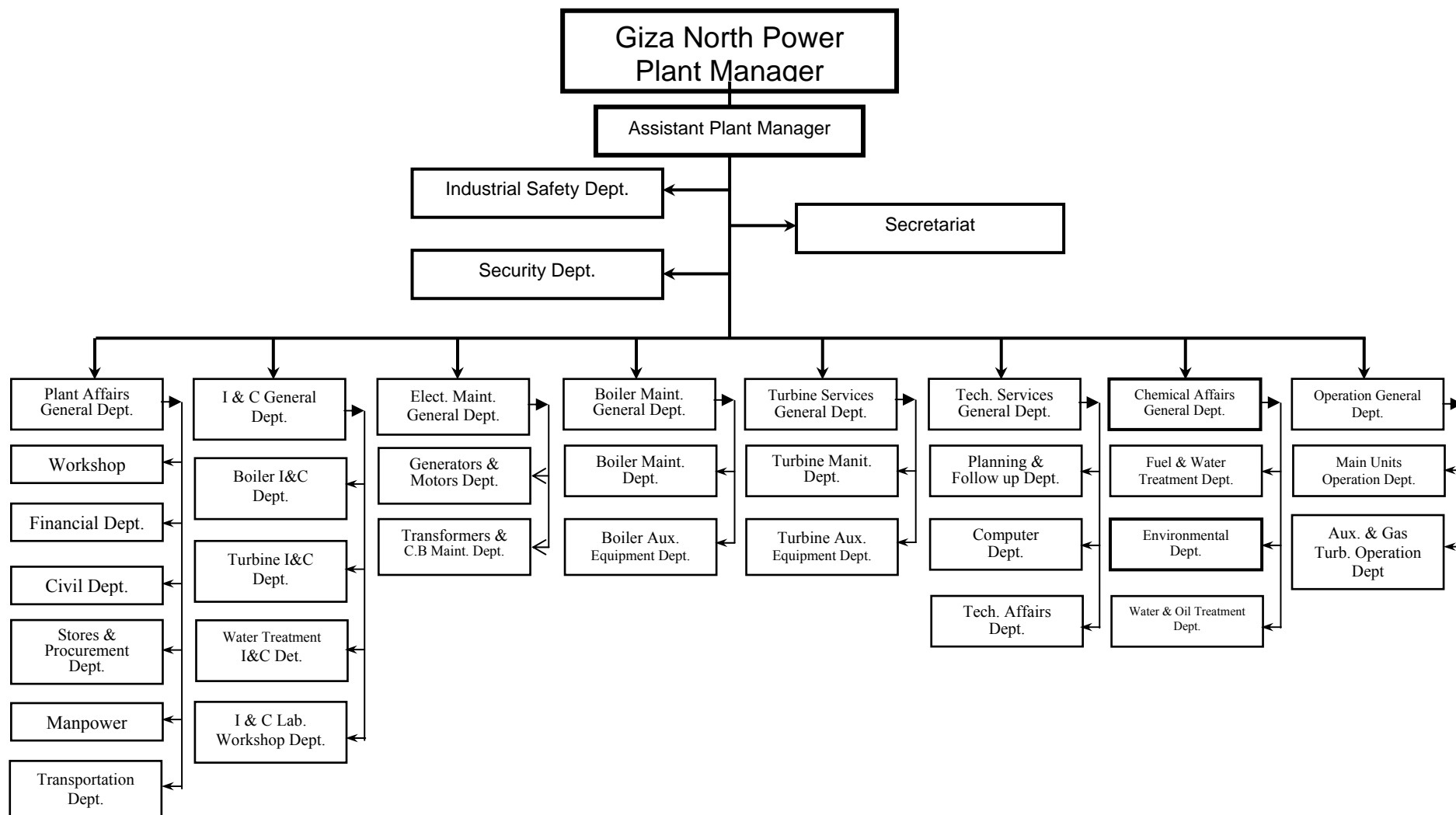
197. The Project Company will ensure that the power plant is manned 24 hours a day, 7 days per week. All staff employed at the plant will be trained in the following:

- general operation of the power plant;
- specific job roles and procedures;
- occupational health and safety; and
- contingency plans and emergency procedures.

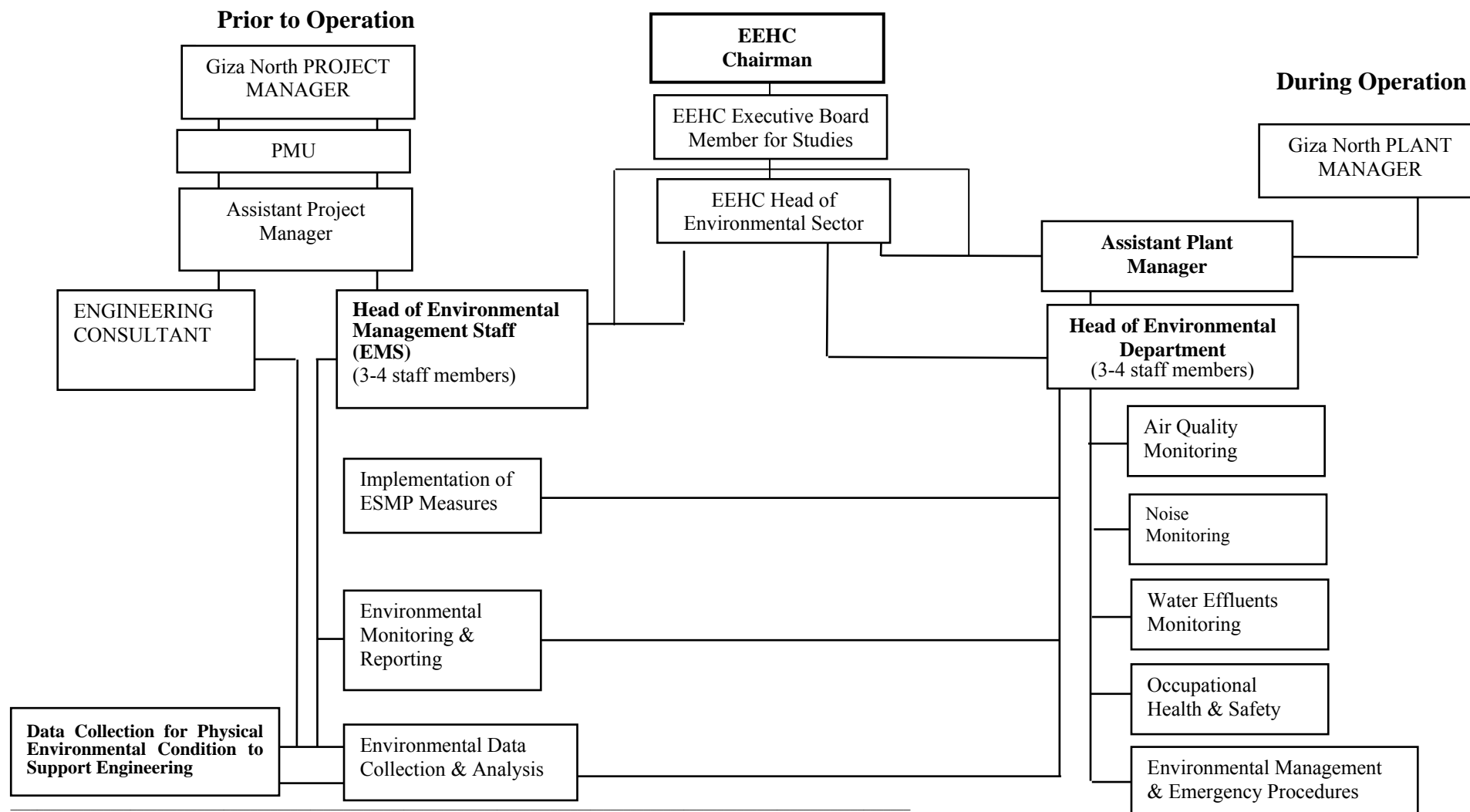
198. Training will include:

- induction training on appointment;
- specialist training (as required for their prescribed job role); and
- refresher training as required.

**Figure 12**  
**Environmental Department (ED) within the Organizational Structure**  
**of Giza North Power Plant**



**Figure 13**  
**Environmental Management Staff (EMS)**  
**within the Project Management Unit (PMU)**



199. The training program will be designed to ensure that appropriate skilled staff are used to operate the power plant at all times. Aspects of occupational health and safety and emergency procedures are described below.

200. In addition to this environmental training for all staff employed at the plant, special environmental training will be given to the staff employed for the EMU. They will receive training in the following:

- day-to-day monitoring activities;
- monitoring the stack emissions;
- collection and analysis of air quality data;
- monitoring the water effluents;
- collection and analysis of water quality information;
- use of monitoring equipment, operation and maintenance;
- industrial hygiene;
- occupational health and safety; and
- emergency and contingency procedures.

*Table 14* illustrates the recommended training for the EMS.

### 9.3 Occupational Health and Safety

201. CEPC/GNPP will establish and integrate policies and procedures on occupational health and safety into the operation of the power plant which meet the requirements of Egyptian and World Bank guidelines as given in Section 2 of the report. The policies and procedures will also be designed to comply with all manufacturers safety data sheets for chemical storage and usage, so as to provide a safe and healthy working environment.

202. Occupational health and safety programs will be supported by staff training for the power plant and the appointment of the Assistant Plant Manager. The training will include, but will not be limited to, the following:

- general area safety;
- specific job safety;
- general electrical safety;
- handling of hazardous materials;
- entry into confined spaces;
- hearing conservation;
- repetitive stress disorders;
- Code of Safe Practices;
- use of personal protective equipment; and
- first-aid.

Table 14

**Recommended Training Required for the PMU/EMS**

Training Course	Contents	Type of Training	Participants	Proposed Scheduling	Cost Estimate (L.E.)
General EHS Training: • Induction Training on Appointment • Specialist Training • Refresher Training (as required)	<ul style="list-style-type: none"> <li>General operation of the power plant.</li> <li>Specific job roles and procedures.</li> <li>Occupational Health &amp; Safety: <ul style="list-style-type: none"> <li>general area safety;</li> <li>specific job safety;</li> <li>general electrical safety;</li> <li>handling of hazardous materials;</li> <li>entry into confined spaces;</li> <li>hearing conservation;</li> <li>repetitive stress disorders;</li> <li>Code of Safe Practices;</li> <li>use of personal protective equipment; and</li> <li>first-aid.</li> </ul> </li> <li>Contingency Plans &amp; Emergency Procedures.</li> </ul>	Classroom and On-job training.	All power plant staff, including EMS.	Once before project implementation and during operation for refresher training.	Included in construction & operation cost. (around US\$ 145 k)
Special Environmental Training on Environmental Aspects of Power Generation and Monitoring.	<ul style="list-style-type: none"> <li>Allover Environmental Performance of the P.P.</li> <li>Day-to-day monitoring activities.</li> <li>Monitoring the stack emissions.</li> <li>Collection &amp; analysis of air quality data.</li> <li>Monitoring the water effluents.</li> <li>Collection &amp; analysis of water quality information.</li> <li>Use of monitoring equipment, operation and maintenance.</li> <li>Industrial Hygiene.</li> </ul>	Classroom and On-job training.	EMS. (3-4 staff members)	Once before project implementation and monitoring program.	Included in construction & operation cost. (around US\$ 10 k)
Environmental Auditing and Inspection, including periodic safety audits	<ul style="list-style-type: none"> <li>Environmental Auditing Techniques.</li> <li>Auditing Checklists.</li> <li>Environmental Auditing Reports.</li> <li>Safety Audits: <ul style="list-style-type: none"> <li>Physical inspections;</li> <li>Review of plant records;</li> <li>Interviews with staff.</li> </ul> </li> </ul>	Classroom and Field Exercises.	EMS.	Once after project implementation	Included in operation cost. (around US\$ 10 k)
Social Communications	<ul style="list-style-type: none"> <li>Communications Skills.</li> <li>Mass Communications.</li> </ul>	Classroom and Field Exercises.	EMS.	Once before project implementation and monitoring program.	Included in construction & operation cost. (around US\$ 10 k)

203. The training will include induction courses when staff are first employed at the power plant, with specialist and refresher training as required by the job role. Training will be updated annually and occupational health and safety procedures will be included within the Operations Manual for the power plant.

204. The safety record at the power plant will be reviewed each month at a formal meeting, led by the Assistant Plant Manager, where the agenda items, comments and attendance will be recorded and kept on file.

205. In addition, periodic safety audits will be conducted to verify compliance with safe working practices, which will comprise physical inspections, review of plant records and interviews with staff. The audits will assign responsibility for any corrective action necessary to mitigate a potential hazard and allow the tracking of the completion of the corrective measure.

#### 9.4 Emergency Procedures and Accident Response

206. Instructions on emergency measures necessary to safeguard employees and the wider environment will be prepared as part of the Operations Manual for the power plant.

##### ***Accident Response***

207. As part of the preparation of emergency procedures and the plans for accident response arrangements, the project company will carry out the following:

- review industry-specific and Egyptian and World Bank standards and regulations;
- establish general guidelines on potential safety and accident risks;
- prepare job-specific operating instructions where appropriate;
- establish safety and security notices for hazardous materials;
- prepare specific emergency operating instructions;
- provide protective equipment (including clothing, air and ear protection etc.) as required;
- evaluate information and feedback from employees; and
- record and investigate all accidents, injuries and incidents.

208. Contingency plans and emergency procedures are being developed to cover events due to operational failures, natural causes and acts of third parties. The plans and procedures will cover, as a minimum, the following:

- fire;
- explosion;
- bomb alerts;
- leaks and spills of hazardous materials;
- structure or equipment failures;

- injuries and illnesses;
- risk from natural disasters (wind, sandstorm, earthquake); and
- third-party risks (potential impacts of an accident occurring at another industrial facility which may impact upon the power plant).

### ***Oil Spill Contingency Plan***

209. As Good practice and part of the ESMP, CEPC/PMU/EMS will prepare an Oil Spill Contingency Plan to be ready for implementation by the start of construction activities.

210. Natural Gas will be delivered to the site by pipelines in a quantity of about 6 Millions m<sup>3</sup>/day.

211. Light fuel oil will be delivered to the site by road and stored in:

- two 20,000 m<sup>3</sup> tanks for the light fuel oil (oil no. 2 / solar).

212. These tanks are surrounded contained within separate retention area which is designed to contain 110% of one tank.

213. The plan will cover the following activities.

- delivery;
- handling;
- spills; and
- cleanup.

214. The plan will detail procedures, responsibilities, chains of command, information flows, monitoring and documentation. Previously illustrated *Figure 12* presents institutional arrangements for the Giza North power project.

## **10. IMPLEMENTATION SCHEDULE AND REPORTING**

215. Environmental and social management and monitoring activities will be implemented (according to the ESMP), following the same project schedule, as all activities are mainstreamed in the project design. Achievements/problems will be reported in the project quarterly progress reports and should be timely addressed by the project management and the Bank.

## **11. CONCLUSIONS**

216. The Project Company proposes to develop a new combined cycle power plant of total capacity 2x750 MWe at the area reserved for the Giza North Power Plant on land owned by the CEPC Company. The site is a rural Setting and does not contain significant residential environmental sensitivity of importance.

217. The key environmental issues associated with the power plant are as follows:

- Emission of oxides of nitrogen to the air;
- Generation and disposal of liquid effluents including cooling water;
- Emission of noise; and
- Socio-economic impacts.

218. The Environmental and Social Impact Assessment has evaluated the potential environmental impacts during construction and operation of the proposed power plant. In particular, the potential impacts of the flue gas emissions to the air, generation and disposal of liquid effluents including cooling water; and the emissions of noise have been assessed using sophisticated modeling techniques, which include consideration of the ambient background environment and the characteristics of the releases or emissions, and predicts the potential impacts which may occur.

219. The Environmental and Social Impact Assessment has, also, evaluated the potential socio-economic impacts during construction and operation of the proposed power plant.

220. It is anticipated that the power plant will provide a net positive socio-economic impact through the provision of employment opportunities and attraction of economic investment into the area. In addition, the use of local labor (95% during construction), will maximize these positive impacts through the development of the local skill base and will also generate increased demand for local services, materials and products.

221. Land expropriation is not likely for the sub-projects, including interconnecting transmission lines and gas pipeline. However, in order to handle any potential future changes, a Resettlement Policy Framework (RPF) is prepared by ECG separately in a stand alone document to be attached with this ESIA report. Fair compensation, if any, will be paid for the right of way according to the *Law 63 of the Year 1974 and the recommendations set out in the RPF*. The ESMP will be revised after exact routes for both of the gas connection and transmission lines are available.

222. The assessment indicates that no significant environmental and social impacts will occur as a result of the construction or operation of the power plant and, when taken together, the overall environmental and social impact will not be significant.

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## Contacts

223. Key persons contacted for comments or further information include the following:

- Chairman of the EEHC: **Dr. Mohamed Awad**
- Executive Board Member for Planning, Research and Affairs of Service Companies: **Dr. Kamel Yassin**
- Chairman of CEPC: **Eng. Ahmed Imam**
- Counsellor for Environmental Management and Studies; EEHC: **Eng. Maher Aziz Bedrous**
- Project Manager of ECG: **Eng. Hassan El-Banna**

**Annex I****CHANCE FIND PROCEDURES**

Chance find procedures will be used as follows:

- (a) Stop the construction activities in the area of the chance find;
- (b) Delineate the discovered site or area;
- (c) Secure the site to prevent any damage or loss of removable objects. In cases of removable antiquities or sensitive remains, a night guard shall be present until the responsible local authorities and the equivalent take over;
- (d) Notify the supervisory Engineer who in turn will notify the responsible local authorities and the General Authority of Antiquities immediately (within 24 hours or less);
- (e) Responsible local authorities and the General Authority of Antiquities would be in charge of protecting and preserving the site before deciding on subsequent appropriate procedures. This would require a preliminary evaluation of the findings to be performed by the archeologists of the General Authority of Antiquities (within 72 hours). The significance and importance of the findings should be assessed according to the various criteria relevant to cultural heritage; those include the aesthetic, historic, scientific or research, social and economic values;
- (f) Decisions on how to handle the finding shall be taken by the responsible authorities and the General Authority of Antiquities. This could include changes in the layout (such as when finding an irremovable remain of cultural or archeological importance) conservation, preservation, restoration and salvage;
- (g) Implementation for the authority decision concerning the management of the finding shall be communicated in writing by the General Authority of Antiquities; and
- (h) Construction work could resume only after permission is given from the responsible local authorities and the General Authority of Antiquities concerning safeguard of the heritage.

These procedures must be referred to as standard provisions in construction contracts, when applicable, During project supervision, the Site Engineer shall monitor the above regulations relating to the treatment of any chance find encountered are observed.

## Annex II

## LIST OF EIA AND SOCIAL ASSESSMENT TEAM MEMBERS

Position	Name
<b>ECG</b>	
Project Manager	Eng. Hassan El-Banna
Atmospheric Dispersion Modeling Specialist	ECG Air Quality Dept.
Socio-economic Specialist	ECG Socio-economic Studies Dept.
Solid & Hazardous Waste Management Specialist	ECG Waste Management Dept.
Ecologist	Dr. Mahmoud Hussein
Air Quality Measurements	National Research Center
Water Quality Measurements	National Research Center
Al-Azhar University, Faculty of Engineering	Dr. Mohamed Youssry and the team
MB. Consultant	Consulting team of the Firm
CSC Consulting Firm	Geological Special team
EcoConServe	Quantitative Risk Assessment team
Hydraulics Research Institute	Dr. Fathi El-Gamal, Eng. Ibrahim El-Dessouki and the team
<b>EEHC Supervisor</b>	
Counsellor for Environment Management and Studies Sector	Eng. Maher Aziz Bedrous