Egyptian Electricity Transmission Company

EETC

Scoped – B ESIA for OTL and Transformer Substation - Gulf of Suez

Prepared by:

Environics, SAE
Environment & Development Advisors

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1. Introduction

1.1 Background

The Egyptian government has set a target to install 4,300MW of Renewable Energy over the coming three years; 2,000 MW for medium sized wind installations and 2,000 MW of Solar installations with an additional 300MW for small PV installations. Lekela Power was prequalified for a 250MW Wind Project from the Egyptian Ministry of Electricity and Renewable Energy to operate within the BOO scheme. This report relates to connecting Lekela BOO wind farm 250 MW to the existing Egyptian Electricity Transmission Company (EETC) Ras Ghareb Substation 500/220 kV via a 30km overhead transmission line and associated substation.

The project is categorized by Egyptian Environmental Affairs Agency (EEAA) under 'Scoped B' Projects - which does not require scoping and consultation activities.

1.2 Objective of the ESIA

The objective of the ESIA is to ensure that the project is environmentally and socially sound and sustainable, and that any potential negative environmental impacts are recognized early in the project cycle and taken into account before project implementation. Furthermore, it is also intended to satisfy the environmental legal requirements of the Egyptian Environmental Law 4 of 1994 amended by Law 9/2009 and its executive regulations No. 338 of 1995 modified by Prime Minister Decree no. 1741/ 2005, modified in 2011/2012 and 2015 as well as the EEAA (Egyptian Environmental Affairs Agency) guidelines for EIAs issued 2009.

Moreover, the ESIA is also intended to satisfy the environmental requirements of the international funding institutions including specifically the Performance Standards (PS) of International Finance Cooperation (IFC).

1.3 Scope of Work

The ESIA of the proposed project would evaluate the project potential environmental impacts in its area of influence; identify ways of improving project environmental performance during its different stages by preventing, minimizing or mitigating potential adverse environmental impacts and enhancing positive impacts. The ESIA will cover the different components of the project at the different phases of site preparation, construction, startup and operation.

1.4 Outline of ESIA study

This ESIA report includes:

- ***Chapter 1:*** Introduction and background on the project for which the ESIA is developed as well as the scope and objectives of the ESIA study.
- ***Chapter 2***: Description of the local regulatory framework as well as the IFC Performance Standards applicable to the project activities
- ***Chapter 3:*** Description of the intended project construction and operation phases
- ***Chapter 4:*** Description of the baseline environment of the project area
- ***Chapter 5:*** Discussion of alternatives for different project components.
- ***Chapter 6:*** Assessment of the potential environmental impacts and their mitigation measures.
- ***Chapter 7:*** The environmental management and monitoring plan.

2. Policy, Legal and Administrative Framework

This section summarizes the environmental legislation and regulations of relevance to the project. They were identified according to the type of the proposed activity (described in detail in chapter 3), its geographic location and the expected impacts. Consideration is first given to the national legislations pertaining to the execution of the ESIA, followed by a review of guidelines of international financing institutions for environmental requirements relevant to the project as well as the company's environmental, health and safety framework requirements

2.1 National Legislation Pertaining to EIA

According to Law 4/1994, law of the environment, and its executive regulations (ERs), which were amended by Law 9/2009, the project proponent should prepare an environmental impact assessment (EIA) with the application for license of new projects and/or extension of existing facilities, thus integrating environmental requirements into the existing licensing system.

According to project classification lists issued by the EEAA [1] , compressor/transformer projects with relevant overhead or land transmission lines are classified as b-scoped projects.

Moreover, the EIA is to be prepared in light of Environmental Impact Assessment Guidelines and Monitoring Protocols for Wind Energy Development Projects along the Rift Valley/Red Sea Flyway with a particular reference to wind energy in support of the conservation of Migratory Soaring Birds (MSB), 2013.

According to law 4/1994 and its ER, the ESIA will be submitted to the Competent Administrative Authority (CAA), under which jurisdiction the project falls. For this project, the CAA is the Egyptian Electricity Transmission Company Authority- Ministry of Electricity & Energy. The CAA would send the EIA to the EEAA to issue its response within 30 days. If no response is received beyond this period, the assessment shall be deemed approved.

[1] The lists are presented in the EEAA website: http://www.eeaa.gov.eg/portals/0/eeaaReports/N-EIA/B-Scope.pdf

2.2 National Environmental Regulations Pertaining to the Project

2.2.1 Air Quality

Article 36 of Law 4/1994 and article 37 of its modified ERs (710/2012) give the maximum allowable limits for exhaust gases from machines, engines and vehicles.

Article 35 of Law 4/1994 and article 34 of its modified ERs give the maximum allowable limits for ambient air pollutants. Table 2-1 presents the maximum allowable limits for ambient air emissions.

The legal stipulations apply mainly to potential air emissions during the construction phase. According to the national environmental law no. 4/1994, projects are required to monitor all emission sources to ensure compliance with the legal stipulations, and record the monitoring results in the project's environmental register.

Table 2-1: Maximum Limits of Ambient Air Pollutants According to Annex (5) of the Modified ERs of Law 4/1994 as well as the international guidelines (IFC)

Pollutant	Area	Maximum Allowable limits			
		1 hr	8 hrs	24 hrs	1 year
Sulfur Dioxide ($\mu g/m^3$)	Urban Areas	300	-	125	50
	Industrial Areas	350	-	150	60
International guidelines (IFC)		-	-	***20***	-
Carbon Monoxide (mg/m^3)	Urban Areas	30	10	-	-
	Industrial Areas	30	10	-	-
International guidelines (IFC)		***30***	***10***	-	-
Nitrogen Dioxide ($\mu g/m^3$)	Urban Areas	300	-	150	60
	Industrial Areas	300	-	150	80
International guidelines (IFC)		***400***	-	***150***	-
Total Suspended Particles ($\mu g/m^3$)	Urban Areas	-	-	230	125
	Industrial Areas	-	-	230	125
International guidelines (IFC)		-	-	***230***	***90***
PM_{10} ($\mu g/m^3$)	Urban Areas	-	-	150	70
	Industrial Areas	-	-	150	70
International guidelines (IFC)		-	-	***150***	***70***

2.2.2 Noise

Article 42 of Law 4/1994 and article 44 of its modified ER (710/2012) give the maximum allowable limits for sound intensity. Table 2-2 shows the maximum limits of environmental noise levels.

The legal stipulations apply to potential increased noise levels during both the construction phase and operation phase. According to the national environmental law no. 4/1994, projects are required to monitor potential noise sources to ensure compliance with the legal stipulations, and record the monitoring results in the project's environmental register.

Table 2-2: Maximum Limit Permissible for Noise Level in the Different Zones According to Annex (7) of the Modified ERs of Law 4/1994

Type of zone	**Permissible limit for noise level, dB (A)**	
	Day time 7 am – 10 pm	**Night 10 pm – 7 am**
Areas on roads whose width is 12 m or more, or industrial areas which comprise light industries and other activities	70	60
International guidelines	***70***	***70***

2.2.3 Solid Wastes

Article 37 of Law 9/2009, modifying Law 4/1994, and articles 38 and 39 of the modified ERs are concerned with the collection and transportation of solid wastes.

Article 39 of Law 4/1994 and article 41 of its ERs set the precautions to be taken during digging, construction, demolition or transport of resulting waste and dust so as to avoid wafting, according to the following precautions:

- Construction waste storage is to be carried out at site such that it does not obstruct movement of vehicles and personnel.
- waste subject to emission should be covered to avoid air pollution
- waste is to be submitted to authorized waste contractors

Law Number 38 of 1967 on General Public Cleaning and Law No. 106 of 2012 amending a number of articles of Law 38, and its executive regulations (decree 134/1968), is the primary law governing the management of solid waste in Egypt including construction/demolition waste. In addition, Articles 37 of the Environmental Law 9 of 2009 and Annex (11) of its modified Executive Regulations (1095 of 2011) are concerned with the collection and transportation of solid wastes.

The legal stipulations apply to construction waste as well as solid waste generated during construction and operation phases, such as food residuals, carton and paper, plastics, glass, metal cans, etc.

2.2.4 Contaminated land

Specific regulations for soil contamination have not been developed yet in Egypt. Land Contamination has been addressed as general stipulations of the Civil Code regarding the actor/committer's responsibility of the harm resulting due to his/her actions. In addition, stipulations of the amended ER of Law /4/1994 related to proper handling and management of the hazardous substances and waste (Article 33 of the ER) state that the owner or manager in charge of the establishment, from which hazardous wastes are generated, is obliged to decontaminate the facility, soil and the site in case of relocation or its the activity has been stopped.

The legal stipulations may apply to previous utilization of the site (if any). This does not apply to the project location as the area has not been previously designated for, or used by, any activity.

2.2.5 Hazardous Substances and Wastes

Article 33 of Law 4/1994 specifies that all precautions must be taken when handling hazardous material either gaseous, liquid, or solid form to avoid any environmental damage.

Article 28 of the ERs of Law No. 4 of 1994 identifies requirements for hazardous waste management including the following:

- Identification: using the HW lists issued by the competent authority.
- Minimization: strive to reduce quantitatively and qualitatively the generation of the HW
- Segregation: HW is to be separated from other types of non-hazardous waste. In addition, the different types of HW must not be mixed together.
- On site Storage: HW is to be stored in a designated area, and containers must be made of suitable materials and be properly sealed to avoid any leakages or spills into the surroundings.
- Off-site transportation: HW is to be submitted to authorized HW contractors.

Article 29 of Law No. 4 of 1994 prohibits handling hazardous substances without obtaining a license from the competent authority.

The legal stipulations apply to the generation of hazardous waste during construction and operation phases, such as used oil, grease and other lubricating materials.

2.2.6 Work Environment

The Egyptian Labour Law number 12/2003 organizes working conditions and management of worker relationship. The national labour law in its different articles; addresses the individual labour contracts, terms of employment, wages and leaves, collective negotiations and collective labour agreements and litigations as well as vocational training are addressed in sections one to four. The occupational health and safety requirements are addressed in Book five. A number of explanatory notes and ministerial decrees have been issued detailing the different stipulations of the law.

Chapter 3 of Book 5 of the labor law number 12/2003, articles 208 through 215, address the responsibility of companies to protect workers against risks resulting from handling of gaseous, liquid and solid chemical substances. The Ministerial Decree 134/2003 requires that organizations hiring more than 50 employees establish an occupational health and safety department to be responsible for the workplace and employees' safety and provide the necessary equipment for measuring and monitoring pollution in the work environment. Besides, Ministerial Decree 211/2003 of the Ministry of Manpower also addresses the requirements to prevent adverse physical, chemical, biological, mechanical hazards and the dynamic electricity hazard in the workplace as well as keeping medical surveillance records for the employees

According to articles 43 and 45 of Law 4/1994 and articles 44, 45, 46 and 47 of its executive regulations, the facility owner must provide protective equipment and all necessary safety measures for the workers against noise, heat stress and gaseous emissions inside the work place. In addition, it is the responsibility of the facility's owner to provide all closed and semi-closed places with efficient ventilation system. Moreover, article 32 of the decree 211/2003 addresses protection against high voltage risks in electricity generation plants. It describes measures for occupational safety measures when handling and maintaining electric equipment, wires and cables.

The legal stipulations apply to the workplace conditions during construction and operation phases.

2.2.7 Management of Liquid Wastes

Law 93/1962 sets the conditions for discharging wastewater to public sewer networks. Decree 44/2000 of the Ministry of Housing modifying the executive regulations of Law 93/1962 address the conditions and maximum allowable limits for discharge of wastewater to public sewer network.

It is not likely that a public sewer system will be extended to the site. However, the decree also provides general conditions and criteria to be fulfilled for treated sanitary wastewater that are re-used for agricultural/landscaping purposes (Article 15).

The legal stipulations apply to the discharge of domestic sewage water resulting from workforce during construction and operation activities.

2.2.8 Biodiversity

Law 4 of 1994 concerning Environmental Protection

Law No. 4 and its Executive Regulations are concerned with the protection of biodiversity. Article 28, as amended by Law 9 of 2009. Annex 4 of the Executive Regulations of law 4/1994, amended by Prime Minister Decree 1095 of 2011, defines the wild animals and plants prohibited from being hunted, killed or captured, as:

- **First:** Birds, wild animals, faunal and aquatic living organisms, or parts of them, or their derivatives; which are forbidden to be hunted, killed, commercialized, raised, possessed, transported, exported, imported or traded living or dead, including
- **Second:** Flora forbidden to be collected, imported, exported, cultivated or commercialized.
- **Third:** Faunal and floral living organisms threatened by extinction, or those raised or cultivated outside their natural habitats without having obtained a permit from the EEAA.

The site is devoid of flora and fauna to which the law refers. Accordingly, the legal stipulations apply mainly to the operation phase which may pose potential risks to the migratory birds.

2.2.9 Cultural Heritage

Law No. 117 of 1983 promulgating the Antiquities' Protection Law, as amended by Law No. 3 of 2010, deals with the protection of antiquities. It is the main law in Egypt regarding the protection of archaeological and historical sites. The Ministry of State for Antiquities (MSA) is the authority concerned with the supervision of all archaeological affairs and sites in the country (Article 5). The Ministry of State for Antiquities (MSA) is responsible for discovery of antiquities and all exploration activities on Egyptian territory. MSA must be notified in the event that an unrecorded ruin is found by any person (Article 23). Although there are no cultural heritage areas in the site vicinity, the ESIA report will refer to relevant regulations for unexpected cases of chance finds.

The legal stipulations apply to the construction phase. However, based on the consultant's knowledge of the project area, no cultural heritage is indicated in the project area or its proximity.

2.2.10 Environmental and Other Registers

Article 22 of Law 4/1994 and article 17 of its modified executive regulations stipulates that establishments should maintain an environmental register for its activities. Article 17 and Annex (3) of the ER provide the content of the environmental register and state that the owner of the facility must inform EEAA with any non-compliance.

Furthermore, articles 26, 28 and 29 of the modified ERs are concerned with the rules and procedures of hazardous substances and waste management. Accordingly, a register for the hazardous waste should be maintained as well as record for the hazardous substances used.

In addition, article 211 of the Labour Law 12/2003 and article 34 of the Decree of the Minister of Labour and Manpower no. 211/2003 regarding requirements to prevent adverse physical, chemical, biological and mechanical hazards in the workplace, stipulates that companies should prepare, records/ reports/register for chemical safety.

The legal stipulations apply to constrcution and operation phase.

2.3 International Conventions

Egypt has been among the first countries to take an active interest in the conservation of biodiversity and the preservation of natural resources and heritage. In 1936, Egypt became party to the "Convention Relative to the Preservation of Fauna and Flora in their Natural State", London 1933. This was later followed by signing and ratifying conventions and agreements pertaining to the various aspects of biodiversity conservation. Those potentially relevant to the site include:

- The Agreement for the Establishment of a Commission for Controlling the Desert Locust in the Near East, 1972;
- The African Convention on the Conservation of Nature and Natural Resources, 1969;
- The International Convention on the Protection of Cultural and Natural Heritage, Paris, 1972;
- The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), Washington D.C., 1975;
- The Convention on Conservation of Migratory Animals, Bonn, 1979;
- The Rio de Janeiro Biodiversity Convention, 1992.
- Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA), 2015

2.4 Guidelines of the International Financing institutions

In addition to Local Regulations and International Conventions, this Scoping Report is prepared according to the requirements of the international finance institutions. In this context, given that IFC environmental and social performance standards are the most comprehensive, and are the reference standards for banks abiding by the Equator Principles, they will be taken as the main reference in the ESIA.

The IFC requires the projects to abide by its Performance Standards (PS) to manage their social and environmental risks and impacts and ensure that they are environmentally sound and sustainable. The performance standards define clients' roles and responsibilities for managing their projects and the requirements. The standards also include requirements to disclose information. The IFC PSs are:

Performance Standard 1: Social and Environmental Assessment and Management System

Establishes the importance of: (i) integrated assessment to identify the social and environmental impacts, risks, and opportunities of projects; (ii) effective community engagement through disclosure of project-related information and consultation with local communities on matters that directly affect them; and

(iii) the client's management of social and environmental performance throughout the life of the project.

This performance standard is relevant to most projects and applies to the current one.

Performance Standard 2: Labor and Working Conditions
Recognizes that the economic growth through employment creation and income generation should balance with protection for basic rights of workers.

The proposed study will address the aspects requirements of employment during the different project phases. In addition, it would also address occupational health and safety aspects with particular emphasis on working at heights and impacts of electromagnetic fields.

Performance Standard 3: Pollution Prevention and Abatement
Recognizes that industrial activities often generate increased levels of pollution to air, water and land, which can have potential adverse impact on the surrounding environment.

Given the type and nature of the project, it is expected that it environmental impacts during operation are not significant. However, aspects related to potential emissions and wastes (solid and liquid), especially during construction activities, will be addressed in the study.

Performance Standard 4: Community Health, Safety and Security
Recognizes that the project activities and infrastructure can increase the potential for community exposure to risks and impacts arising from equipment accidents, structural failure and releases of hazardous materials. Impacts may also arise from exposure to diseases and the use of safety and security personnel.

Given the nature of project location and absence of residential or other human activities, the potential impacts of the project on community are expected to be insignificant.

Performance Standard 5: Land Acquisition and Involuntary Resettlement
Recognizes that the project design minimizes economic and physical displacement, balancing social environmental and financial costs and benefits.

No involuntary resettlement for this specific project or change in current land use is expected to take place. Therefore, provisions of this PS do not apply to the project.

Performance Standard 6: Biodiversity Conservation and Sustainable Natural Resource Management
This PS addresses how projects can avoid or mitigate threats to biodiversity arising from their operations as well as sustainably manage renewable natural resources.

The project site is located along a migration pathway of global importance for many protected species. Accordingly, potential impacts of the project will be addressed within the study.

Performance Standard 7: Indigenous Peoples
This PS aims at preventing adverse impacts of the projects on communities of Indigenous peoples and to provide opportunities for development benefits.

Provisions of this PS do not apply to the proposed project since there are no indigenous communities in Egypt.

Performance Standard 8: Cultural Heritage
The objective of this PS is to protect the cultural heritage from the adverse impacts of the project activities and support its preservation.

The study will address measures to be adopted in case of chance find

3. Project Description

3.1 Project Location

The Egyptian government has set a target to install 4,300MW of Renewable Energy over the coming three years; 2,000 MW for medium sized wind installations and 2,000 MW of Solar installations with an additional 300MW for small PV installations. Lekela Power was prequalified for a 250MW Wind Project from the Egyptian Ministry of Electricity and Renewable Energy to operate within the BOO scheme. Lekela Egypt intends to prepare the ESIA report for the construction and operation of overhead transmission line (OTL) and associated substation with the purpose of connecting Lekela BOO wind farm 250 MW to the Egyptian Electricity Transmission Company (EETC) Ras Ghareb Substation 500/220 kV. Lekela is preparing the ESIA for the project on behalf of EETC for submission to the EEAA and IFIs for approval.

The project site is located in the Eastern desert by the Red Sea coast, north of the town of Ras Ghareb. The site is serviced by the Ras Ghareb – Zafarana Highway to the East from which it can be accessed as well as the Ras Ghareb – Minya Road to the South. The OTL route is divided into two main stretches, the first running roughly parallel to the existing Ras Ghareb – Zaafarana highway with an approximate length of 15km comprising approximately 42 towers, while the second stretch runs roughly parallel to the Ras Ghareb – Minya road with an approximate length of also 15km comprising 38 towers. The OTL is located in an uninhabited state owed desert land, where no land acquisition is necessary.

The nearest residential area is the coastal town of Ras Ghareb, about 16 km to the east of the site.

Figure 3-1, below shows the activities surrounding the proposed project location as well as the indicative route of the transmission line and location of the proposed substation.

Figure 3-1: The site, neighboring roads and surrounding activities

The main land uses within the area and their environs are petroleum industry and related infrastructure. The proposed roads, shown in the NREA Map below and Plots of land for wind farm projects in the Gulf of Suez appear to minimise the interface with the Petroleum Companies.

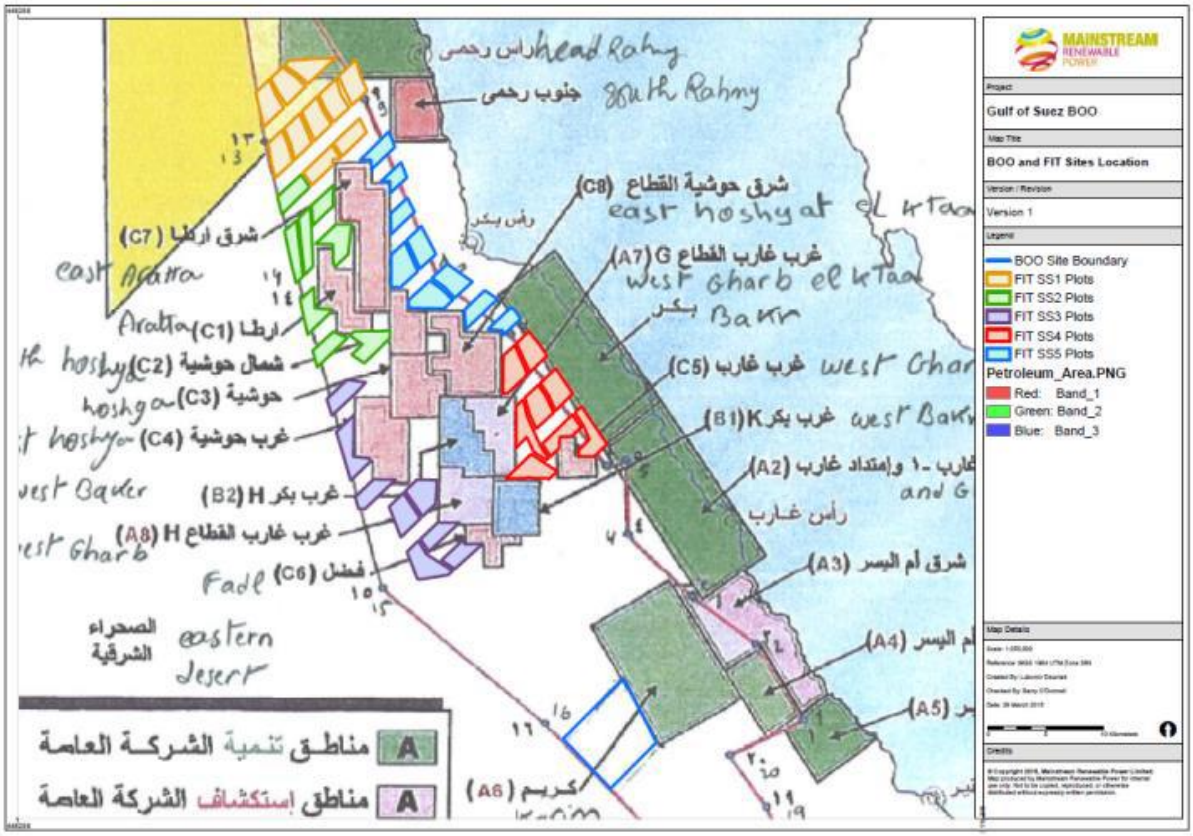

Figure 3-2: Wind farms and surrounding petroleum exploration activities

The site is located south of concession areas of petroleum companies, which have constructed access roads for their own operations.

3.2 Project components

The main components of the project include:

3.2.1 Overhead Transmission Line

As mentioned above, there are two stretches of the overhead transmission line. The first, with approximate length of 15km, is a 220 kV line connecting the wind farm to an interim substation where the voltage is stepped up further and the electrical energy produced is delivered to the existing EETC Ras Ghareb 500kV/ 200kV Substation via a 15km 550kV transmission line.

The line electrical characteristics are assumed as follows:

- Nominal voltage of a three-phase system: 500 kV.
- Highest voltage of a three-phase system: 550 kV.
- System design short circuit current: 40 kA.
- Lightning impulse voltage withstand 1.2/50 μs (peak): 1550 kV.
- Rated frequency : 50 Hz.
- Maximum operating conductor temperature: 80^0C.

- **<u>Creepage Distance</u>**

  The creepage distance for insulators takes into consideration the pollution level in the zone at which the line will be erected. Overhead lines are subject to conditions that depend on the place in which they are installed. Depending on the characteristics of the region considered and the atmospheric characteristics the level of insulation required can vary in the same line.

  For the project location within the Red Sea coast, Zone No. (IV) will be considered. In this respect, insulators will be designed for a minimum nominal specific creepage distance of 45 mm/kV. Table (1) below provides selection criteria for creepage distances.

Table (3-1): Selection of Creepage Distance[1]

Zone No.	Region	Pollution level (layer conductivity) (μs)	Maximum specific leakage path cm/kV	Withstand voltage
I	Naga-Hammadi – Aswan No industrial.	30	3.0	1.25 Umax/$\sqrt{3}$
II	Minya, Asyout, Naga Hammadi Western, Cairo desert, Sinia, Little industrial.	35	3.5	
III	Delta, Cairo	40	4.0	

[1] Samallout / Suez Gulf / Jabal El-Zayt 500 kv Transmission Line and Substations project, Engineering Consultants Group (ECG), 2011

IV	Coast pollution	50	4.5	

- **Tower Components**

The main components of the towers include the foundation, lattice steel structure, conductors, insulators and earth wires.

Foundations:
The specific tower locations will require site preparation prior to constructing the foundation. Selection of the tower locations will avoid any areas of vegetation, if any, to minimize vegetation clearance of the site. Additionally, the choice of locations will avoid Wadis, particularly Wadi Hawashiya. Tower foundations will be of reinforced concrete pad and chimney. Each tower type will have its own foundation design.

Lattice Steel Structure
The tower structure is primarily made of lattice steel bolted together. The structure is imported via Sokhna port and trucked to the project location. The Tower shape will be designed for vertical arrangement, Lattice steel self-supporting double circuit towers will be used.
The positioning of the conductors and of the earth-wires on the tower shall be determined considering the following clearances:

- Clearance to ground and obstacles.
- The clearances between tower's live and earthed parts.
- The clearances between the conductors and between conductors and earth-wires in mid-span and still air.
- The earth-wire's shade protection angle.
- Clearances between conductors at structures.

Conductors, insulators and earth wires
These components are installed on the lattice structure to serve various purposes.

Insulators The suspension and tension insulator string units shall be of ceramic or toughened glass type. support the conductors and endure both the normal operating voltage and potential surges of switching and lightning. The insulators will be of ceramic type or toughed glass.

The ***conductors*** are the main components that transfer the electrical power generated in the wind farm to the substation, or from the substation to the grid. The line conductors will be AAAC 506 mm^2

Earth wires are necessary to avoid lightening from striking the phase conductors. Earth wires will be optical ground wire (OPGW). The OPGW will be designed and comply with the International Electro technical Commission Standard (IEC).

Spacers are installed to keep partial conductors of the bundle line spaced to prevent their damage. The spacer is designed to maintain the bundle

spacing of 450mm under all normal operating conditions and to effectively control aeolian vibrations as well as sub span oscillations.

Dampers reduce oscillations and vibrations caused by wind.

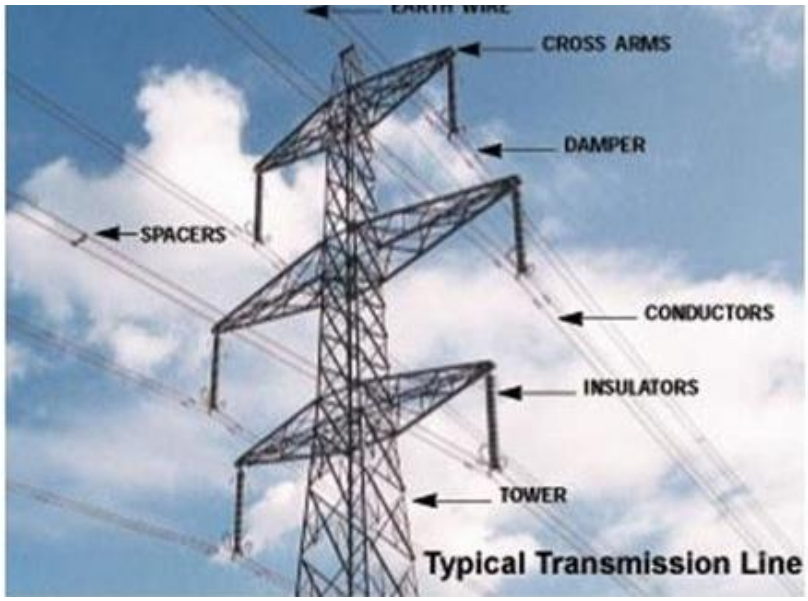

Figure 3-3: Main Tower Components

3.2.2 Transformer Substation, Electric Equipment and Connection to the grid

The transformer substation is a step-up type used to raise the voltage level of the electric current received form the wind farm to feed into the existing 500kV/ 200kV substation where the voltage is stepped up further and the electrical energy produced is delivered to EETC Transmission System.

The construction of the substations will require the creation of permanent access roads connecting to the local / national road network. The new substation site will first need to be cleared of vegetation, if any, and levelled. Civil works would then start including creation of on site roads, drainage, digging of foundations, pouring of concrete and creation of areas of hard standing. Substation buildings for housing instrumentation and for storage would then be erected.

The substation is basically a structure that includes a number of electrical components to step of the voltage to the required level, these include.

- Electrical Power transformers
- Switchgears
- Instrument transformers
- Conductors& Insulators
- Isolators
- Bus bars
- Lightning arresters
- Circuit breakers
- Relays
- Capacitor banks and miscellaneous equipment

3.3 Utilities and Infrastructure

3.3.1 Buildings

- ***Temporary Compound (during construction)***
  A temporary laydown area (for storage of materials and servicing of machinery) and a temporary office would be erected at the project site. Such temporary facilities will have welfare facilities.

  The Contractor shall provide suitable welfare facilities for all site personnel including:
  - Regularly maintained general canteen/mess area.
  - All site welfare facilities including lockable Male and Female flushable Toilet Block of portacabin type.
  - Changing rooms/showers.
  - First Aid cabin including, first aid equipment, etc.
  - Installation and commissioning of all temporary power supplies.
  - Adequate vehicle parking space.
  - Adequate area for temporary containerized site offices and storage containers for all site contractors.
  - Temporary site lighting and services for the compound.
  - Temporary communications for the compound.
  - Fuel tanks and other liquid storage areas with suitable segregation, refuelling areas.

- ***Operation***
  The substation will be constructed to accommodate a limited number of employees (maximum 10 persons) and electric infrastructure for operation and maintenance activities.

  In addition to the electrical step up equipment, the substation building shall include;
  - office area,
  - storage area,
  - bunded area for materials/wastes containing oil, area for hazardous substances,
  - server/communications room,
  - male & female toilets and showers and rest/recreation area all in accordance with relevant legislative requirements.

  The substation building shall include permanent water supply and sewage connection or collection system (Septic tank) as applicable as well as all services (electrical, communications, water, etc.) and furniture.

3.3.2 Storage tanks

- **Wastewater (WW) tank:** A sewage tank will be constructed such that it allows for WW treatment and percolation. The WW tank will be emptied

by external contractors authorized by the governorate for WW sludge disposal.

- **Diesel generator and associated tank:** diesel will be used to power a generator for construction works.

- **Potable water tank**; during construction, water will be supplied from tanks. A PVC tank will be considered with supporting structure and would have sufficient storage capacity to supply the estimated volume of 50 liters per person per day for water consumption.

  During operation, this tank will also be used to store water needed for domestic uses. The water is expected to be provided through a subcontractor.

3.3.3 Security instrumentation

In the course of ensuring that operation assets and personnel are secured and safeguarded in a legitimate manner, EETC will ensure sound security measures are undertaken.

3.3.4 Safety equipment

During the project's design phase, the elements that must be taken into consideration as sources of potential hazards for workers are the following:

- Adequate fire protection and fire extinguishers in O&M building
- First aid facilities
- Shelter for workers during the construction.

3.4 Construction Activities

3.4.1 Main Activities and Schedule

Site construction works are expected to take up to approximately 8 months.

The project will be constructed under an EPC (Engineering, Procure and Construct) agreement or a multi contract approach.

<u>Preconstruction</u>

- Preparation of access roads
- Preparation of construction camp
- Geotechnical investigations
- Design of tower and substation foundations
- Electrical design, including number and types of towers, relevant earthing, sag and tension calculations, creepage distance, etc.
- Detailed survey and finalization of selection of the tower and substation locations.

<u>Construction</u>

- Excavation and auguring for foundations;
- Construction of substation and tower foundations;
- Construction (civil works) of the substation building;

- Supply of towers and electrical components through Sokhna port;
- Assembling of transmission line towers;
- Installations of electrical components for towers (line stringing) and substation;
- Commissioning of site equipment and testing; and
- Site restoration.

Construction equipment will include:
- Mobile crane and crane mounted truck
- Excavator
- Roller compactor
- Concrete mixer trucks and vibrators

For the ***overhead transmission line***, it is expected that the towers will be of lattice steel type, with each tower requiring four reinforced concrete foundations. The foundation depth and design will depend on the findings of the geotechnical investigations. The design of the towers and the projection of its foundations above ground will take into consideration the flash flood potential of the location. Their locations will be selected to avoid drainage lines. Each tower is expected to require an approximate volume of $15m^3$ of reinforced concrete, which translates into approximate water requirements of $2m^3$ for concrete curing per tower. Water requirements for concrete preparation will not be provided by the project, since ready mixed concrete will be acquired via trucks. The lattice steel structure is constructed ground up. Specific parts are assembled near the tower location and lifted in place using a crane, depending on the available space near each tower location. All tower base reactions shall be computed from design structure loading. The exact bearing capacity has to he found from real soil investigation at the site.

Overhead Conductor Stringing will be carried out using tension method. A puller (winch) is set up at one end of the line section, and a bullwheel tensioner at the other end. The reel of conductor is staged behind the bullwheel tensioner. A steel cable or synthetic rope (pulling line) is strung from the puller through each stringing block between the puller and bullwheel tensioner. The end of the pulling line is then attached to the conductor end after it has been threaded through the bullwheel tensioner. During the stringing process, the conductor is pulled through the stringing sheaves until the end reaches the puller. The tension maintained between the bullwheel tensioner and the puller keeps the conductor clear of the ground and other obstructions that could cause damage.

Similar to the transmission line, the ***substation*** will require reinforced concrete foundations, where ready mixed concrete will be brought from an existing batch plant and transported to the site via trucks. Accordingly, minimal volumes of water are necessary for the foundation, restricted to concrete curing requirements. Other civil works involve brickwork and interior/external finishings. The electrical components will be imported via Sokhna port.

3.4.2 Estimated number of the required labor

The direct labour force required for the project during construction will be dependent on the phase of the work but will be up to approximately 200 workers at peak construction stage, including skilled and unskilled persons. EETC will encourage contractors to hire workers from local communities.

3.4.3 Utility inputs for construction

- ***Water***

Domestic Water

Regarding the potable water for human use (i.e. drinking, washing and cleaning) during construction, water supply would be acquired via tankers from the Hurghada – Ras Gharib water pipeline. An on-site water tank will be installed in order to provide potable water to the construction operations.

For concreting works

Minimal volumes of water would be required, mainly for concrete curing as ready mixed concrete will be acquired by truck mixers

Table 3-1 below presents the approximate water consumption per WTG for the different construction activities.

Table (3-2): Estimated Water consumption

Activity	Maximum water requirement
Substation foundation curing	1 m^3 per foundation per day, as it Is assumed that 10 days will be sufficient for foundation curing
Tower foundation curing	2 m^3 per tower

- ***Power Source***

During construction and commissioning activities, a small mobile diesel generator will be installed to provide energy in order to undertake construction works.

3.4.4 Construction Emissions and Wastes

Construction operations may generate gaseous emissions, liquid effluents, noise and solid waste as follows:

- ***Noise***

The main noise sources during construction include heavy equipment, and machines and vehicle movement.

- ***Air Emissions***

Air emissions during construction phase include smoke, fumes, exhaust gases and dust from site clearance, excavations and filling, construction and transportation of construction materials.

- ***Wastewater***
  The domestic waste water generated during construction will be collected in a septic tank and collected by authorized contractors for off-site disposal in a licensed wastewater treatment plant.

- ***Solid Waste***
  Non-hazardous solid wastes will include:
  - Packaging and plastic, wood scrap waste
  - Unused construction materials, off-cuts from piping and cabling bulks;
  - Civil wastes and debris such as sand, cement, bricks, aggregates, steel parts, aluminium, wood, etc.
  - Municipal solid waste from workforce, offices and administration buildings.

  The solid waste will be collected by a licensed contractor for safe disposal through approved sites. Non-hazardous wastes will be separated in labelled containers prepared for this purpose.
- ***Hazardous waste***
  Hazardous wastes include mainly waste oil, used sprays and lubricants.
  Hazardous wastes will be packed and stored according to the national legislation and remove hazardous waste through authorized waste management contractors.
  Potential hazardous wastes of oily nature from the project will finally be disposed of through Petrotrade Company[2].

3.5 Operation Activities

3.5.1 Labour

Preference will be given to workers from neighbouring areas, depending on the availability of suitable qualifications.

During operation, permanent employees on site are expected to be a maximum of 10.

3.5.2 Utility inputs for operation

- ***Water***

Domestic Water

Regarding the potable water for human use (i.e. drinking, washing and cleaning) during operation, water supply would be usually via tankers from the Hurghada – Ras Gharib Nile water pipeline. An on-site water tank will be installed in order to provide potable water to the buildings. The daily consumption is expected to be 50 liter/ person per day.

[2] Petrotrade is the company authorized by the Egyptian General Petroleum Company for collection and treatment of waste oil from industrial activities.

3.5.3 Operation Emissions and Wastes

- ***Wastewater***

  The wastewater treatment system must be designed considering the number of permanent and temporary people that will remain in the facility during the operation of the plant.

  The generated domestic wastewater sludge will be unloaded by external truck of authorized WW contractors.

- ***Solid Waste***

  Non-hazardous solid wastes will include mainly municipal solid waste from workforce, offices and administration buildings. The solid waste will be collected by a licensed contractor for safe disposal through approved sites or safe waste disposal site. EETC will contract a licensed contractor for solid waste disposal.

- ***Hazardous Waste***

  Hazardous wastes include mainly waste oil, transformers cooling oils, used sprays, contaminated plastic and metallic containers from machinery and maintenance activities. Wastes of oily nature will be temporarily stored in designated area inside tightly closed barrels and finally disposed through Petrotrade Company.

4. Environmental Baseline

The baseline aims to provide an assessment of the environmental sensitivity at and/or surrounding the site to and potential hazards of the study area.

The environmental baseline will address the following issues in particular:

- **Physical Environment**
- **Biological Environment**
- **Socio-economic characteristics**

This section of the report is based on a desk study and on field visits to the project area surroundings carried out during December 2017 as well as a rapid site visit on 3-4 April 2018. The desk study mainly relied on publicly accessible data sources such as Central Agency for Public Mobilization and Statistics (CAPMAS), as well as previous detailed specialist studies of the study area carried out by Environics in 2014 (Environics, 2014a; 2014b; 2014c) and in 2015. Technical reports and recent literature covering the same area, as well as satellite images have also been utilized. Findings of the field visits were used to refine and supplement information on the project site and nearby sensitivities. Desk reviews were complemented by consultation with key concerned stakeholders, which were carried out earlier, in the context of preparation of the ESIA for the wind farm project.

4.1 Physical Environment

This section presents regional information on land use, meteorological conditions, topography and geomorphology, geology, as well as surface and ground waters, with emphasis on the project site and its surroundings.

4.1.1 Climate

Similar to the rest of the Eastern Desert, the study area is hyper-arid. The climate is warm and dry except for rare and sporadic flash floods during the winter. The summer is hot and dry, whereas few sprinkles may occur in spring. The average temperatures in summer range between 30-35ºC, while the average winter temperatures range between 20-25ºC. The prevailing northwesterly winds dominate. The total annual rainfall is 1 mm/year, with a high evaporation rate.

a. Wind

The prevailing NW-NNW wind dominates most of the year. The figures below show the expected wind rose and wind speed distribution for the site. According to the provided Lekela project documents, the winds data (Figure 4-1 and Figure 4-2) are based on data measured at 80m height within 40km from the site, and have been verified using MERRA reanalysis data from NASA.

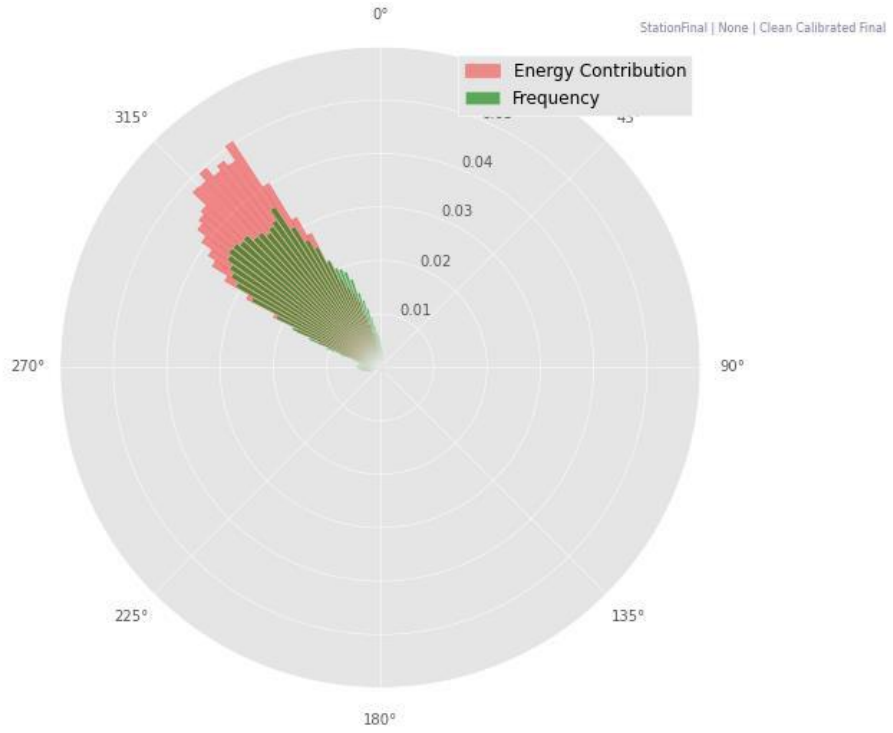

Figure 4-1: Wind Rose
Source: Lekela Project documents

The monthly wind speed variations are shown below.

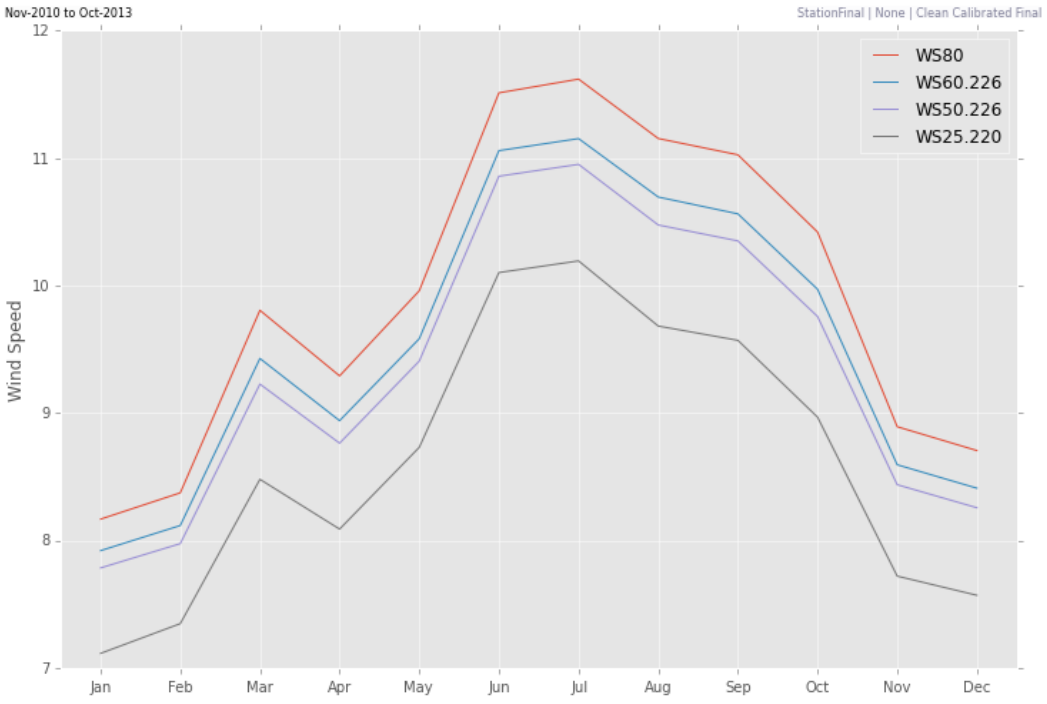

Figure 4-2: Wind Speed Variations
Source: Lekela Project documents

4.1.2 Air Quality

There are no emission sources at the area that may affect the air quality. Traffic frequency of vehicles of the oil companies is low and has no relevance for the air quality. This applies also for the main Ras Ghareb – Zaafarana Highway as well as the Ras Ghareb – Minya asphalt road where even less traffic occurs. Deterioration of air quality takes place during windy days, which are quite frequent. Due to the desert character of the area, the level of dust and fine sand content in the air is quite high in case of high wind speeds which reach 15 m/s and more. Based on wind speed measurements at nearby stations, such high wind speeds are expected to be in the order of 8% of the time.

The desert soil contains significant concentration of salt, which is uplifted by stronger winds. Moreover, about 10% of the wind is coming from the northern sector and has absorbed salt when passing the Gulf of Suez at a distance of about 4km.

Deterioration of air quality takes place during windy days, which are quite frequent. Due to the desert nature of the area, the level of dust and fine sand contents in the air is quite high in case of high wind speeds

4.1.3 Noise

No measurements of the ambient noise level are carried out due to lack of man-made noise emission sources and of sensitive receptors in and around the project site (RECREE, 2018), which was confirmed to remain the case during the visits of December 2017 and April 2018. The existing sources of noise potentially result from natural ambient noise levels in the project area resulting from high winds speeds occurring frequently. There is very few traffic tacking place on the adjacent roads.

Such punctual noise from cars are negligible compared to the natural noise level, and cannot be detected on site.

4.1.4 Topography and Geomorphology

Due to the mountainous nature of the Red Sea region, the ground surface elevation reaches about 1960 meters above mean sea level and decreases to zero at the shores of the Gulf of Suez.

The surface configuration of the Red Sea and Eastern Desert is a result of combined endogenous and exogenous processes. The complicated tectonic history of the Gulf of Suez region produces unique types of landforms as shown in Figure 4-3.

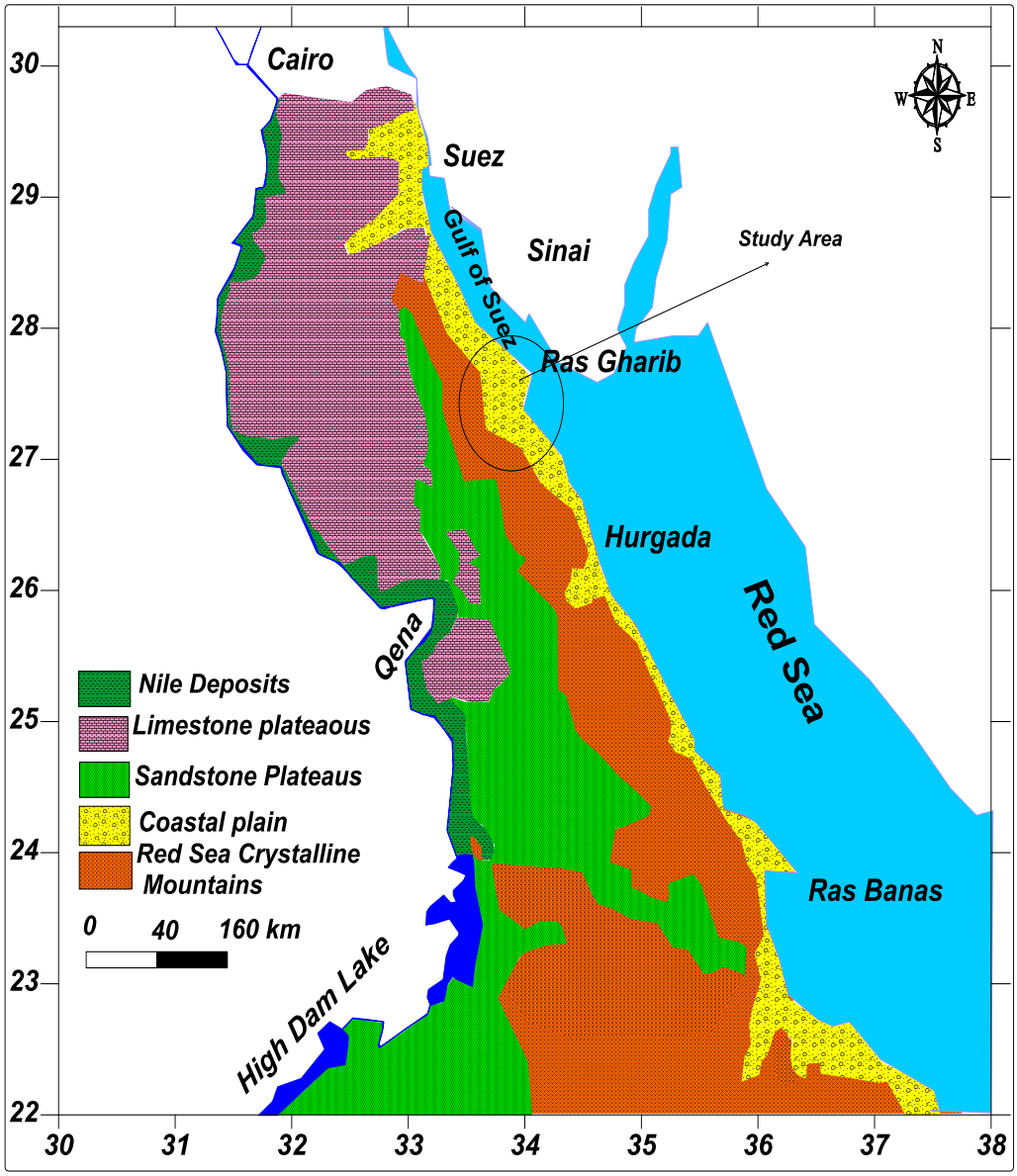

Figure 4-3: General Geomorphology of Eastern Desert

4.1.5 Geology and Soils

Ras Ghareb area represents most of the geologic setting of the Gulf of Suez province. The sedimentary section ranges in age from Pre-Cambrian to recent. A geological map of the study area is shown in Figure 4-4. The project site is located in an area of Undifferentiated Quaternary Deposits, characterized by the presence of alluvial fans, wadi deposits, sand, gravel and recent coastal deposits. The soil surface is composed of detritus, sands and pebble while the underlying layer is composed of conglomerate sands and coral limestone.

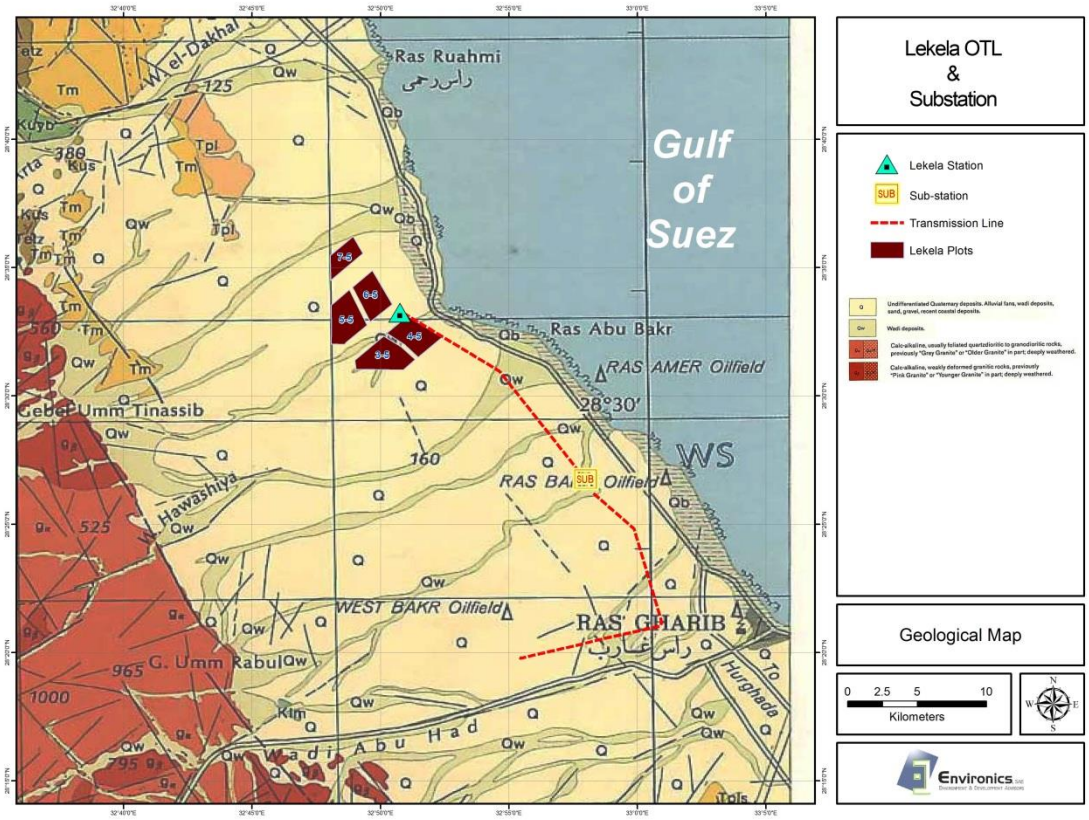

Figure 4-4: Gelogical map of the study area
(extracted from Geological Map of Egypt)

4.1.6 Surface Water Conditions

There are no permanent fresh surface water bodies or streams in area. There are, however, dry streams through which occasional precipitation on the Eastern Desert mountains finds its way to the Sea. These flash floods could represent a serious event resulting in extensive loss of life and property. The Red Sea area is subjected to seasonal flash floods which are characterized by their high velocity and low duration with a sharp discharge peak. The recorded history indicates the occurrence of significant flash floods that affect the coastal areas along the Red Sea as shown in Table 4-1. These floods threaten people and man-made structures along their main streams and the outlet of their catchments. The gradual increase of human activities and the extension of settlements along the Red Sea coast increase the impacts of flash floods and resulting socioeconomic impacts.

Table 4-1: Historical records of flash floods along the coastal areas of the Red Sea

Date	Area	Reference
26-27 October 2016	Hurghada, Ras Ghareb and Sohag	- UN Office for the Coordination of Humanitarian Affairs (UNOCHA), (OCHA, 5 Dec 2016) https://reliefweb.int/disaster/fl-2016-000114-egy - http://floodlist.com/africa/egypt-deadly-flash-floods-hit-sohag-red-sea
17-18 January 2010	Along the Red Sea	- Water Resources Research Institute (WRRI)
May 1997	Safaga and El Qusier	- Information and Decision Support Center in Red Sea Governorate, 2009. - The National Authority for Remote Sensing and Space Sciences (NARSS)- Red Sea Governorate, 1997.
November 1996	Hurghada and Marsa Alam	

Date	Area	Reference
November 1994	Safaga and El Quseir	
August 1991	Marsa Alam	- Reports of Red Sea Governorate, 1994. - Red Sea Environmental Profile, 2008
20 October 1990	Wadi El Gemal between Marsa Alam and Shalateen	
23 October 1979	Marsa Alam and El Quseir	

Flood Hazard

Flood hazards can be divided into primary hazards that occur due to contact with water, secondary effects that occur because of the flooding, such as disruption of services, health impacts such as famine and disease, and tertiary effects such as changes in the position of river channels. To determine the possible impact of the flash floods on the project area, a preliminary flood intensity mapping was carried out as presented in Figure 4-5. The mapping exercise was inferred from a previous hydrological study of the area (Environics, 2014a). It is noted that the substation project site is not intersected by major flood streams, whereas the transmission line intersects a few intermediate and higher order streams, which are advised to be avoided while locating the towers.

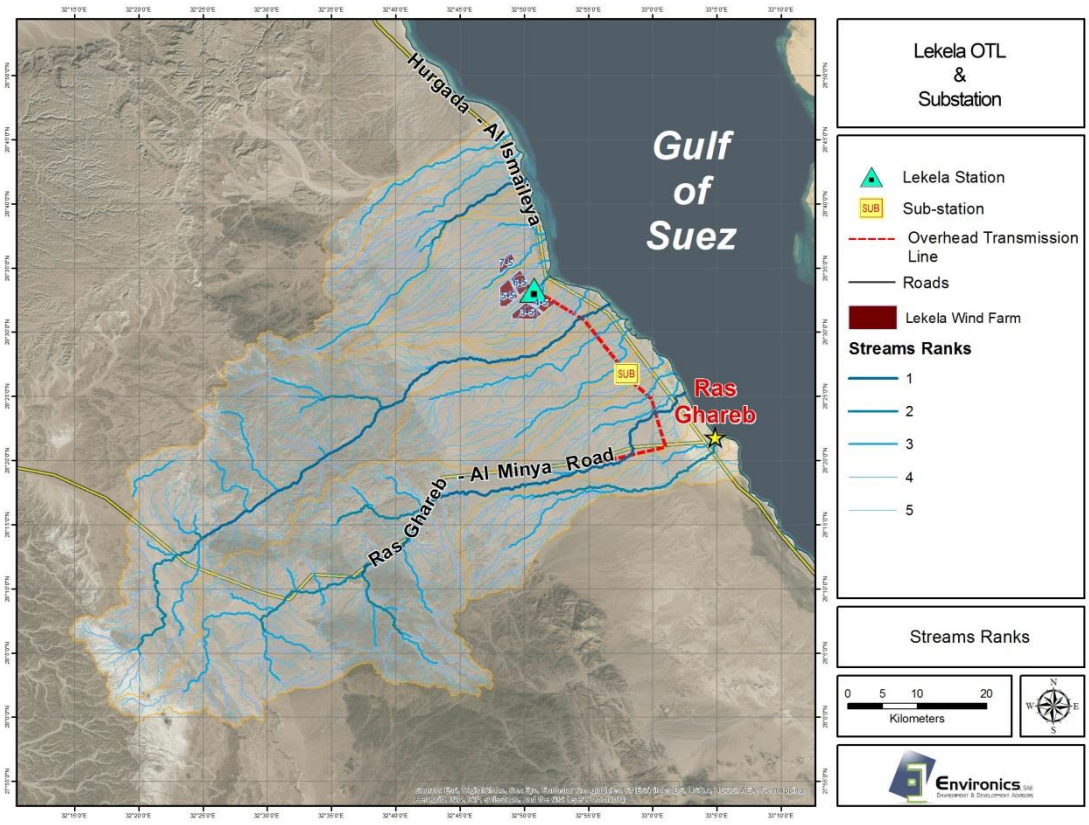

Figure 4-5: Drainage basin streams ranking

Flood risk

Probability rating of flooding in each basin is done by considering certain causative factors. The causative factors taken into account for this study include: maximum daily rainfall, side slopes of watershed, type of soil and land use. Accordingly, the flood risk map is classified into four classes: very high, high, moderate and low.

The flood risk levels of the drainage basin that affect the project area are shown in Figure 4-6. According to the inferred map, the flood risk for the substation falls in a medium risk zone, but close to a higher risk zone towards the south. As mentioned earlier, attention should be taken while locating the transmission towers.

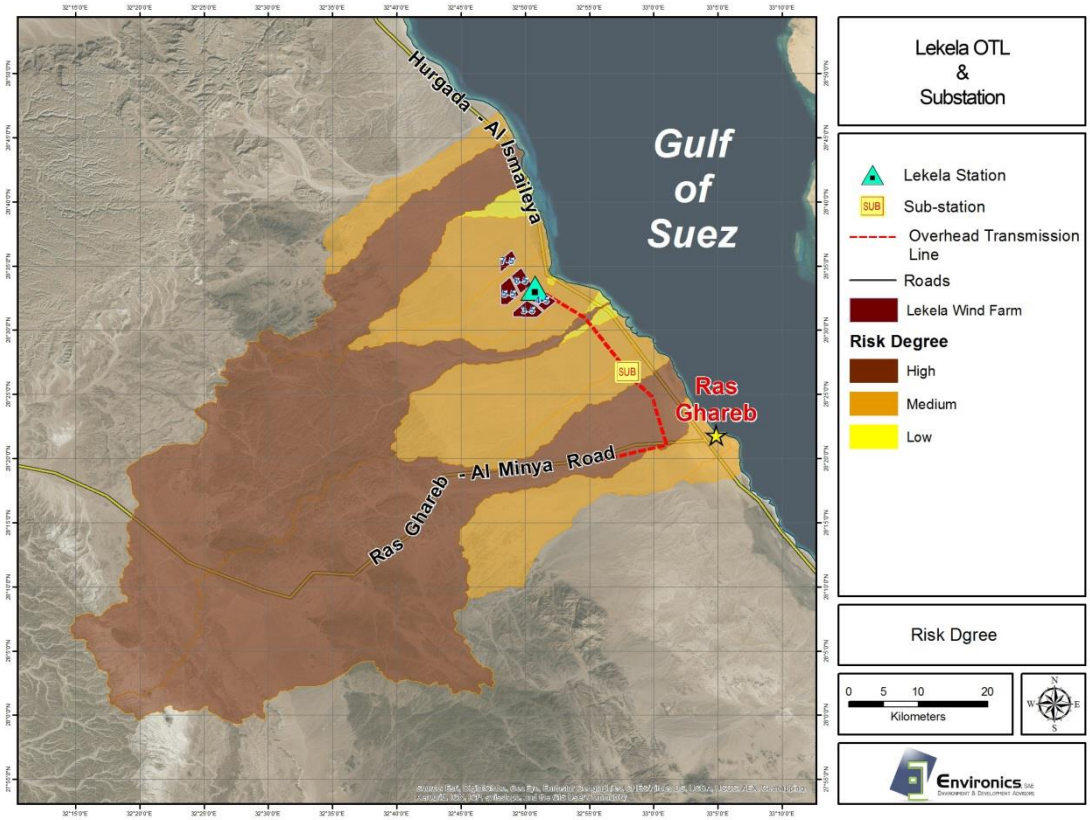

Figure 4-6: Flood risk map for the project site and wider area

Flood intensity

Intensity is the rate of rainfall, and duration is how long the rain lasts over an area. It is a function of flood depth and flow velocity depending on topographic and soil characteristics. The inferred map indicates that the substation location falls a in medium flood intensity zone (Figure 4-7), while the transmission line mostly falls in lower intensity zones.

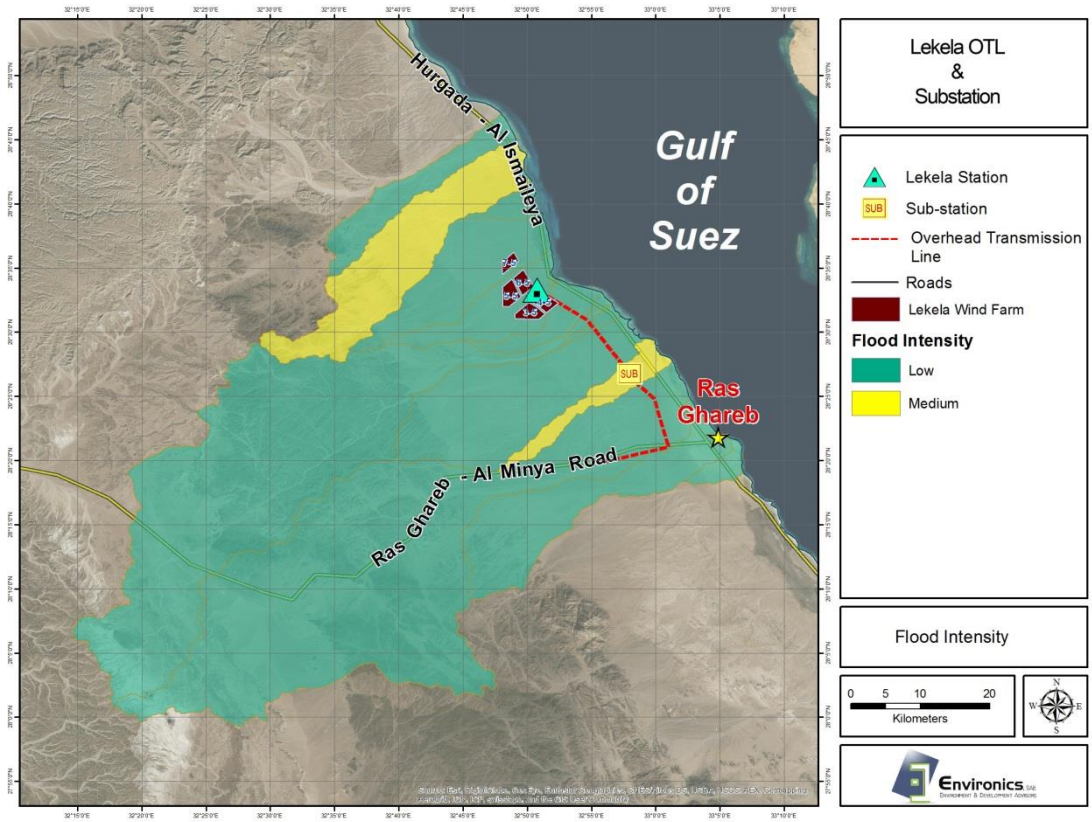

Figure 4-7: Flood Intensity map for the project site and wider area

In conclusion, the substation location falls in an area of medium intensity and risk. Accordingly, in terms of hazards, the potential floods are not expected to be of a destructive nature, whereas caution is required while selecting the tower locations.

It must be noted here that the above maps show lower flood intensity zones (Figure 4-7) falling in areas of higher flood risk level (Figure 4-6). To clear the potential contradiction in these two maps, it is important to understand that high flood risk is an indication of high rainfall intensity, high rate of the basin slope and the degree of imperviousness of the basin rocks. Despite the high flood risk at the basin level, the flood intensity might be low. The reason behind is that the width of the stream may be large and hence the runoff depth and velocity will be small. Moreover, the low flood intensity does not necessitate that the study area is safe against flash floods.

4.1.7 Groundwater Hydrology

The project site is located in an area of wadi deposits, surrounded by local moderately to low productive aquifers with insignificant surface recharge and limited sub-surface recharge.

The available literature information does not enable estimation of the water depth at the project specific area. In the wider area, the recent well inventory and the available literature show that groundwater wells are concentrated within Wadi Dara, located about 50 km south of the project site.

The collected information from 20 groundwater wells in Wadi Dara reveals that the well depth varies between less than 10 meters and reaches up to 300 meter. Groundwater samples collected from Wadi Dara wells indicate that the water salinity varies between 2800 ppm and 5000 ppm. The water is mostly brackish and is of NaCl type. This hydrochemical features indicate that such water is only suitable for the irrigation of salt tolerant plants. It is also of limited potential and expensive to utilize due its depth. Nevertheless, it is still a valuable resource.

4.1.8 Earthquakes

The seismic activities in the Egyptian territory occur along the following belts (El-Hadidy, S. et al 2003) as shown in Figure 4-8, below.

- Gulf of Aqaba-Dead Sea trend,
- Gulf of Suez trend,
- Cairo-Suez road trend,
- East Mediterranean-Cairo-Fayum trend,
- Mediterranean coastal dislocation trend, and
- Southwest Cairo seismogenic zone.

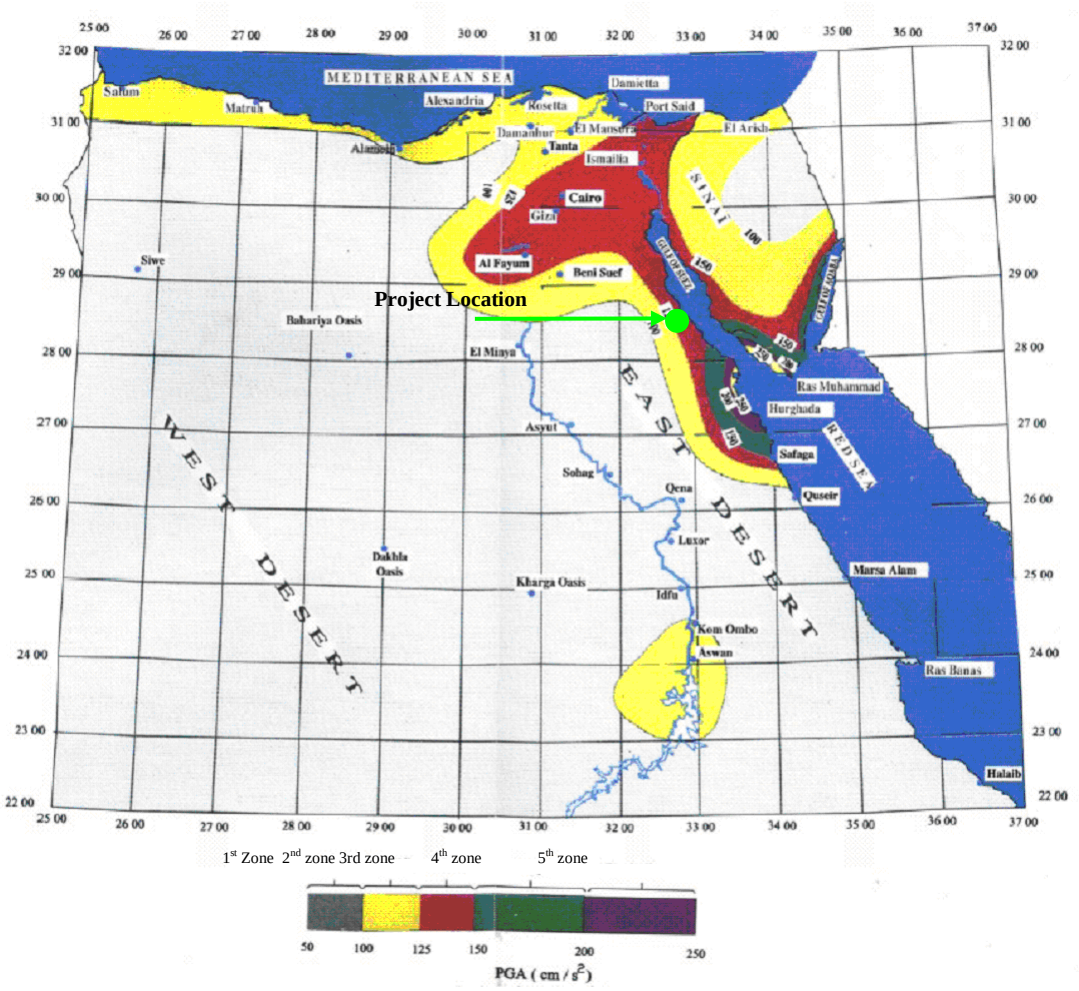

Figure 4-8: Earthquake Zones

4.2 Biological Environment

This section describes the biological environment within the project wider area and focuses on the project area, including the specific project site and its immediate surroundings.

4.2.1 Ecology of the Wider Area

This section is based on literature review, field surveys carried out by NREA (2013), Environics (2014c) during the period 4-7 August 2014[1], as well as project-specific field investigations carried out by Environics' team in December 2017and a rapid visit on 3-4 April 2018.

Literature review and field surveys of the project area and its hinterland show that the region is organized ecologically into three principal terrestrial ecosystems, lying on west-east axis perpendicular to the coast, as illustrated in Figure 4-9. These are the coastal mountains, the desert coastal plain and the littoral belt that includes coastal salt marshes.

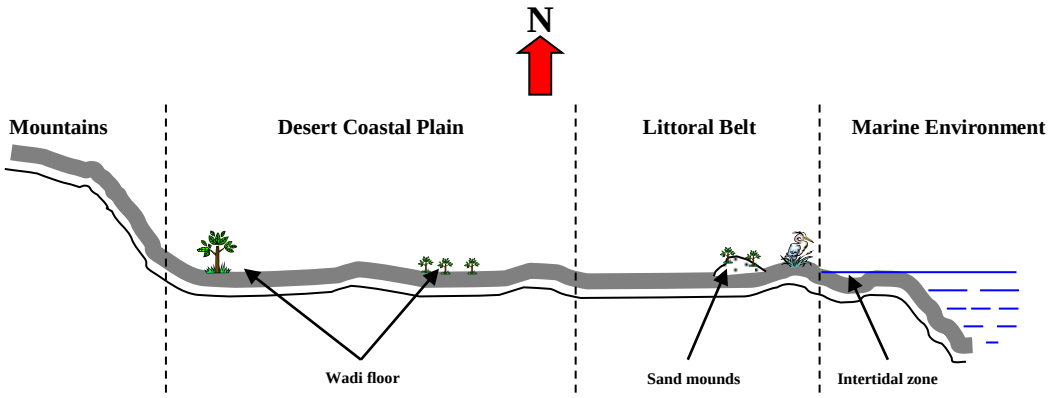

Figure 4-9: Schematic representation of the ecological zones of the study area

a. Flora

In August 2014, Environics carried out a detailed floral survey of three Petroleum concessions. The flora of the study area was surveyed through random selection of a number of stands (each 50 × 50 m Figure 4-10) to represent the vegetation physiognomy and the different habitats of the study area.

[1] These field investigations were carried out during the preparation of the ESIA for seismic acquisition for three Trans Globe concessions (Environics, 2014c), which enclose the Lekela site.

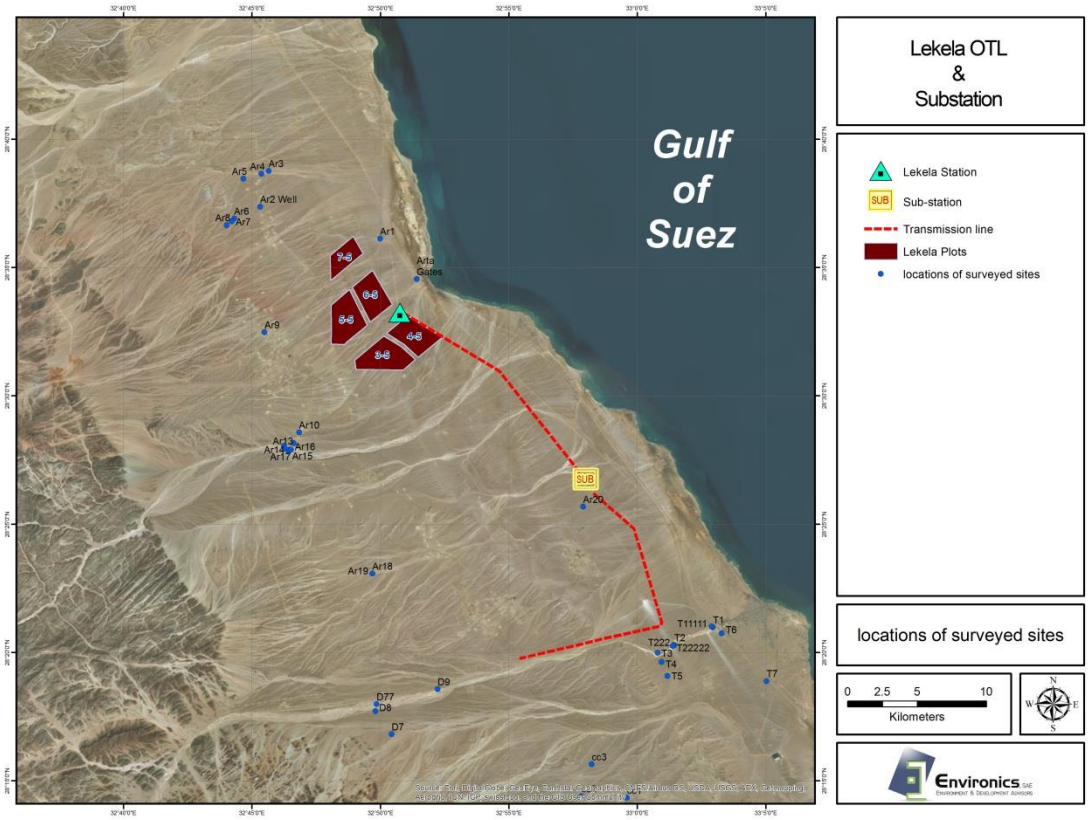

Figure 4-10: The sites surveyed during the August 2014 survey

The results of the survey indicate that the vegetation of the wider area is scarce with low species diversity. Twenty-five species (18 perennials and 7 annuals) were recorded.

Fifteen species of the total number of species were very common such as: *Amaranthus graecizans*, *Citrullus colocynthis* and *Pulicaria incisa*, while nine species were common such as: *Acacia tortilis* subsp. *raddiana*, *Atriplex halimus* and *Salsola imbricata*, and one species, *Atriplex leucoclada*, is rare.

Moreover, results of the Strategic Impact Assessment carried out by RCREEE and Lahmeyer International and Ecoda (2018) for the whole wind farm area confirmed that the vegetation cover in the project area is extremely sparse and restricted to single drainage channels. Vegetation within the area generally has a low species composition, density and a very patchy distribution.

Plants found in the project area were mostly limited to very sparse communities of *Ochradinus baccatus* and *Zygophyllum coccineum*. *Stipagrostis plumosa* was observed in the southern part of the project area. No tree or larger bush occur within the project area. All species found within the wider project area are common and widespread in the Eastern Desert and, thus, not believed to be endangered or threatened.

b. Fauna

The faunal description is based on literature review and previous surveys of the project wider area (Environics, 2014c; NREA 2013), as well as a project specific survey. The surveys included the main wadis dissecting the coastal plain and the littoral area. Particular attention was given to Wadi Hawashiya that intersects the location of the transmission line, to the north of the substation location.

Reptiles

Reptiles include Bosc's Lizard (*Acanthodactylus boskianus*), Red Spotted Lizard (*Mesalina rubropunctata*) Egyptian Gecko (*Tarentola annularis*), Egyptian Fan-toed Gecko (*Ptyodactylus hasselquistii*) and Keeled Rock Gecko (*Cyrtopodion scabrum*), Sinai Agama (*Pseudotrapelus sinaitus*) Egyptian Dabb Lizard (*Uromastyx aegyptia*). Shokari Sand Snake (*Psammophis schokari*) and the Horned Viper (*Cerastes cerastes*) are very common (Baha El Din, 2006; NREA, 2013). The latter is an extremely venomous snake whose bites could result in human fatalities. This species has been observed during the November 2015 survey (Figure 4-11) in the western part of wadi Hawashiya.

Figure 4-11: Horned Viper (Cerastes cerastes)

Avifauna

Resident Birds

Resident birds include true desert species such as Mourning Wheatear (*Oenanthe lugens*), Desert Wheatear (*Oenanthe deserti*), Spotted Sandgrouse (*Pterocles senegallus*), Crowned Sandgrouse (*Pterocles coronatus*), Greater Hoopoe Lark (*Alaemon alaudipes*), Desert Lark (*Ammomanes deserti*) and Cream-coloured Cursor (*Cursorius cursor*). Two species of concern, the Sooty Falcon (*Falco concolor*) and the Barbary Falcon (*Falco pelegrinoides*), have been also previously recorded from the wider area (NREA, 2013). In addition, several individuals of Nile Valley Sunbird (*Anthreptes metallicus*) have been

found roosting and nesting on *Acacia tortilis* in the western part of Wadi Hawashiya during the November 2015 survey (Figure 4-12).

Figure 4-12: A nest on Acacia tortilis in the western part of Wadi Hawashiya.

The littoral area at Ras Ghareb is highly influenced by human activities. This is reflected on fauna which is mainly composed of commensal and opportunistic species. For example, a large colony of Desert Raven (*Corvus ruficollis*) is present in the area (Figure 4-13). Other common resident birds include the House Sparrow (*Passer domesticus*), Barn Swallow (*Hirundo rustica*) and Rock Dove (*Columba livia*).

Figure 4-13: Desert Ravens at Ras Ghareb feeding on human waste

Therefore, potential mismanagement of waste generated during project activities might attract commensal and opportunistic species as well as pest species to the site.

Migratory Birds

The Red Sea attracts hundreds of species of wintering and migratory coastal birds, as well as many seabirds. The narrow 100-km strip extending along the Gulf of Suez – Red Sea Coast from Ras Gharib in the north to the bay of Ghubbet El Gemsa in the south is classified as Important Bird Area (IBA) by BirdLife International[2] (Figure 4-14) according to a set of criteria developed by BirdLife International Secretariat and may be considered a bird migrating route of the highest global importance (Baha El Din, 1999; Baha El Din[3], personal communication). Vast numbers of migrant soaring birds are funneled through this stretch of coast on both spring and autumn journeys. Birds of prey, storks and pelicans migrate through and usually land, rest or roost near the coastline and on the surrounding

IBA Categories Applying to the Area

Category A1: Globally threatened species
The site regularly holds significant numbers of a globally threatened species, or other species of global conservation concern.

Category A4: Congregations
iv) Site known or thought to be a bottleneck where > 20,000 storks (Ciconidae), pelicans (Pelecanidae), raptors (Accipitridae and Falconidae) or cranes (Gruidae), or a combination thereof, regularly pass during migration.

[2] Gebel El Zeit IBA (Code: EG031)
[3] Dr. Sherif Baha El Din represents BirdLife International in Egypt.

desert plains and hills. Resting and roosting storks especially, utilize the two bays of Ghubbet El Zeit and Ghubbet El Gemsa and the salt marsh at Sabkhet Ras Shukeir. Moreover, almost all of the vast numbers of White Stork (*Ciconia ciconia*) that migrate over South Sinai in autumn (most of the world population) pass through this area. A one-day count on 7 September 1998 produced a total of 56,000 White Stork (Baha El Din, 1999). Black Stork (*Ciconia nigra*), White Pelican (*Pelecanus onocrotalus*) and many species of birds of prey also pass through the area in huge numbers. The most numerous birds of prey are Steppe Eagle (*Aquila nipalensis*), Steppe Buzzard (*Buteo buteo*), Honey Buzzard (*Pernis apivorus*) and Levant Sparrow Hawk (*Accipiter brevipes*).

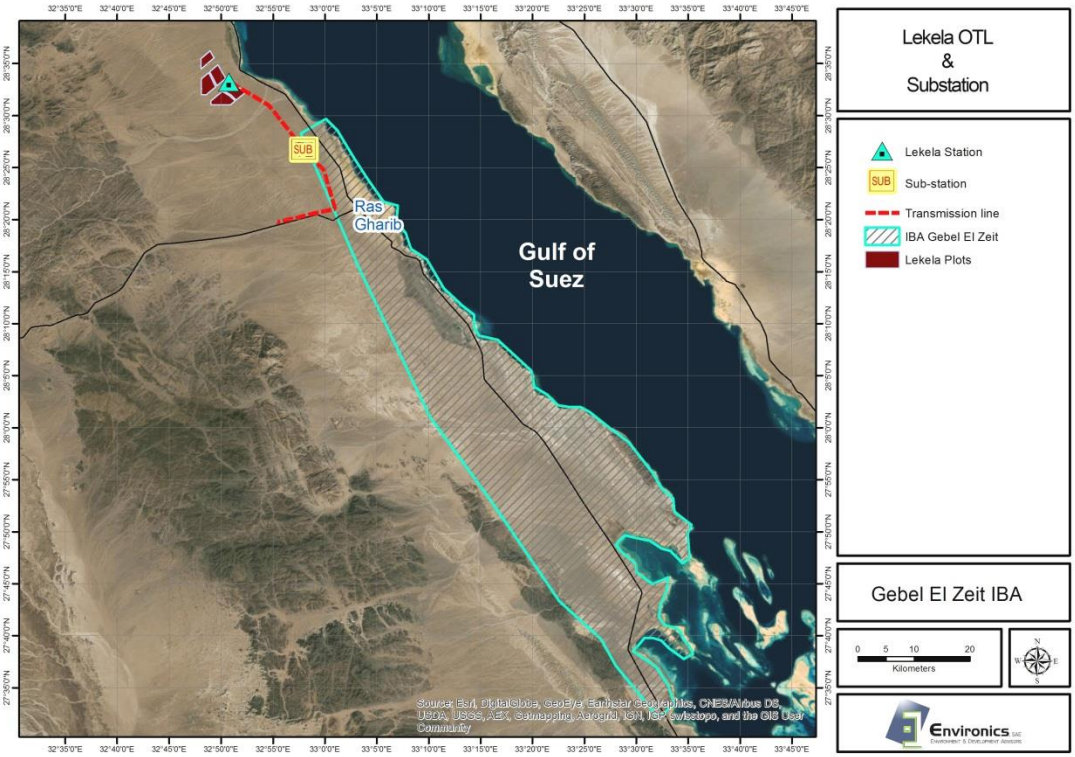

Figure 4-14: Location of Gebel El Zeit IBA (source: BirdLife International)

Mammals

Few mammals have been documented in the wider area, indicating that diversity and density is very low because of the harsh living conditions in the desert. However, most mammals expected to be present in the region are active at night, possibly another reason for the limited numbers of records.

Burrows indicate the presence of rodents. According to literature and previous records in the wider area (NREA, 2013), these might include the Lesser Egyptian Jerboa (*Jaculus jaculus*), the widespread and abundant Greater and Lesser Egyptian Gerbil (*Gerbillus pyramidum* and *Gerbillus gerbillus* respectively). The Cape Hare (*Lepus capensis*) is reported to be present, but it might need more vegetation than currently found.

Burrows and tracks of Red Fox (*Vulpes vulpes*), are regularly seen in the wider area (Figure 4-15) and the animal itself have been sighted in several occasions. Rüppell's Fox (*Vulpes rueppellii*) is less frequently observed, probably due to the presence of fewer individuals but also due to the more elusive nature of the animal.

Figure 4-15: Fox burrow in the western part of Wadi Hawashiya

4.2.2 Ecology of the Specific Project Area

The project area includes the site and its immediate surroundings, including Wadi Hawashiya, which is located north of the substation location.

a. Flora

The soil of the project site is composed of a hard sandy substrate covered with gravel, stones and boulders. Moreover, there are no depressions where water would accumulate, allowing the growth of vegetation. As a result, the project site is totally devoid of vegetation

The eastern part of Wadi Hawashiya which is almost contiguous to the project site was also found devoid of vegetation, as shown in Figure 4-16. The wadi soil differs from coastal plain. It has a looser texture mainly composed of sand, with few gravel and pebbles.

Figure 4-16: Total absence of vegetation in the eastern part of Wadi Hawashiya

b. Fauna

The three main habitats of the wider area recur from north to south, showing similar ecological features. Therefore, species known to be present in the wider area can be potentially present in the project site and surroundings. In addition, due to their high mobility, the presence of animals can be hardly delimited to definite locations and can be found in different areas and habitat types. However, it is important to note that none of the species found within the wider area were recorded in the project area and immediate surroundings (excluding migratory birds).

Avifauna

This section describes a number of seasonal monitoring events that took place within the project wider area through the period 2015 to 2017, as presented hereunder:

i. Detailed seasonal ornithological survey, prepared by Lahmeyer International and Ecoda (2017) for RCREEE

The detailed seasonal ornithological survey was carried out as part of the Strategic and Cumulative Environmental and Social Assessment Active Turbine Management Program (ATMP) for Wind Power Projects in the Gulf of Suez targeting the overall development area including the project site. The survey focused on large soaring species (target species) as these birds have limited flight ability, are less maneuverable, have larger body sizes and spans and are therefore considered to be significantly more vulnerable than other bird species. Nevertheless, other migrating species, local and roosting birds were recorded too, to identify important breeding or roosting sites and habitats for vulnerable or endangered species.

The main bird monitoring took place during three different migration periods and lasted from:

- April 15th to May 25th, 2016 (comprising the 2nd half of spring migration period in 2016);
- September 10th to November 10th, 2016 (comprising two third of autumn migration period in 2016); and
- February 20th to May 20th (comprising full spring migration period in 2017).

The investigation was based on standardized observations using fixed observation sites. A total of 14 observation sites were selected to obtain a representative sample of migration of large soaring birds within the project area. Observations covered 35 days (525 hours) in spring 2016, 54 days (950.3 hours) in autumn 2016 and 77 days (1,351.1 hours) in spring 2017.

In addition, in spring and summer 2017, combined transect-/point-counts with mainly direct observations were conducted to collect data on the occurrence of roosting and breeding birds.

The following figure shows the location of the observation sites.

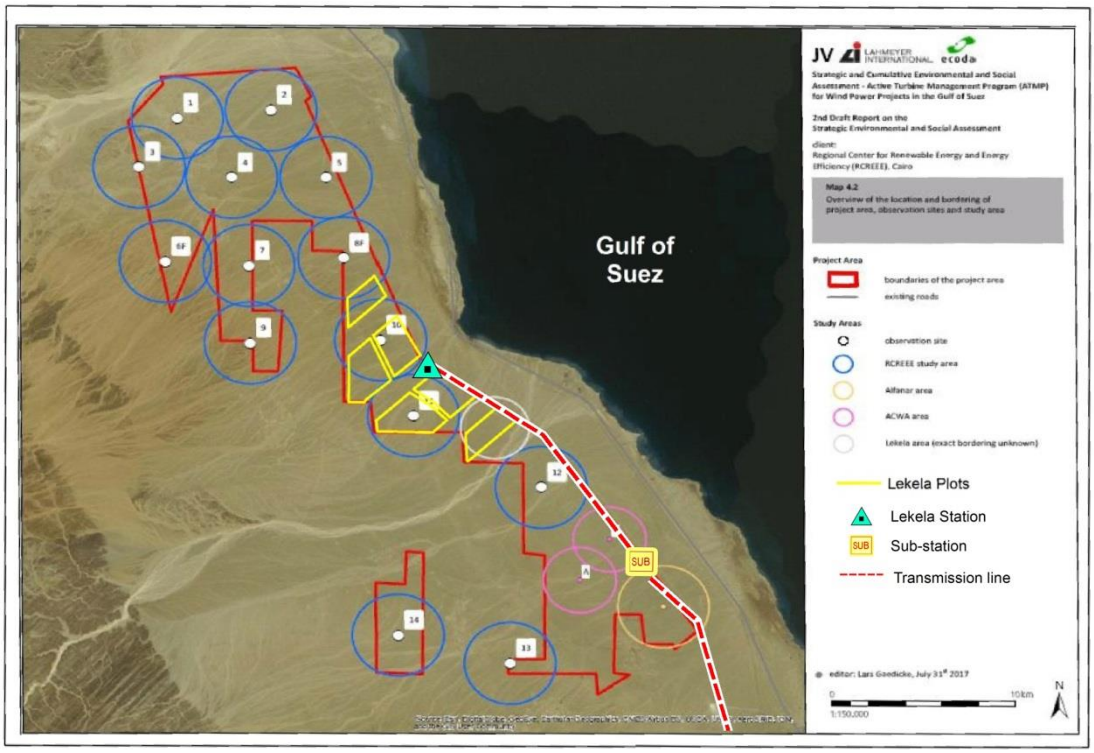

Figure 4-17: Locations of the observation sites (modified from Lahmeyer International and Ecoda, 2017) with respect to the Lekela site

Autumn findings

During the standardized field observations in autumn 2015, lasting from September 26th to November 8th, only very few large soaring birds were recorded at distances of up to 2.5 km to the observation site in the Alfanar area: 138 birds from 15 relevant species. This result was clearly caused by the late start of the survey.

During the study period in autumn 2016, a total of 2,437 birds from 23 target species occurred at distances of up to 2.5 km to the observation sites. European Honey Buzzard, White Stork and Great White Pelican were the most numerous species, representing about 91% of all registered individuals. A total of 318 records (of an individual or a flock) were registered at distances of up to 2.5 km to the observation sites. European Honey Buzzards were registered most often (47% of all records). By contrast, Great White Pelican and White Stork were observed only 3 and 5 times, respectively.

About 74% of all birds and 48% of all records were recorded at altitudes above 120 m. 24% of all birds and 38% of all records were – at least temporary – registered at altitudes from 30 to 120 m. Only few birds/records migrated exclusively at altitudes below 30 m.

Spring findings

During the study period in spring 2016, i.e. from April 15th to May 25th, a total of 66,211 birds from 26 target species were observed at distances of up to 2.5 km from the 14 observation sites. White Stork, European Honey Buzzard, Steppe Buzzard, Great White Pelican and Black Kite were the most numerous species. These five species represented 97% of all registered individuals. White Stork made up about 69% of all registered birds and was, thus, by far the most numerous species. A total of 1,510 records (of an individual or a flock) were registered at distances of up to 2.5 km from the observation sites. Steppe Buzzard (22%), European Honey Buzzard (17%) and Black Kite (13%) were recorded most often. During the study period, four species of special interest (due to their status on the IUCN Red List) were recorded in the study area: Egyptian Vulture (EN), Greater Spotted Eagle (VU), Steppe Eagle (EN) and Eastern Imperial Eagle (VU). In addition the "Near Threatened" species Pallid Harrier and Sooty Falcon occurred in the study area in spring 2016.

In spring 2016 about 62% of all birds and 75% of all records were recorded at altitudes above 120 m. About 31 % of all birds and 19% of all records were – at least temporary – registered at altitudes from 30 to 120 m. Only few birds/records migrated exclusively at altitudes below 30 m. Species listed as "Endangered" of "Vulnerable" were mainly registered at altitudes above 120 m: Egyptian Vulture (85%), Greater Spotted Eagle (100%), Steppe Eagle (80%) and Eastern Imperial Eagle (29%)

Spring migration in the study area might be higher in favorable situations (with wind from southern directions (that rarely occur) or with low wind speeds) and lower in unfavorable conditions (with medium to strong wind from northern directions). However, as northern wind is predominant at the western coast of the Red Sea and as birds need to reach the breeding territories in time (as early as possible), birds are forced to migrate even during unfavorable conditions.

During the study period in spring 2017, i.e. from February 20th to May 20th, a total of 147,611 birds from 27 target species were observed at distances of up to 2.5 km from the 14 observation sites. White Stork, Steppe Buzzard and European Honey Buzzard were the most numerous species. These three species represented 90% of all registered individuals. White Stork made up about 63% of all registered birds and was, thus, by far the most numerous species. A total of 3,601 records (of an individual or a flock) were registered at distances of up to 2.5 km from the observation sites. Steppe Buzzard (27%), Steppe Eagle (23%), Black Kite (11%), European Honey Buzzard (8%) and Short-toed Snake Eagle (8%) were recorded most often. During the study period four species of special interest were recorded in the study area: Egyptian Vulture, Greater Spotted Eagle, Steppe Eagle and Eastern Imperial Eagle. In addition the "Near Threatened" species Pallid Harrier and Sooty Falcon occurred in the study area in spring 2017.

In spring 2017, about 59% of all birds and 58% of all records were recorded at altitudes above 120 m. About 41 % of all birds and 38% of all records were – at least temporary – registered at altitudes from 30 to 120 m. Only few birds/records migrated exclusively at altitudes below 30 m. A relevant portion of birds from species listed as "Endangered" or "Vulnerable" were registered – at least temporary – at altitudes from 30 to 120 m: Egyptian Vulture (32%), Greater Spotted Eagle (30%), Steppe Eagle (21%) and Eastern Imperial Eagle (21%).

For further details on the seasonal ornithological survey, refer to Lahmeyer International and Ecoda (2017).

ii. Detailed seasonal ornithological surveys carried out by Lekela

In addition to the monitoring activities described above, Lekela performed detailed seasonal ornithological surveys targeting the specific wind farm project site (Northern part of the current transmission line and substation project location):

- autumn 2015, 16 August and 5 November 2015, for a period of 82 days (Environics and Hemaya, 2016),
- spring 2016, 10 February and 15 May 2016, for a period of 96 days (Environics and Baha El Din, 2016),
- spring 2017, 20 February and 15 May 2017, for a period of 85 days, (Environics and NCE, 2017a), and
- autumn 2017, 15 August and 5 November 2017 for a period of 85 days, (Environics and NCE, 2017b).

The field methodology and data analysis used for the specific project activities followed the guidelines of the "Environmental Impact Assessment Guidelines and Monitoring Protocols for Wind Energy Development Projects with a particular reference to Migratory Soaring Birds" (MSB Project 2013); which includes guidelines developed by the UNDP/BirdLife International Migratory Soaring Birds Project and adopted by the EEAA.

The methodology was composed of three primary components:

1) fixed vantage point observer-based visual field monitoring of bird migration at the study area;
2) casualty surveys under existing power lines and other ad-hoc observations of mortality within and around the study area; and
3) data analysis and reporting, including review of the available data from other previous and relevant studies.

Six fixed vantage points were selected to conduct stationary observations at the project sites (Figure 4-18). Each monitoring location was established at a central location within the perimeter of each of the Lekela plots, each with a visual radius of roughly 2 km, which is a distance within which birds can be detected and identified with a good level of confidence (as indicated in EEAA guidance). Each observation point was separated from its closest neighboring point by 2.3 to 4.4 km.

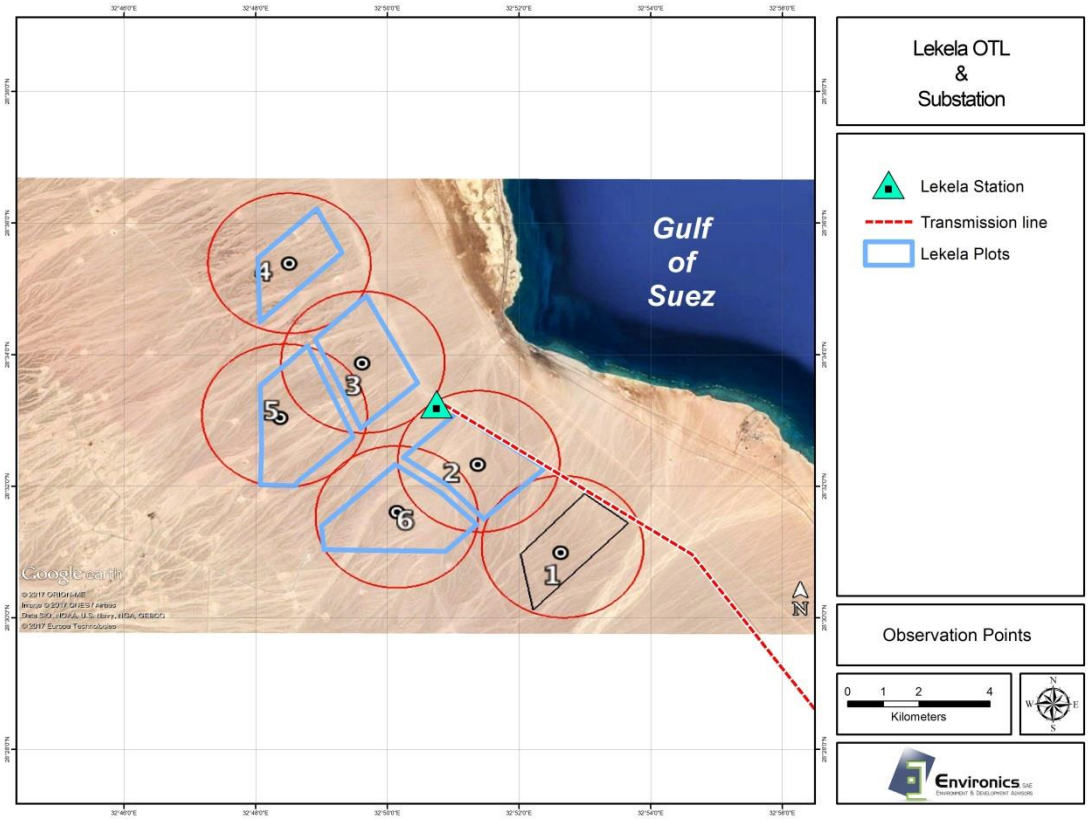

Figure 4-18: The study site showing observation points and 2 km observation radius around each Lekela plots (Northern part of current study area)

The field observations took place on two 5 hour shift basis, one starting at around 7 am and ending at noon and the other starting at noon and ending at around 5 pm.

Observations at each of the six observation points took place every 2-3 days during morning and evening sessions. Thus, during the course of the different seasonal studies, each site was monitored about 14 times during either a morning or an evening session.

Autumn findings

In autumn 2015, a total of 966 observations were made with a total of 23,845 birds belonging to at least 36 species documented, including 1,534 non-soaring birds belonging to 15 species. Of these 16,507 birds were recorded within the project area (of which 616 were non-soaring birds), while 7,338 birds were recorded in the adjacent zone (of which 918 were non-soaring birds). The total number of soaring birds recorded both inside and outside the study site was 22,311 birds, with an overall migration rate of 26.2 birds / hour.

Only four bird species contributed to about 97% of the total soaring birds recorded. The most numerous specie was the White Stork (14,131 birds representing 63.3% of the total), followed by Honey Buzzard (5,992 birds representing 27% of the total), Black Stork (1,000 birds representing 2.2% of the total), and White Pelican (504 birds representing 5.5% of the total). The remaining 17 species of soaring birds combined made up about 3% of the total.

In autumn 2017, the total number of observations of soaring birds inside and outside the study sites was 704 observations, with a total of 22,732 birds belonging to at least 24 species, with an overall migration rate of 28 birds / hour. Of these 582 observations, 17,473 birds belonging to 20 species were recorded within the project area, while 5,259 birds were recorded in the adjacent zone, outside the 2 km radius of observation. The overall migration rate inside the study area was an average of 22 birds / hour, reaching an average of 72 birds / hour during the first three weeks of the study.

In autumn 2017 and 2015,similar to the observations in springs of 2017 and 2016, the same seven species that contributed about 95% of the total soaring birds were recorded, with the exception of a Black Stork, which was represented by a single large flock in 2015 but was absent in 2017. There are only modest variations in the contributions of each species to the total volume of migration, but in large the numbers and diversity is notably consistent amongst the years and seasons, which sheds a good level of confidence in our ability to consistently and accurately detect and identify bird migration in the region.

The most numerous species was the White Stork (14,309 birds representing 63.4 % of the total), followed by Honey Buzzard (7,754 birds representing 34.4 % of the total), and White Pelican (183 birds, representing 0.8% of the total).

Spring findings

In spring 2016, 2,550 observations were made (both inside and outside the study site), resulting in a grand total of 67,358 birds, belonging to 57 specie. 4,530 non-soaring birds belonging to 31 species were recorded. A total of 2,099 observations of soaring birds were made with a total of 62,819 birds belonging to at least 26 species, with an overall migration rate of 57.8 birds / hour. Of these, 31,607 birds were

recorded within the project area, while 31,212 birds were recorded in the adjacent zone.

Seven bird species contributed about 95% of the total soaring birds recorded. The most numerous species was the White Stork (40,510 birds representing 64.50% of the total), followed by Steppe Buzzard (11,304 birds representing 18 % of the total). The remaining 19 species of soaring birds combined made up about 5% of the total.

In spring 2017, 2,868 observations were made (of soaring and non-soaring birds, inside and outside the study sites), resulting in a grand total of 61,179 birds (notably close to the total of 67,358 birds recorded in spring 2016), belonging to 66 species. Of these, 12,205 non-soaring birds belonging to 42 species were recorded.

Notably, the same seven species that contributed to about 95% of the total soaring birds recorded in spring 2016, contributed to about 93% of the total in spring 2017. There are only modest variations in the contributions of each species to the total volume of migration, but in large the numbers and diversity is surprisingly consistent, which sheds a good level of confidence in our ability to consistently detect and identify bird migration in the region.

The most numerous species was the White Stork (23,714 birds representing 48 % of the total), followed by Steppe Buzzard (11,644 birds representing 23.6 % of the total), and Honey Buzzard (3,072 birds, representing 6% of the total). The remaining species of soaring birds combined made up about 20% of the total

Table 4-2, below presents the results of monitoring for the different seasons.

Table 4-2: Birds documented inside and outside the study site in autumn of 2017 and 2015

	Autumn 2017				**Autumn 2015**			
Species	Number of birds	% of total	Number of obs.	% of total	Number of birds	% of total	Number of obs.	% of total
White Stork	14309	63.40	8	1.31	14131	63.34	17	2.04
Honey Buzzard	7754	34.35	431	70.66	5992	26.86	414	49.64
Black Stork	0	0.00	0	0.00	1000	4.48	1	0.12
White Pelican	183	0.81	2	0.33	504	2.26	8	0.96
Black Kite	123	0.54	38	6.23	0	0	0	0
Raptor sp.	63	0.28	14	2.30	239	1.07	118	14.15
Marsh Harrier	108	0.48	86	14.10	151	0.68	117	14.03
Crane	0	0.00	0	0.00	80	0.36	2	0.24
Kestrel	31	0.14	31	5.08	50	0.22	46	5.52
Total	**22571**		**610**		**22147**		**723**	

Table 4-3: Birds documented inside and outside the study site in autumn in spring of 2017 and 2016

	Spring 2017				**Spring 2016**			
Species	**Number of birds**	**% of total**	**Number of obs.**	**% of total**	**Number of birds**	**% of total**	**Number of obs.**	**% of total**
White Stork	23,714	48.2	52	2.39	40,510	64.5	71	3.4
Steppe Buzzard	11,644	23.6	645	29.70	11,304	18	676	32.5
Steppe Eagle	2,550	5.1	335	15.42	2,199	3.5	336	16.1
White Pelican	1,165	2.3	6	0.28	1,775	2.8	17	0.8
Honey Buzzard	3,072	6.2	133	6.12	1,532	2.4	81	3.8
Black Kite	2,181	4.4	285	13.12	1,459	2.3	285	13.7
Levant Sparrowhawk	1,326	2.7	37	1.70	1,073	1.7	10	0.48
Total	**45,652**	**92.8**	**1493**	**69**	**59,852**	**95.3**	**1476**	**71**

Other species

During the November 2015 survey, no signs indicating the presence of reptiles or mammals were found within the project site. The site is characterized by a hard sandy soil generally covered with gravel, stones and boulders, the absence of water and vegetation, and a flat topography. The lack of water, food resources and potential shelters render the site unattractive to most resident fauna of the wider area and only passerby species are expected to occur. On the other hand, stools and burrows indicating a limited presence of wildlife were recorded in the eastern part of Wadi Hawashiya, which intersects the transmission line route, to the north of the substation location (Figure 4-19 and Figure 4-20).

Figure 4-19: Stools found in eastern part of Wadi Hawashiy

Figure 4-20: Rodent burrow found in eastern part of Wadi Hawashiya

Assumptions on species recorded in the wider area that might be potentially present in the project area are presented in Table 4-4. The project area includes the project site and the eastern part of Wadi Hawashiya. Assumptions are based on a set of criteria, including:

- Species range;
- Species occurrence and abundance,
- Presence of suitable habitats;
- Presence of potential sources of food; and
- Expert judgment.

Potential presence of species (probability of occurrence) is categorized into absent, unlikely, possible, probable and definite. However, animals potentially occurring in the project area and immediate surroundings should be regarded as vagrant individuals as the area lacks the presence of resident communities.

There are no habitats of special concern found within the project area, which is located in the wide coastal plain and the eatsern edge of Wadi Hawashiya. The project area and surroundings are totally devoid of vegetation and none of the plant species recorded from the wider area is of conservation concern. This is due to the features of the area which shows a total lack of vegetation, water, shelter and other features that could support the presence of animals.

On the other hand, the western part of the wadi was found to be of more particular concern, as it supports the majority of biodiversity of the area, and thus can be considered a sensitive habitat. Although this sensitive part of the wadi is located far from the project site, off-road driving during construction and operation activities might constitute a potential impact to the wadi.

In conclusion, no additional biodiversity studies are deemed necessary for the Project. In fact, migratory birds flying over the area are of concern, but these have been adequately and comprehensively covered through detailed spring and autumn surveys carried out over a period of two years. On the other hand, the project area and surroundings do

not support any plant, reptile, resident bird or mammal of concern (and definitely no Critical Habitat triggering species), and the presence of wildlife (other than migratory birds) is limited to some vagrant individuals, if any.

Table 4-4: Faunal species of the wider area potentially occurring in the project site and immediate surroundings

English Name	Scientific name	Probability of occurrence	Potential location of occurrence	Rationale
Reptiles				
Bosc's Lizard	*Acanthodactylus boskianus*	Definite	Project site and/or Wadi Hawashiya	Widespread and very abundant. Inhabits a variety of habitats. Found in gravel and stony soils.
Red Spotted Lizard	*Mesalina rubropunctata*	Probable	Project site and/or Wadi Hawashiya	Uncommon but widespread. Found in large wadis and coastal plain. Occasional records in the wider area.
Egyptian Gecko	*Tarentola annularis*	Possible	Project site and/or Wadi Hawashiya	Found in rocky habitats and wadis of flat open desert. More common south of the project area.
Egyptian Fan-toed Gecko	*Ptyodactylus hasselquistii*	Possible	Project site and/or Wadi Hawashiya	Common but usually found more to the south. Found on boulders, vertical rocky faces, under ledges and in caves. Forages in wadis.
Keeled Rock Gecko	*Cyrtopodion scabrum*	Possible	Project site and/or Wadi Hawashiya	Locally abundant. Usually found in urban habitats along the coast. Natural habitat not well known but probably rocky habitats. Has great colonizing capacity.
Sinai Agama	*Pseudotrapelus sinaitus*	Possible	Project site	Widespread in the whole Eastern Desert but with patchy distribution. Found in rocky habitats.
Egyptian Dabb Lizard	*Uromastyx aegyptia*	Possible	Wadi Hawashiya	Colonies recorded in the western part of Wadi Hawashiya. Feeds predominantly on vegetation.
Schokari Sand Snake	*Psammophis schokari*	Possible	Wadi Hawashiya	Common and widespread in arid and semiarid regions with some water including desert lowlands with sparse vegetation, mountain foothills and plateaus. Often finds refuge under stones, building rubble and abandoned rodent burrows. More common in the littoral area.
Horned Viper	*Cerastes cerastes*	Definite	Project site and/or Wadi Hawashiya	One of the most versatile reptiles of the Egyptian deserts. Endures extreme conditions. Common and widespread in rocky and sandy habitats of the Eastern Desert. Sometimes shelters in rodent burrows or under grass tussocks or flat rocks.
Resident Avifauna[4]				
Mourning Wheatear	*Oenanthe lugens*	Probable	Wadi Hawashiya	Common resident of the Eastern Desert. Recorded in habitats similar to those of the project area.

[4] Do not include avifauna recorded during the ornithological survey.

English Name	Scientific name	Probability of occurrence	Potential location of occurrence	Rationale
Desert Raven	*Corvus ruficollis*	Unlikely	Wadi Hawashiya	Recorded in Ras Ghareb and other areas of human presence where waste and other sources of food are found.
House Sparrow	*Passer domesticus*	Unlikely	Project site and/or Wadi Hawashiya	Not a desert species. Found in coastal human settlements.
Barn Swallow	*Hirundo rustica*	Unlikely	Project site and/or Wadi Hawashiya	
Rock Dove	*Columba livia*	Unlikely	Wadi Hawashiya	Rocky seacoast and inland areas.
Nile Valley Sunbird	*Anthreptes metallicus*	Unlikely	Wadi Hawashiya	Recorded nesting and roosting on Acacia trees in the western part of Wadi Hawashiya. However, no Acacia trees are found in the eastern part of the wadi, south of the project site.
Mammals				
Lesser Egyptian Jerboa	*Jaculus jaculus*	Possible	Wadi Hawashiya	Uncommon. Found in desert areas of soft sands or rocks. Prefers sandy arid areas to dig deep spiral hole.
Greater Egyptian Gerbil	*Gerbillus pyramidum*	Probable	Wadi Hawashiya	Common and widespread in the area. Rodent burrows recorded in the eastern part of Wadi Hawashiya south of the project site. Feeds on plants, insects and plant remains in camel dung.
Lesser Egyptian Gerbil	*Gerbillus gerbillus*	Probable	Wadi Hawashiya	
Cape Hare	*Lepus capensis*	Possible	Wadi Hawashiya	Regionally common, but might need more vegetation than actually present. Feed on different plant species including *Acacia* and *Zygophyllum*.
Red Fox	*Vulpes vulpes*	Definite	Wadi Hawashiya	Common and widespread. Covers long distances in search of food.
Rüppell's Fox	*Vulpes rueppellii*	Possible	Project site and/or Wadi Hawashiya	A true desert species found in rocky and sandy deserts. Presence in the wider area ascertained.
Golden Jackal	*Canis aureus*	Unlikely	Project site and/or Wadi Hawashiya	Few records in the Eastern Desert.

4.3 Socio-Economic Environment

The proejct site is located in a desert area where no communities or human settlements are found. The closest city is Ras Ghareb located about 16 km from the project site. Ras Shoqeir is located about 25 km to the South of Ras Ghareb City (about 46 km from the project site), while Wadi Dara Village is located about 50 km to the south of Ras Ghareb City (50 km south of the project site). El Zaafarana is located about 100 km to the north of Ras Ghareb City (77 km north of the project site) Figure 4-21.

The following sections present a brief description of the Ras Ghareb area, focusing on Ras Ghareb City. Data and information are based on secondary sources such as CAPMAS and documents from Ras Ghareb City Council, as well as Environics socio-economic study for Ras Ghareb area (2014b).

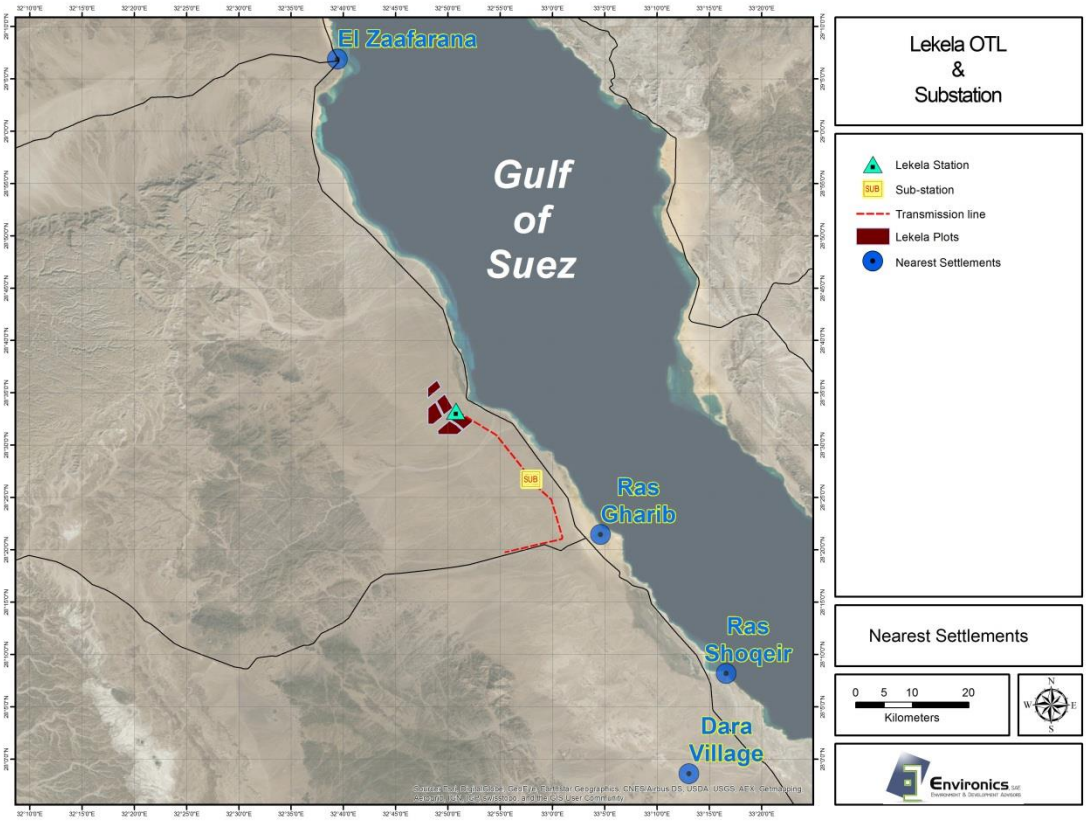

Figure 4-21: Location of the nearest settlements to the project site

4.3.1 Local Context

a. Land Use and Infrastructure

The total area of Ras Ghareb City is estimated at 35 km^2 and the total populated area within this fringe is estimated at 15 km^2 (about 43%). It is estimated that about 35% of total populated area is State land, 30% is Army land, another 39% is usufruct land for Petroleum companies, and almost 5% is privately owned land.

Ras Ghareb City is a small town with many spaces between residential areas. Roads are mostly medium wide and paved. Buildings in the down town are mostly 2 story buildings. Ras Ghareb City has three informal settlements (squatters), for which there are plans for upgrading. However, to date, none of these areas have experienced upgrading works. Newer, modern and higher buildings are already erected or under construction in new extensions on the fringes of Ras Ghareb.

b. Roads and Transportation

Public transportation is available on all main roads. Public buses link Ras Ghareb to many coastal and inner cities in Egypt and have stations in almost all main residential settlements. Many private transportation means taxis operate in the area. The main airport in the area is located in Hurghada at about 80 km south of Ras Ghareb.

The Sokhna-Hurghada is the main road leading to the project area. However, the section from Sokhna for about 30 km southwards is relatively narrow and winding and is considered potentially dangerous. The new double road, Gabal El Galala Road, Sokhna-Zaafarana has recently been completed comprising three lanes in each direction in addition to two interconnections to the old (existing) coastal highway.

4.3.2 Socio-demographic Characteristics

a. Demographics

The main bulk of population in Ras Ghareb (98% of total population) lives in the City representing a balanced male/female ratio (54/46). Average family size is five members. The rest (2% or 115 households) who live in the rural parts of Ras Ghareb District (El Zaafarana and Wadi Dara Villages) are mainly males (81%) and are expected to be male immigrants (RedSeaGov, 2015).

Based on growth rate projections, population of Ras Ghareb is expected to have grown from 32,369 in 2006 to 56,264 in 2015.

b. Educational Levels

Education level in Ras Ghareb indicates that about 11% are illiterate, 34% received pre intermediate level education (read and write, primary education, and preparatory education), additional 37% received intermediate education, and about 5% have a university degree of higher (RedSeaGov, 2015).

4.3.3 Social Services

a. Education

There are 13 primary schools, 9 preparatory and 3 secondary schools in Ras Ghareb with a total capacity of 7272 pupils and average class density of 29-33 pupils. There are also 3 technical schools, two commercial schools, and

2 nursing classes in the City. In addition, there are 26 kindergarten with total capacity of 789 children and average class density of 30 children (Education Department, 2013/2014).

b. Healthcare

Ras Ghareb lacks health services in urban and rural areas. There is only one central hospital, one blood bank, 8 dialysis machines, two operation rooms, two health care units, five family planning units, four ambulance units, and one health office in the City; in addition to one health unit and one ambulance unit in El Zaafarana Village. (Health Department, 2013).

c. Recreation

There are 3 youth centers in Ras Ghareb City including three libraries and two computers only in addition of three private clubs. All three clubs (El Ameleen, Amer, and El Nasr) belong to the Public Petroleum Company in Ras Ghareb (Youth Department, 2013).

d. Social Security and Safety Networks

There is a total of three social units and 38 NGOs (31 charity and seven development oriented) in Ras Ghareb City. In addition, there are 22 nurseries, two elderly clubs, and one rehabilitation center. (Social Security Department, 2013).

4.3.4 Economic Activities

a. Employment and Unemployment

According to Red Sea Governorate electronic portal (2015), about 51% of total population (15+) in Ras Ghareb District is inside the labor force, representing an unemployment rate of 12%. Table 4-5, below presents the employment status for Ras Ghareb.

Table 4-5: Population (15+) distribution by mode of employment, (ResSeaGov, 2015)

Sex	Inside labor force					Total inside labor force	Total outside labor force	Total labor force
	Own business	Self employed	Wage earner	Unpaid laborer	Un-employed			
M	647	525	13277	25	1526	16000	5474	**21474**
F	37	12	3221	33	899	4202	13942	**18144**
T	764	537	16498	58	2425	20202	19416	**39618**

b. Type of Economic Activities

Distribution by type of economic activity indicates that about 17% are engaged in scientific and technical professions, 14% in social services, 13% in mining and oil, 12% in administration, 10% in trade and retail, 8% in construction, 6% in manufacturing, 5% in transport and storage, and 3% in other services (CAPMAS, 2006).

4.3.5 Housing Conditions and Facilities

a. Tenure

In Ras Ghareb City and Wadi Dara Village, the majority of households live in owned dwellings (73% and 96% respectively). In El Zaafarana Village, about 63% own their dwellings in addition to 37% who rent them. About 3% of total households in Ras Ghareb are estimated to be occupying their dwellings without title (CAPMAS, 2006).

b. Type of Dwelling

The majority of households in Ras Ghareb City live in a house (65%), in addition to one third (34%) who live in an apartment. Less than 1% (0.7%) of households in Ras Ghareb City live in a shared room or inadequate dwelling. In El Zaafarana, almost 60% live in a house and 40% in an apartment, while in Dara, all households live in a house (CAPMAS 2006).

c. Facilities

According to CAPMAS census of housing conditions in 2006, the majority of households in Ras Ghareb City (86%) use trenches as a main sanitary drainage system.

The majority of households in Ras Ghareb District have access to potable water inside their dwelling and are connected to the public water network.

The majority of households in Ras Ghareb City (99%) use electricity as a source of lighting.

There are no human settlements or livelihood activities within the proximity of the project site. The closest settlement is Ras Ghareb City located about 25 km south of the project site. Currently, the main road to the site is experiencing very low traffic loads. In some sections the road is not very well serviced, however, with establishing the new Gabal Galala road the site accessibility is highly improved.

d. Electromagnetic Interferences

The corona of overhead transmission line conductors and high frequency currents of overhead transmission lines may result in the creation of radio noise.

A military radar is operated south of the project area. As the area was already cleared by the Ministry of Defense before being assigned for wind power development by presidential decree, it can be assumed that no interference with wind farm developments is expected. One mobile phone telecommunication mast and one radio link mast are placed at the Ras Ghareb-El Shaikh Fadel road southwest of the project area.

Due to the large distance of at least 9 km wind farm developments should not block any signal from any directional transmitters. Moreover, transmission line rights-of way and conductor bundles are created to ensure radio reception at the outside limits remains normal.

4.4 Archaeology and Cultural Heritage

The ESIA for an area of 300 km² at the Gulf of Suez prepared by NREA (2013) regarding wind development projects in the Eastern Desert[5] (about 15 km inland from the Gulf of Suez, west of Ras Gharib), indicated that there are no archaeological, historical or cultural heritage sites existing inside or adjacent to the study area[6].

On the other hand, Castel[7] visited Wadi Hawashiya, located close to the southern borders of the project sites, in 1993 and 1995, and observed at that time traces of copper carbonate (malachite) and copper residues in the sandstone formation, which might be due to old mining activities. Moreover, many tracks on the banks of the wadi contained fragments of granite indicating the presence of quarries in the nearby mountain. Due to lack of time and resources, Castel could not identify their locations (Castel, personal communication, December 2015).

In addition, Tristant[8] mentioned that there are great chances that archaeological sites are located in the area. The project site is located at the mouth of the *via Hadriana* (Murray, 1925), and there might be archaeological sites nearby. For earlier periods, including prehistory, no data is available for this location as the area has never had a systematic archaeological survey (Tristant, personal communication, January 2016).

This being said, the most proximate areas of archaeological significance are found to be about 50 km or more from the project location. The most notable of these are Wadi al Jarf, Saint Anthony and Saint Paul Monasteries, Wadi Dara, Gebel Zeyt and Bir Abu Nakhlah, in the figure below.

[5] Adjacent to the project site

[6] Environmental and Social Impact Assessment for an Area of 300 km² at the Gulf Of Suez. New and Renewable Energy Authority (NREA). November 2013.

[7] Dr Georges Castel, Institut français d'archéologie orientale (IFAO), Cairo, Egypt

[8] Dr Yann Tristant, Senior Lecturer, Department of Ancient History, Level 5, W6A Building, Macquarie University, NSW 2109, Australia

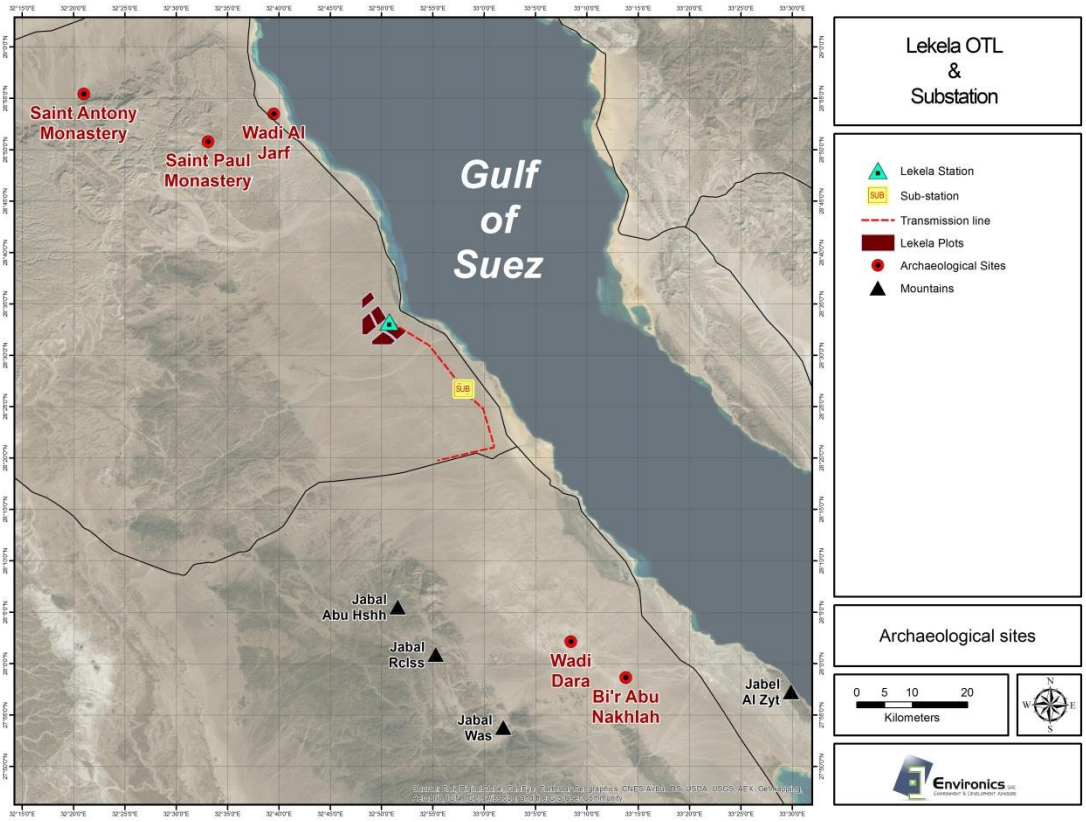

Figure 4-22: Sites of archaeological significance near the project site

5. Analysis of Alternatives

The analysis of alternatives is based on the evaluation of numerous project alternatives during the conceptual and pre-feasibility design phases.

When evaluating alternatives, particular emphasis was placed on the environmental and social implications of the alternatives to ensure that the option selected is environmentally sound and meets the Egyptian Laws and regulations.

5.1 No Development Alternative

The alternative not to develop the proposed overhead transmission line and substation was used in this ESIA as the scenario with which to compare the environmental and social impacts of project construction, operation and closure.

It is worth mentioning that the project allows Egypt to benefit from one of its main renewable energy resources, through connecting a wind farm project to the national grid. As such, the wider project will contribute to meeting part of continuously increasing energy needs in Egypt. It will also contribute to lessening greenhouse gases emissions, particularly CO_2, that would have been generated if the same amount of energy was generated from fossil fuel fired power plants. This is of great importance following the Paris Agreement in 2015 where it was decided that countries, including Egypt, will be bound to reduce the greenhouse gas emissions.

It is worth mentioning that if the "no-development" alternative be selected, it would not be possible to connect the electricity generated via the wind farms to the grid, leaving the wider wind farm project useless. Moreover, the land proposed for the development would still be used for other renewable energy projects related infrastructure.

Considering the type and nature of the project and that its minimal potential impacts, the "no development" alternative has not been given further consideration.

5.2 Alternative Overhead Transmission Line Route

The selected route runs parallel to the existing roads and crosses the eastern side of Wadi Hawashiya, thus minimizing the potential impacts on the western side of the Wadi, which is of higher ecological value.

5.3 Alternative Substation Location

The substation must be located along the transmission line route to enable stepping up the voltage to another existing substation level. The proposed location also avoids the Wadi Hawashiya, where ecological importance was

identified. However, the location selection will still be fine-tuned to minimize intersection with drainage lines.

5.4 Alternative Transmission Methodology

Overhead transmission was selected over underground since it allows for easier maintenance and future upgrade (to carry more power). Overhead transmission costs are also much less, and require less earthwork (trenching).

5.5 Alternative water sources

Water consumption is not considered significant for either the construction or operation phases of the project. However, the site is not connected to any water sources, thus the potential options would include:

Groundwater abstraction

As stated in the baseline section, groundwater wells are concentrated within Wadi Dara, The collected information from 20 groundwater wells in Wadi Dara reveals that the well depth varies between less than 10 meters and reaches up to 300 meter. The construction and utilization of groundwater wells needs permits from the Ministry of Irrigation and Water resources as well as a separate Environmental Impact Assessment Study. In this context, the management of wells, potential well clogging and the disposal of the resulting pre-treatment liquid waste (brine and/or backwash of demineralization column) constitute the main constraints facing the option of groundwater usage. Moreover, the costs for well construction may be significant, while the required volumes of water are minimal.

In this respect, abstracting water from wells is not a preferred option for the project.

Water trucking

Water can be provided via tankers transporting water from the Hurghada – Ras Gharib Nile water pipeline[1]. The transmission water pipeline passes parallel to the Suez – Hurghada road. Water trucking depends on the water requirements for construction and domestic uses during the project construction phase as well as water for domestic use during the operation phase. As described in Chapter 3 above, a water tank will be constructed for domestic uses. In this respect the water trucking does not involve additional infrastructure. Water trucking depends on the water requirements for construction and domestic uses during the project construction phase as well as water for domestic use during the operation phase. For concreting works, the concrete will arrive in ready-mix form. The flexibility and adaptability of water trucking, it is most convenient during operation.

[1] According to the ESIA for an area of 300 km² at the Gulf of Suez prepared by NREA (2013)

6. Environmental and Social Impacts Assessment and Mitigation

6.1 Methodology

Environmental assessment was carried out to identify potential impacts of the project on the environment as well as impacts of the environment on the project. The assessment was carried out in three main steps, as follows:

1. Identification of potential impacts
2. Evaluation and assessment of the impacts in terms of their significance
3. Identification/ proposing mitigation measures for minimizing the effects of the significant impacts.

6.1.1 Identification of Potential Environmental and socio-economic Impacts

Potential impacts of the proposed project are identified based on a modification of the Leopold matrix (Table 6-1). The matrix was designed such that the key potential impacts associated with the project become immediately apparent. The layout of the matrix is arranged as follows:

- The "rows" of the matrix consist of a list of activities presented according to construction and operation activities. It also consists of the list of aspects associated with each activity or group of activities.
- The "columns" consist of the resources and receptors susceptible to impacts categorized as physical, biological and socio-economic environment. Identified resources and/or receptors were:

    - Air quality
    - Noise level
    - Soil
    - Habitats, flora and fauna (excluding avifauna)
    - Avifauna
    - Public health
    - Employment
    - Workplace health and safety
    - Infrastructure (Roads)

6.1.2 Evaluation and Assessment of Impacts

The interaction between the different activities and the environmental receptors, identified through the baseline information, was carried out. Such interactions may result in negative or positive impacts. The different types of impacts were identified.

Based on the analysis of the baseline environmental conditions and the nature of the receiving environment, some aspects were found to be irrelevant to specific activities of this particular project. These are identified as "scoped out impacts"

Potential relevant impacts were subject to a process of impact evaluation, based on the analysis of the proposed project components and activities, in order to determine the significance of the different impacts. The evaluation process takes into account the information collected in the field, available in the literature and/or based on the professional judgment of the consulting team and public consultation.

Impact evaluation is based on pre-set criteria including, impact magnitude, duration, planned mitigation measures, regulatory standards and sensitivity of environmental receptors.

6.1.3 Scoped out Impacts

Potential impacts in the Leopold matrix were identified in relation to their effects on potential receptors. This step would facilitate eliminating and scoping out irrelevant impacts taking into consideration the following:

- Type of project
- Location
- Characteristics of the surrounding environment.
- Receptor sensitivity or importance: depends on its nature, value, scarcity etc. There are three types of receptors:

  - On site receptors encompassing soil and workplace.
  - Receptors surrounding the site such as ambient air, humans, plants and animals.
  - Final sinks/receptors such as surface and groundwater.

Examination of the environmental setting of the area and the operational processes has shown that the following impacts are irrelevant:

- **Impacts on "surface water quality", "ground water quality" and "aquatic life"**
  There are no fresh surface water bodies or aquatic life in the project area. In addition, given the nature of the project will be no interaction with the groundwater in the area especially that the groundwater table is at considerable depth, (refer to baseline chapter) Moreover, the project activities during construction and operation have no interaction with the groundwater in the area.

- **Visual Impact**
  Visual effects arise from changes in the composition and character of views available to receptors affected by the proposed development (e.g. residents, recreational users, tourists etc). Visual impact assessment considers the response of the receptors who experience these effects, and it considers the overall consequence of these effects on the visual amenity of the view. There are no receptors near the project area, and these are limited to the transient drivers along the surrounding roads. Moreover, the project does not introduce a new element for these drivers, since overhead power transmision lines already exist on the road from Zaafarana to Hurghada, while the substation structure has a small footprint and will not

pose any visual intrusion. Accordingly, the visual effects of the project are insignificant.

- **Impacts on archeology and cultural heritage**
  According to the Environmental and Social Impact Assessment for the adjacent area of 300 km², no cultural heritage components exist within the project area. Moreover, there are no registered antiquities within or in close proximity to the proposed project location. However, Castel and Tristant[1] (personal communication 2015-2016) mentioned that there is a potentiality to have archeological remains in Wadi Hawashiya. Therefore, in case of unlikely chance find, the appropriate chance find procedures will be implemented, which mainly entail halting the activities and fencing the area while notifying the concerned authorities immediately according the stipulation of Law 117 of 1983 concerning the Protection of Antiquities.

  Table 6-1 below presents the project aspects during its construction and operation phases and their potential (adverse/positive) impacts on the relevant environmental components. For each potential negative impact the significance before and after implementing the design integrated measures and/or applying management and monitoring practices is determined as will be elaborated below.

[1] Refer to Chapter 4 .4 – Socio-economic Conditions

Table 6-1: Potential / Residual Impacts Matrix

Activities (Sources of impacts)	Aspects	Environmental Attributes[1]										
		Physical Environment			Biological Environment				Socio-economic			
		Air Quality	Noise level	Soil	Habitats	Flora	Fauna (excluding Avifauna)	Avifauna	Public Health	Employment	Work place H & S	Infrastructure (Roads)
Construction Phase												
- Site leveling - Civil works - System components installation (OTL and Substation) - Electrical installations - Pre-commissioning - Workers' accommodation and transport - Transport of materials, etc.	• Labor	NA	NA	NA	NA	NA	NA	NA	NA	+	NA	NA
	• Dust Emissions	-	NA	NA	-	-	-	-	-	NA	-	NA
	• Gas emissions (vehicles & equipment)	-	NA	-	-	-	-	-	-	NA	-	NA
	• Noise (vehicles & equipment)	NA	-	NA	NA	NA	-	-	NA	NA	-	NA
	• Construction waste (including generation of solid and liquid municipal waste)	NA	NA	-	-	-	-	NA	-	NA	-	NA
	• Accidents (vehicles & equipment)	NA	NA	-	-	-	-	-	-	NA	-	-
	• Spills (vehicles & equipment)	NA	NA	-	-	-	-	NA	NA	NA	-	-
	• Off-road driving	-	-	-	-	-	-	NA	NA	NA	-	NA
	• Sewage from workers	NA	NA	-	NA	-	-	NA	NA	NA	NA	NA
	• Water consumption	NA	NA	NA	NA	NA	NA	NA	-	NA	NA	-
Operation Phase												
Activities related to workforce	• Labor	NA	NA	NA	NA	NA	NA	NA	NA	+	NA	NA
	• Municipal solid waste generation	-	NA	-	-	-	-	NA	-	NA	-	NA
	• Water consumption	NA	NA	NA	NA	NA	NA	NA	-	NA	NA	-
	• Sewage generation	NA	NA	-	-	-	-	NA	NA	NA	NA	NA
	• Off-road driving	-	-	-	-	-	-	NA	NA	NA	-	NA
Operation activities	• Noise (from turbine rotation and transformers)	NA	-	NA	NA	NA	-	NA	NA	NA	-	NA

1) (-): Negative impact (+): positive impact N/A: Not applicable

6.1.4 Mitigation Measures

The project intends to result in a net positive environmental impact. Mitigation measures are either incorporated as an integral part of the project design or through environmental management and monitoring measures. By implementing both types of mitigation measures, the residual impacts, which are those possibly remaining after implementing the mitigation measures, will be minimal/insignificant/ acceptable. As much as possible, the avoidance and prevention of impacts is favored over minimization, mitigation or compensation. Based on the impact identification and evaluation process, irrelevant impacts are scoped out of the assessment process, and mitigation measures are proposed for significant impacts, while minor impacts are integrated within the management plans of the facility.

6.2 Impact Assessment

Based on the preliminary analysis of the baseline environmental conditions, nature of the receiving environment and the project activities, it is indicated that the main environmental adverse impacts would result during the project construction phase, where civil works take place including the use of different construction vehicles, heavy equipment, construction of internal roads and manpower. Adverse impacts during operation on the physical and socioeconomic aspects are considered not as significant and may be addressed through management plans and procedures.

6.2.1 Positive Impacts

- **Employment**

  The project will provide employment during construction and operation phases. Priority will be given to the local workforce. In this respect, the availability and duration of jobs will depend on the job function and construction schedule and phases.

  An additional direct benefit during the construction phase is the opportunity for ‘on-the-job’ training for local people.

  It is estimated that during the construction phase of the project would provide about 200 direct job opportunities to the local community. During operation, permanent employees at the substation are expected to be approximately 10.

  It is envisaged that local medium sized businesses will be able to supply the majority of auxiliary components such as ladders, ducts and platforms as well as nuts and bolts.

  Approximately 40 percent of the jobs available during construction will be undertaken by semi-skilled and unskilled labour, while 60 percent of the construction jobs will require skilled labour[3].

[3] Environmental Impact Report Revision 2 Proposed 90 MW Drennan Photovoltaic (PV) Power Facility, Eastern Cape Solaire Direct Southern Africa, 2014

Accordingly, the project will contribute to positive social impacts including community development and reduction of local unemployment mostly during peak construction phase

6.2.2 Potential Negative Impacts

After exclusion of the irrelevant impacts and identifying the positive impacts, the remaining "potential negative impacts" were assessed based on the following criteria:

- ***Magnitude*** of the impact.
- ***Duration:*** period of time that impact lasts.
- ***Mitigation measures;*** its availability whether integrated in the project design or implemented as management measures**.**
- ***Adherence to regulatory standards according to Egyptian legal and regulatory framework*** (described in Chapter 2).
- ***Public concern*** and perception

6.2.2.1 Impact of the project on the physical environment

- **Ambient Air quality**

Construction Phase

Construction activities may result in minor, localized, short term, air quality impacts in the form of dust/particulate matter from soil leveling and emissions from construction equipment and transport vehicles. Both towers and the substation will require laying of reinforced concrete foundations. Normal civil works will be required for the substation, including reinforced concrete and brickwork. This is in addition to the transformer electrical installations. The towers will also be assembled on site and the electric cables installed and connected to the wind farm and grid.

A small mobile diesel generator will be used for electricity supply during construction. Accordingly, air emissions during construction include dust, nitrogen oxides, sulphur oxides and carbon monoxide.

Such impacts are localized and will occur for relatively short duration and are expected to affect mainly the workplace environment. On the other hand, impact on public health is unlikely due to the fact that the nearest residential area to the site is the coastal town of as Ghareb at distance more than 28 km to the east of the proposed site. Thus, this impact is considered minor.

Mitigation Measures

To prevent dust emission from vehicles, the project contractors will ensure that all vehicles entering or leaving the site carrying a load that may generate dust are covered, expect during loading and unloading.

EETC will ensure that the contractors will install, operate and maintain dust control measures and/or equipment in the areas in which the risk is identified (such as mobile water tanker equipped with a pump and sprays to suppress dust from unsealed roads or storage area or consider windy days in the plan of the activities).

Residual Impacts

The above mitigation measures are anticipated to be sufficient for minimizing the potential impacts. Therefore, the residual impacts of construction on the air quality are negligible.

Operation phase

The operational phase will have minimal emissions, mainly due to transport of persons and supplies/wastes and potential maintenance requirements. However, given the nature of the project, these activities are minor and the air emissions are considered insignificant.

Residual Impacts

No residual impacts

- **Ambient Noise levels**

Construction phase

The activities that can generate noise are excavations, earthworks, concreting and construction equipment. The use of construction equipment may result in localized, short term, increase in noise levels. Table (6.2) shows typical noise levels, in decibels, expected at various distances from construction machinery.

It is not expected that noise from the construction activities would pose impacts on the neighboring areas (roads or nearby communities) as they are located at significant distances. The coastal town of Ras Ghareb is about 16 km to the east of the site. Thus, the impact on ambient noise from the construction activities is considered minor

Table (6-2): Average Noise Levels from Construction Equipment

Equipment Type	Distance from Noise Source (dBA)			
	10m	15.3 m	50m	100m
Crane	72	-	58	52
Bulldozer	74	-	60	54
Generator	76	-	62	56
Backhoe	79	-	65	59
Concrete Mixer	-	85	-	-
Concrete Pump	-	82	-	-
Concrete Vibrator	-	76	-	-
Truck	-	88	-	-

*Doubling the distance drops the intensity by about 6 dB and that 10 times the distance drops the intensity by 20 dB[4]

[4] The Inverse Square Law is an idealization because it assumes exactly equal sound propagation in all directions. If there are reflective surfaces in the sound field, then reflected sounds will add to the directed sound and you will get more sound at a field location than the inverse square law predicts. If there are barriers between the source and the point of measurement, the propagated noise intensity may get less than the inverse square law predicts. Nevertheless, the inverse square law is a logical first estimate of the sound at a distant point in a reasonably open area. Estimating Sound Levels with the Inverse Square Law, http://hyperphysics.phy-astr.gsu.edu/hbase/acoustic/isprob2.html

Mitigation Measures

EETC and their contractors will put in place the following control measures:

- Machines and construction equipment must comply with the best practice technical developments
- Periodical maintenance of machines and equipment with internal combustion engine according to the manufacturer's instructions.

In addition, if necessary a grievance mechanism will be adopted for assessing complaints associated with construction noise, if any.

Residual Impacts

Noise resulting during construction activities is unlikely to have an impact on the general public. However, the impact of construction activities on workplace can be potentially significant. But with implementing the above mitigations measures and health and safety procedures, residual impacts are considered negligible.

Operation phase

The results of the Strategic and Cumulative Environmental and Social Assessment Active Turbine Management Program (ATMP) for Wind Power Projects in the Gulf of Suez, on the Strategic Environmental and Social Assessment for the Area of 284 km2 at the Gulf of Suez[5] prepare by The Regional Centre for Renewable Energies and Energy Efficiency (RCREEE), as well as based on literature review, potential cumulative noise from wind farm plants (the wider project) ranges from 35 to 65 db. Moreover, the IFC Environmental, Health, and Safety Guidelines for Electric Power Transmission and Distribution state that "noise in the form of buzzing or humming can often be heard around transformers or high voltage power lines producing corona.

The general audible noise levels associated with ***overhead transmission lines*** are highest during heavy rainfall. However, since the sound of raindrop splash contributes to high ambient noise levels and thereby masks the sound produced by the line, the crackling (hissing) and low frequency humming sounds associated with high voltage transmission are more apparent following rainfall or during foggy weather. Wet-conductor noise levels generated by standard de sign 500-kV transmission lines are primary sources of annoyance rather than an environmental hazard.

Design standards are such that nominal operation will result in noise levels of about 49 dB (wet-conductor conditions) at the centerline, and 46 dB[6] at the edges of the transmission line ROW. It is worth noting here that the project does not include ultra-high voltage lines, and lies within a considerably dry location.

[5] Strategic and Cumulative Environmental and Social Assessment Active Turbine Management Program (ATMP) for Wind Power Projects in the Gulf of Suez, on the Strategic Environmental and Social Assessment for the Area of 284 km2 at the Gulf of Suez, March 2018

[6] 500 kV INTERNATIONAL TRANSMISSION LINE NSP-TR .1 Forbes, Minnesota to Manitoba, Canada Northern States Power Company U.S. DEPARTMENT OF ENERGY, 1979

Given the significant distance of receptors at Ras Ghareb, the contribution of the project to the ambient noise level is minimal. Accordingly, the potential noise impact is considered insignificant.

Regarding the noise levels within the workplace, implementing the mentioned mitigation measures and implementation of effective occupational health and safety measures including restricted access to the substation and providing the tower/line maintenance workers with the necessary personal protective equipment (PPEs) and limiting the exposure period, the residual impacts in workplace are considered negligible.

Mitigation measures

The following mitigation measures could be implemented during operation to minimize the potential noise impacts:

- Potential noise generating machines and equipment are designed to meet statutory regulations concerning noise.
- Acoustic enclosures are installed for noise generating equipment, wherever possible such as inverters and transformers
- Workers at noise generating machinery and equipment will be provided with the suitable PPEs.

Residual Impacts

Potential noise during operation activities is unlikely to have an adverse impact on the public. Moreover, the impact of noise on workplace will be negligible with implementing the above mitigations measures and health and safety procedures.

- **Soil**

  Construction phase

  Generally, the construction activities are unlikely to result in soil contamination that will need future decontamination and clean-up activities.

  Potential impacts during construction phase generally result from domestic wastewater management, material and waste storage, accidental spills from machinery, and potential spills from the diesel generator and lubricating oils.

  Mitigation measures

  Wastes generated during construction phase will be collected by an approved contractor to be disposed of in designated landfill sites. Mitigation measures mainly involve site management procedures and good housekeeping activities and proper waste management measures. Other construction wastes will be safely and temporarily stored on site and periodically disposed through approved contractors.

  Contractors will be forced to apply good workmanship and housekeeping during construction by contractual stipulations and by assignment of supervising engineers in order to assure adequate and timely disposal of solid waste and waste water, as well as to prevent or to collect spillages of used oils, grease, diesel, etc. Diesel fuel used on site will be stored with

secondary containment to minimize release to soils. Other construction wastes will be safely and temporarily stored on site and periodically disposed through selling to contractors, if possible.

In addition, during construction, contracts with different contractors will include requirements for periodic inspection of equipment and machinery which will contribute to minimizing spills and leaks. The E&S site personnel will follow up on the contacts performance and ensure they abide by the contract EHS stipulations.

Septic tanks will be constructed for collection of domestic wastewater. It will be insulated with bituminous lining for leak prevention. Contents will be emptied regularly for disposal at the nearest wastewater treatment plant at adequate intervals through a licensed contractor.

It is worth noting that effective housekeeping can eliminate some workplace hazards and contribute to allow a work to be carried out safely and in proper manner. Effective housekeeping involves:

- Regular cleanliness of workplace
- Regular collection and disposal of waste
- Maintaining clean and orderly surfaces, aisles and stairways
- Organized and orderly storage of material, tools and equipment
- Spill control and cleanup

Thus, the potential impacts on soil as result of the different activities are considered moderate.

Residual impacts

Impact on soil during construction activities will be negligible with implementing the aforementioned housekeeping and management measures.

Operation phase

During the project operation, potential soil impacts may arise from domestic wastewater management, material and waste storage accidental spills from machinery, and potential spills from the diesel generator and lube oils.

Thus, the potential impacts on soil are considered moderate.

Mitigation measures

As part of its EMP, the project will develop a waste management system to comply with the national legislation as well as septic tank integrity checking. In addition, the emergency response plan shall include response to spill scenarios.

Any supply or change of oil, lubricant or hydrocarbon to vehicles will be done in gas stations. These activities shall not be carried out on site and strict control will be applied by a site supervisor.

The contractors will provide effective protection for land and vegetation resources at all times and should be held responsible for any subsequent damage.

Domestic wastewater will be collected in an isolated internal sewage system and discharged to a lined concrete septic tank for periodic emptying through licensed sewage trucks.

Residual impacts

Upon implementation of the mitigation measures, potential impacts of the project operation on the soil are not significant.

- **Water**

  While domestic water consumption during operation will be primarily due to domestic uses and the estimated water consumption would be less than 1 m^3/day (assuming 40l/person/day - 10 person).

  Water use will be optimized and this quantity will not have significant impact on water resources. EETC will also implement preventive maintenance equipment to avoid water leaks or losses and monitor the proper functioning of toilets, avoiding leaks, overflows, etc.

  The impact of this project on water resources consumption is of little consequence.

6.2.3 Impact on the Biological Environment

The project sites' are located in the wide coastal plain, composed of a hard sandy substrate covered with gravel, stones and boulders with limited vegetation restricted to the borders of tracks and minor landlocked wadis. Few signs of animal presence have been recorded within the sites' boundaries. However, due the high mobility of species known to be present in the wider area, the presence of animals can be hardly delimited to definite locations and can be found in the project site and surroundings. The eastern side of Wadi Hawashiya intersects the transmission line location, while the substation location lies south of the Wadi. It is worth noting that the wetsern side of the Wadi, which falls outside the project location, is the area of concern because it is richer in biodiversity and species representing all the trophic levels of the ecological pyramid of the area have been recorded within a very close range. In this respect, such species can be affected by the construction and operation activities of the project.

- **Construction Phase**

  Habitats

  The project will involve direct habitat loss, trails for the power line, storing positions for heavy machines and other technical installations.

  The construction of the substation and towers would include mobilization and demobilization activities, removal and partial destruction of the top soil surface and some deeper soil layers will occur. However, the substation and tower footprint is relatively small, which minimizes potential impact.

Moreover, the majority of the site is located within the vast coastal desert plain which is common and recurrent from north to south all along the Red Sea coast. This ecosystem is characterized by an almost total absence of water and, accordingly, the vegetation cover is very low and animal life is mainly found in wadis.

Mitigation measures

- Habitat loss and/or modification would be permanent and cannot be mitigated. However, as mentioned above, it is expected to be minor as the land use is very limited, no critical habitats are found within the specific project location and given the ecological characteristics of the coastal plain which include a very limited biodiversity.
- Fragmentation of habitats can be reduced by limiting construction of access roads and other infrastructure to the minimal requirements. In wadis (particularly Wadi Hawashiya) construction of access roads and other infrastructure should be avoided.
- Limit off-road driving within the project sites and prohibit driving in wadis, particularly Wadi Hawashiya, to avoid soil compaction.
- Avoiding Wadi Hawashiya, while locating the overhead transmission towers.

Residual Impacts

The residual impacts of construction on habitats are considered to be low.

Flora

The project sites are characterized by a very scarce vegetation cover scattered on a vast scale. Hence, project activities can easily avoid impacts on vegetation. In addition, no rare, threatened or endemic plants were recorded within the specific project area.

Compaction of soil might lead to a damage of local seed banks and a reduction of the suitability for plant growth. However, as the potential for plant growing in this hyper-arid area is very limited, this is valued as minor impact. Moreover, as stated above, the affected area is very limited, leaving most of the area free from any interventions.

Dust emissions will be limited to a very small area and limited to rather brief periods. No significant impact on flora is expected due to dust emissions.

Waste resulting from construction works will cause no significant impact on flora. However, it might pollute larger areas when drifted away by strong winds.

Mitigation measures

- When erecting the substation and towers, avoid the few areas where vegetation is found to avoid vegetation clearance;
- Limit off-road driving within the project sites and prohibit driving in wadis;

- Remove waste immediately from the site and store it at or near the site in appropriate ways before final disposal.

Residual Impacts

The above mitigation measures are anticipated to be sufficient for minimizing the potential impacts. Therefore, the residual impacts of construction on flora are negligible.

Fauna (excluding avifauna)

The project installations will reduce available habitats for local animals. On the other hand, the importance of the project sites as a habitat for animals is limited and most species were recorded in Wadi Hawashiya, particularly the western sides of the Wadi.

Local animals might be affected by disturbances during the construction phase. Large native mammals (Red Fox and Rüppell's Fox) that sporadically use the area will most likely abandon the site because of the disturbance from the construction work. However, disturbance effects are limited to a rather small area. Thus, local animals can find alternative habitats during construction. Moreover, construction works are limited in time and local animals can repopulate the area after construction. In the western parts of Wadi Hawashiya, however, human activities should be avoided.

The Egyptian Dabb Lizard was the only species of concern previously recorded in the area (NREA, 2013). Conversely, intensive site investigations aiming at assessing the current presence of the animal within the project sites were carried out by Environics in February 2016, but the animal was not found and potential presence could not be confirmed.

Organic solid waste generated during project activities could attract pest species such as insects, rodents and feral dogs and cats, which might affect indigenous species. Feral dogs compete with local wildlife and are known to contribute in the decline of wild carnivores due to food competition and potential hybridization of wild species.

Moreover, species of urban and rural environments alien to the area can be imported with construction materials and containers. This should be avoided as much as possible, because alien species often affect indigenous species.

Mitigation measures

- Limit off-road driving within the project sites and prohibit driving in wadis;
- Implement waste management measures;
- As most animals are active at night and early morning, limit work activities to daytime;
- As much as possible, reduce activities during sensitive periods of the year (such as breeding seasons);
- Implement mitigation measures concerning air emissions and noise to reduce impact and disturbance on wildlife.

Residual Impacts

The above mitigation measures are anticipated to be efficient for minimizing the potential impacts. Therefore, the residual impacts of construction on fauna are negligible.

Avifauna

Migrating birds in active flight are not expected to be affected during the construction phase. The noise and dust emissions at distinct construction sites might bring migrating birds to alter their flight path however, this is not consideredas a significant impact.

Construction works might also lead to the modification or a loss of habitat for local birds by using areas for foundations of towers and the substation, permanent access roads, trails for the power line, storing positions for heavy machines, other technical installations etc. However, as the local bird community is very poor in species and the bird density is very low, the impact on resident birds caused by construction within the said area is assessed not to be significant.

Moreover, construction work is limited to a rather short period of time. Local birds can reoccupy all areas after construction phase.

Local birds may be attracted to the site if areas with garbage, open water or houses with vegetation are constructed. An increase in bird numbers within the area might increase the risk of collision during operation of turbines. Thus, attracting birds has to be avoided both during construction and operation by efficient and timely removal of garbage.

Mitigation Measures

Develop, implement and update a solid waste management plan to include waste collection, storage, transport and disposal in an environmentally sustainable manner.

- **Operation Phase**

Habitats

No impacts are expected to occur on habitats during operation except potential soil compaction from off-road vehicles during periods of maintenance.

Mitigation measures

During periods of maintenance, driving will be restricted to the already existing roads.

Residual Impacts

The above mitigation measures are anticipated to be efficient for minimizing the potential impact. Therefore, the residual operation impact on habitats is negligible.

Flora

Operation of transmission lines and substations is not known to affect plants or plant growth. Yet, human activities and off-road driving might affect local flora during maintenance activities.

Mitigation measures

During periods of maintenance, driving and human activities will be restricted to the already existing roads and storage positions.

Residual Impacts

The above mitigation measures are anticipated to be efficient for minimizing the potential impacts. Therefore, the residual impacts of operation on flora are negligible.

Fauna (excluding avifauna)

Noise from the transmission lines and substation is limited in space and time. Hence operating the project is not expected to impact wildlife which is already very limited.

There might be a risk of disturbance of species by site personnel, by off-road driving, or by waste from used spare parts..

- Driving will be restricted to the already existing roads and off-road driving avoided.

Residual Impacts

The above mitigation measures are anticipated to be efficient for minimizing the potential impacts. Therefore, the residual impacts of operation on fauna are negligible.

Avifauna

- **Assessment for the wider project area**

  The impact of the operation phase on the migratory birds is considered potentially significant. NREA has developed a Strategic Impact Assessment for the whole wind farms in the area (the wider project area) including the cumulative impacts on Avifauna (Lahmeyer International and Ecoda, 2018).

  Collision and Electrocution Risks

  According to IFC Environmental, Health, and Safety Guidelines for Electric Power Transmission and Distribution, "The combination of the height of transmission towers and distribution poles and the electricity carried by transmission and distribution lines can pose potentially fatal risk to birds and bats through collisions and electrocutions. Avian collisions with power lines can occur in large numbers if located within daily flyways or migration corridors, or if groups are traveling at night or during low light conditions (e.g. dense fog). In addition, avian collisions with power lines, electrocution incidents, and roosting and nesting can damage power line

infrastructure, requiring significant and costly repairs, and have the potential to cause power outages and fires.

According to BirdLife International[7], medium voltage or distribution power lines – typically smaller (approximately 5–15 m tall) than high voltage transmission lines – form a threat to migratory soaring birds mainly through electrocution and to a lesser extent through collisions, whereas for high voltage transmission power lines – typically around 20–60 m tall – the energised and non-energised parts are so far separated that electrocutions are rare. Thus high voltage power lines mainly pose a risk for flying birds through collisions.

Migrating birds of species of minor relevance (mainly passerines) do not concentrate in certain areas and, in addition, according to current local knowledge, bird collisions do not seem to be a major concern.

For the Autumn season

The wider project area is not of particular importance for large soaring birds during autumn migration. Over vast periods of the autumn season migratory activity of relevant species was low. Remarkable migratory activity was restricted to single days and mainly referred to larger flocks of three species, namely, European Honey Buzzard, White Stork and Great White Pelican, none of of which is considered as to be threatened or near threatened. As a consequence, collision risk with the transmissiomn lines and towers is not assumed to pose a major threat for large soaring birds in autumn. However, single collisions might occur even during autumn migration, but the expected collision rate is unlikely to result in significant effects on the birds population. Therefore, collisions during autumn are not believed to have a significant impact on migrating birds.

For the Spring season

High numbers of large soaring birds have been recorded in the project area during spring. Consequently, collision rates leading to additional mortality potentially causing significant population effects for some species cannot be excluded, which applies particularly to Steppe Eagle, but also to Great White Pelican, White Stork, European Honey Buzzard, Black Kite, Egyptian Vulture, Short-toed Snake Eagle, Levant Sparrowhawk and Booted Eagle. Though migration of relevant species was low over larger periods, a very high migratory activity was obtained on single days. Relevant numbers of "Endangered" or "Vulnerable" species occurred in the area. Hence, the importance of the project area for large soaring birds in spring has been assessed as high. .

[7]Guidance on appropriate means of impact assessment of electricity power grids on migratory soaring birds in the Rift Valley / Red Sea Flyway.
http://migratorysoaringbirds.undp.birdlife.org/sites/default/files/msb_guidance_-impact_assessment_of_power_grids.pdf

Mitigation Measures

EETC, The Migratory Soaring Birds Project and BirdLife International are discussing potential cooperation to establish mitigation measures that minimize the potential impacts of wind projects and power lines on the migratoy birds in the Gulf of Suez area[8]

The following mitigation measures are proposed for the project, based on the seasonal (autumn and spring) ornithological studies carried out by Environics as well as the different guidelines developed by BirdLife[9]

- Considering routing of lines to avoid key areas for birds, including migratory flyways and bottlenecks (BirdLife, Power Lines Guidance);
- Maintaining 1.5 meter (60-inch) spacing between energized components and grounded hardware or, where spacing is not feasible, covering energized parts and hardware (IFC guidelines);
- Retrofitting existing transmission or distribution systems by installing elevated perches, insulating jumper loops, placing obstructive perch deterrents (e.g. insulated "V's"), changing the location of conductors, and / or using raptor hoods (IFC guidelines);
- Considering the installation of underground transmission and distribution lines in sensitive areas (e.g. critical natural habitats) (IFC guidelines);
- Depending on the location and topography, it may be suitable to have low-lying power lines which are beneath the altitude at which birds may travel (BirdLife, Power Lines Guidance);
- Carrying out carcass observations and mortality surveys, as part of the comprehensive monitoring.
- Maintain the unattractiveness of the site to migrant birds. This is achieved by rigorously banning any type of cultivation, or plantation of green areas in or around the site; prevention of garbage or other solid or liquid waste in or near the site.
- Minimising the vertical spread of power lines. Having lines in a horizontal plane reduces collision risk. It is to point out that the majority of power lines in Egypt utilize horizontal cross arms configuration[10].
- Installing visibility enhancement objects such as warning spheres, bird deterrents, diverters (IFC guidelines) or bird deflectors (BirdLife, Power Lines Guidance). Employing mitigation measures already during the development of new lines is more cost-effective and would ensure a substantially reduced potential number of casualties from the onset of the operation of the power line. EETC will install bird deterrents on the transmission lines. A wide range of potential 'line marking' devices has evolved over the years, including: spheres, swinging plates, spiral vibration dampers, strips, swan flight diverters, etc…. The figure below provides example for bird deterrent to minimize the possibilities of bird collision.

[8] Environics meeting with MSB project and BirdLife Tuesday 3/7/2018
[9] http://migratorysoaringbirds.undp.birdlife.org/en/documents
[10] Based on communication with EETC

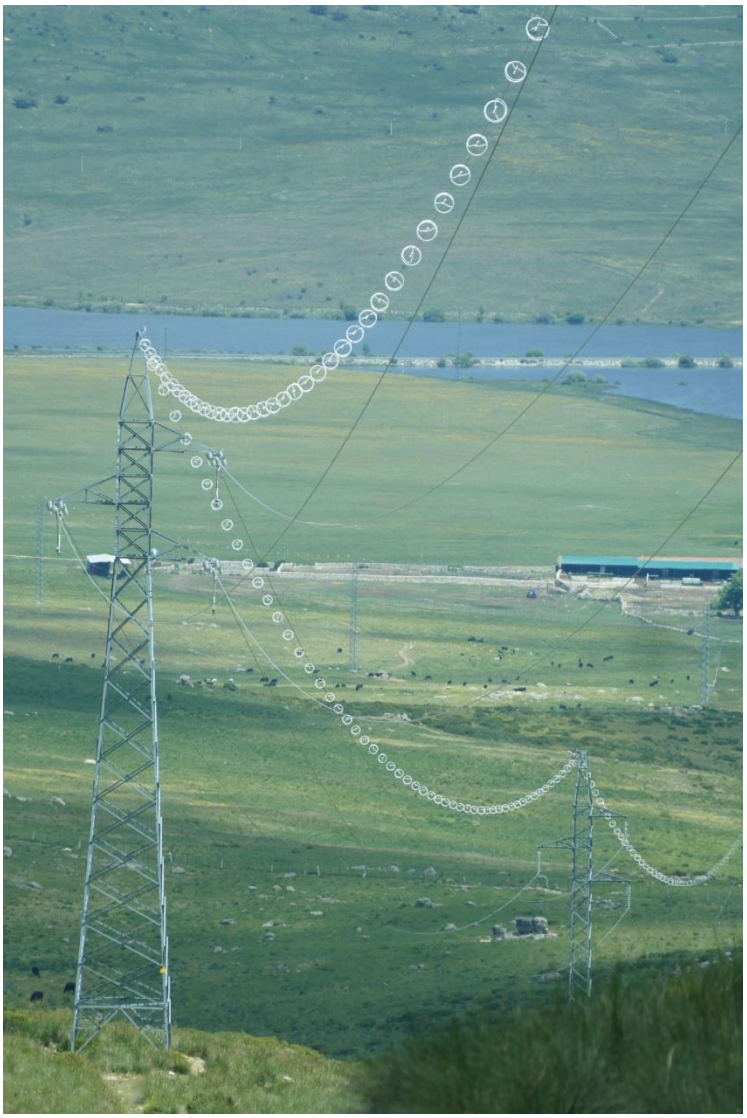

Figure 6-1: Proposed bird deterrents

6.2.4 Impact of the project on socio-economic aspects

- **Impact of the project on work place conditions**

Construction Phase

Potential impacts during construction could arise from noise, accidental slipping of the workers and hazards from exposing to dust and emissions from material handling. In this context, the potential workplace impacts can be considered moderate

Mitigation measures

EETC will oblige the contractor, through the contracts, with the following measures and will follow up their implementation:

- Abide by national occupational health and safety regulations, including Law 12/2003.

- Provision of personnel protective equipment (PPE) and training suitable for different activities.
- Periodic maintenance of equipment according to manufacturers' schedule
- Good workmanship and housekeeping during construction by contractual stipulations and by assignment of supervising engineers in order to assure adequate waste management
- Assignment of a health and safety engineer with full authority to give health and safety instructions.
- Strictly supervise health and safety measures undertaken by the local civil works companies, which may be employed via the main contractor.
- Develop a health and safety plan for the construction site
- Ensure erection works are halted during adverse weather conditions

Residual impacts

Through implementation of the above mitigation measures, the expected residual impact on the workers' health is insignificant.

During operation

Potential occupational health and safety risks during the operation and decommissioning phase of the overhead transmission line and substation are similar to those during the construction phase.

Minor health and safety risks are expected, if a proper health and safety program is established and properly executed.

- **Impact of the project on the community**

During construction

Workers will be employed to undertake construction works. These workers are expected to be housed in neighboring areas and introduced to existing communities.

It is the common practice for EPC contractors that work in Egypt to hire local workforce for the jobs that do not require significant skills, as their number is significant for construction and it is more economically viable, whereas the required highly skilled labor may not be from the local communities.

Since the numbers of required workers is minor and in view of the limited construction duration, potential pressures on the available resources and utilities are considered insignificant.

- **Site security**

For security measures, EETC will assign an annually contracted security company to provide security services for the site premises. The security company will provide security guards on site, exchanging shifts. The presence of guards may have a negative impact on the community if not properly trained, equipped and monitored.

Mitigation measure
The security personnel will be adequately trained, have appropriate conduct toward workers and community and will act within the applicable law. Furthermore, a grievance mechanism will be developed to allow the potentially affected community to express concerns about the security arrangements and acts of security personnel.

Residual impacts
No residual impacts are anticipated.

6.2.5 Impact of the project on traffic

Trucks of various sizes will be required for transportation of project components. In addition, workers and other supplies will be transported to the site during construction. However, according to the Environmental and Social Impact Assessment for the adjacent area of 300 km², the main roads in the overall region are very well dimensioned at low traffic frequency. Accordingly, the additional traffic, distributed through the construction period of 8 months is not expected to significantly impact the existing roads.

During operation, there is almost no project related traffic except minor car traffic in case of maintenance or in exceptional cases transport of bulky goods for heavy repair.

6.2.6 Impact of electro-magnetic interference

The corona of overhead transmission line conductors and high frequency currents of overhead transmission lines may result in the creation of radio noise.

A military radar is operated south of the project area. But as the area was already cleared by the Ministry of Defense before being assigned for wind power development by presidential decree, it can be assumed that no interference with wind farm developments is expected. One mobile phone telecommunication mast and one radio link mast are placed at the Ras Ghareb-El Shaikh Fadel road southwest of the project area.

Due to the large distance of at least 9 km, from the closest directional transmitters, the overall wind farm developments are not expected to block any signal.

6.2.7 Impact of the Environment on the project

- **Impact of venomous species**

  Due the high mobility of faunal species known to be present in the wider area, the presence of animals can be hardly delimited to definite locations and can be found in the project site and surroundings. In this respect, project activities, particularly the workplace safety, may be affected by the potential presence of venomous species which can represent a potential hazard to project staff. Scorpions and vipers are very numerous throughout the area and accidents might occur.

At least one highly venomous snake occurs in the area. This is the Horned Viper (*Cerastes cerastes*), recorded from Wadi Hawashiya, and whose bites are known to have resulted in human fatalities. Bites usually occur when a snake buried in the sand, and hardly visible, is stepped on or closely approached by the unsuspected person.

Another snake, Schokary Sand Snake (*Psammophis schokari*), potentially present in the area, can produce envenoming that is not life threatening, but can be painful and can cause local secondary infection.

A number of scorpion species occur in the study area, often in large numbers. Although the sting of these scorpions can be very painful, it is not considered life threatening to adults.

Mitigation measures

The following measures should be adopted to avoid envenoming accidents or to deal with potential envenoming cases:

- Project staff should not turn over a stone with bare hands or put a hand or foot into a crevasse or hole where snakes or scorpions may hide;
- Avoid walking in areas where there is tall grass and brush;
- Dress in protective clothing when you are out in the field;
- Set camp in areas where snakes are less likely to be. Do not camp near large logs, rocky areas or tall grass;
- Use caution when approaching a snake you think might be dead and do not touch it;
- Training and awareness of workers to learn which snakes may be present in the area and familiarize with their habits;
- Purchase species-specific venom antidotes before starting project activities to be available at the camp site and during seismic survey;
- A person trained on how to deal with snake and/or scorpion bites should be present at the camp site and during field activities.

- **Impact of flash flood**

  The hydrologic analysis indicated that the study area is most probably affected by flash floods from a series of active wadis. The flood risk is medium to high while the flood intensity is low to medium.

  Mitigation measures

  Flood protection measures may be required during the implementation of the project. The following preventive measures should be considered to avoid the flood risk on the human, as well as, the infrastructures of the equipment.

  - Respect the boundaries of the existing wadis and avoid the installation of any fixed structures inside the wadis (locate the transmission towers outside the active Wadis) or along its peripheries (Figure 6-1);
  - Detailed hydrologic and hydraulic analysis are required to determine the accurate water depth and water velocity at each point inside the project area;

- Design the substation and tower foundations as well as the structures in accordance with the hydraulic analysis results.

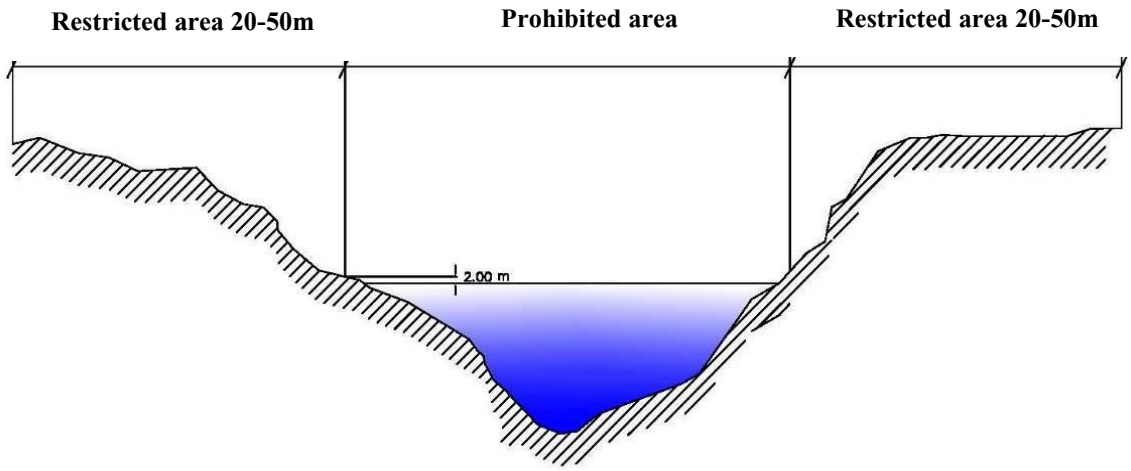

Figure 6-1: Flood zones (safe, Prohibited and unsafe zones) inside the wadi

7. Environmental and Social Management Plan

The project's environmental and social management plan (ESMP) consists of a set of mitigation, monitoring and institutional measures that should be performed during the construction and operation phase to ensure the sound environmental performance of the project. The plan also includes the actions needed to be taken to implement these measures. The overall objective of this chapter is to describe how the Project plans to deliver the mitigation and management measures outlined in this ESIA Report.

The purpose of the ESMP is to:

- Ensure continuing compliance with all Egyptian legislation, international Guidelines and Project policies;
- Outline the ways in which the potential impacts identified in this ESIA report will be managed;
- Provide assurance to regulators and other stakeholders that their requirements with respect to environmental performance are being met;
- Ensure that appropriate monitoring is undertaken, including the establishment of a monitoring plan; and
- Provide a framework for the compliance auditing and inspection programs that will enable the Project to be assured that its aims with respect to environmental performance are being met.

ESMPs will be developed in detail by the Project and their contractors as the overhead transmission line and substation project develops and as EPC contractors are appointed. The ESMP is to be considered as operational or 'live' documents that will be frequently updated by the project teams to reflect the activities at the project site

The project's ESMP consists of the following:

1. ***Summary of the impacts***

2. ***Mitigation measures*** to identify feasible and cost effective measures that will reduce potentially significant adverse environmental impacts to acceptable levels as discussed in Chapter (6).

3. ***Monitoring Plan*** during project implementation to provide information about key environmental aspects of the project, particularly to monitor environmental impacts of the project and the effectiveness of mitigation measures.

7.1 Mitigation Measures

Following is a brief summary of the mitigation measures for the construction and operation phases previously discussed in chapter (6). The mitigation measures either address the environmental aspect (for example preventing/ avoiding/ minimizing the occurrence of the aspect) or address the potential exposure to the impact. The facility's ESMP plan will be developed in accordance with the relevant national regulatory requirements.

Contractors commissioned for the construction and operation will be required to undertake the necessary measures to protect the environment and the workers as per the outlines mentioned in chapter 2. The project will ensure that contractors will carry out necessary measures to minimize impacts. This is to be included in the contractor's scope of work (contract) and addressed in the contractor management plan. This will be in accordance with chapter 2 (construction and work sites) of the Ministerial Decree 211/2003, implementing Labour law 12/2003 as well as the IFC EHS guidelines and the workers' accommodation processes and standards.

Table 7-1 below presents a summary of the environmental and socioeconomic aspects, mitigation measures and residual impacts as assessed for the different project phases.

Table 7-1: Summary of Impacts

Issue	Impact category (not significant, minor, moderate, major)	Mitigation Summary	Residual Impact
Construction Phase			
1- Ambient Air Quality			
• Fuel combustion Emissions from Diesel generator; • Dust emissions during construction activities	Minor	• Maintenance of equipment and vehicles; • Speed limit restrictions will be implemented on site • Dust suppression methods will be adopted where applicable • Excavated materials will be covered, as feasible, to reduce potential for windblown matter	Not significant/negligible
2- Ambient Noise			
• Machinery and equipment • Earth works	Minor	• Equipment and machinery will be maintained in good working conditions, • Use of further reduction measures (e.g. mufflers) may be assessed. • If necessary a grievance mechanism will be adopted for assessing complaints associated with construction noise, if any.	Not significant/negligible
3- Soil			
• Septic tanks • Oil leaks and fuel spills	Moderate	• Proper domestic wastewater and waste management • Proper management of fuels used on to minimize release to soils • Secondary containment of storage tanks and availability/training on spill response • At decommissioning develop a re-instatement plan	Not significant
4- Biological Environment			
• Habitat integrity	Minor	• Limit construction of access roads and other infrastructure to the minimal requirements. • Avoid the construction of access roads and other infrastructure in wadis (particularly Wadi Hawashiya).	Not significant/negligible

Issue	Impact category (not significant, minor, moderate, major)	Mitigation Summary	Residual Impact
		• Limit off-road driving within the project sites and prohibit driving in wadis, particularly Wadi Hawashiya, to avoid soil compaction. • Selection of tower locations to avoid wadis, particularly Wadi Hawashiya	
• Flora and fauna	Minor	• Limit off-road driving within the project sites and prohibit driving in wadis; • Remove waste immediately from the site and store it at or near the site in appropriate ways before final disposal. • Minimize vegetation clearance through selection of tower locations; • Limit work activities to daytime as most animals are active at night and early morning • Reduce activities during sensitive periods of the year (such as breeding seasons) as much as possible	Not significant/negligible
• Avifauna	minor	• Site area management and waste management	Not significant /negligible
5- Labor and workplace health and safety			
• Work environment health and safety	Moderate	• A health and safety policy will be applied throughout the project and among all project contractors. • Abide by all national occupational health and safety regulations, Law 12/2003 • Preparation and implementation of HSE procedures specific to the relevant tasks, particularly covering work on the transmission line towers. • Provision of suitable PPE, training and ongoing safety checks • Equipment periodic maintenance according to manufacturers' schedule	Not Significant

Issue	Impact category (not significant, minor, moderate, major)	Mitigation Summary	Residual Impact
6- Socio-economic			
• Employment	Positive	• Work opportunities for local communities mostly during construction phase	Positive
• workers influx and accommodation		• In case of worker accommodation camp onsite, a worker accommodation plan will be required from the contractor detailing mitigation measures.	
• Water resources used during construction activities	Minor	• Proper water resources management	Minor Using ready mix concrete, the impact would be not significant
• Traffic: Impacts resulting from increased traffic movements	Minor	• Traffic management plan	
• Site security	Minor for single project	• The security personnel will be adequately trained • Grievance mechanism will be developed	Not significant
Operations			
1-Ambient Noise Impacts			
• Transmission lines and substation	Not significant	• Acoustic enclosures are installed for noise generating equipment, wherever possible such as transformers • Workers at noise generating machinery and equipment will be provided with the suitable personal protective equipment (PPEs) • If necessary a grievance mechanism will be adopted for assessing complaints associated with operation noise, if any.	Not significant
Soil			
• Septic tanks • Oil leaks	Minor	• Proper domestic wastewater and waste management • Proper management of fuels used on to minimize release to soils • At decommissioning develop a re-instatement plan	Not significant

Issue	Impact category (not significant, minor, moderate, major)	Mitigation Summary	Residual Impact
		• Septic tank integrity checking • Good house-keeping measures; and, • Emergency response plan to include response to spill scenarios.	
2- Impact on Biological Environment			
• Habitats, flora and fauna	Minor	• Restricting driving and human activities to the existing roads and storage positions. • Implement and update a solid waste management plan to include waste collection, storage, transport and disposal in an environmentally sustainable manner to avoid attraction of vermin	Not significant
• Avifauna	Moderate	• Site area management • Installing visibility enhancement objects such as warning spheres, bird deterrents, or diverters (IFC guidelines) on the transmission lines • conduct carcass observations and mortality surveys during migratory seasons • Having lines in a horizontal plane to reduce collision risk. • Maintain the unattractiveness of the site to migrant birds	Not significant
3- Labor and workplace health and safety			
• Work environment health and safety	• Minor	• A health and safety policy will be applied throughout the project and among all project contractors. • Abide by all national occupational health and safety regulations, Law 12/2003 • Provision of suitable PPE, training and ongoing safety checks • Installing fire detection and fighting system • Equipment periodic maintenance according to manufacturers' schedule	Not significant

Issue	Impact category (not significant, minor, moderate, major)	Mitigation Summary	Residual Impact
4- Socio-economic			
• Employment	• Positive	• Work opportunities for local communities	Positive
• Workers influx and accommodation	• Minor for the single project	• Approximately 5 workers are anticipated during project operation. In case of their accommodation on site, this will be accounted for in the O&M buildings constructed.	Not significant
• Traffic: Impacts resulting from increased traffic movements	• Minor		not significant

7.2 Institutional Arrangements

According to the requirements of the Ministerial Decree 134/2003 of the Ministry of Labour and Manpower implementing law 12/2003, ISO 14001, OHSAS 18001 standards, the project will develop an HSE policy.The contractor and all sub-contractors will at all times comply with National HSE Regulations, Equator Principles and IFC Environmental, Health and Safety Guidelines.

The HSE policy is in line with international and local best practice. The outline of the HSE policy requirements for the OTL and substation project is summarized as follows:

- Contractor will ensure and demonstrate to the Client that they and all subcontractors to be appointed on the construction project will implement a health and safety management system.

- The Client will designate for the project a HSE team, that will permanently stay on site to monitor and audit the execution of the contractors' Health and Safety Plans on behalf of the Client

- Depending on the activity to be performed and number of workers/contractors on site, the Client could require from the Contractor and to the subcontractors the appointment of:
  - a Health and Safety Officer
  - an Environmental Control Officer,
  - Risk assessor
- Details and specifications of responsibility for all appointments shall be defined in the HS plan, and described in a suitable organizational chart.

- Contractors and the subcontractors shall provide all the documentation required by the local Act, update it whenever the activities change and keep a copy on site, available to an inspector or a Client inspection. Documents include:
  - Health and safety file
  - Health and safety plan
  - Risk assessment
  - Environmental operational plan

- The Client requires Contractors and subcontractors to implement a system of reporting including workers attendance record, vehicles record, minute meeting, audit report, HSE initiatives record and incident reporting.

7.2.1 Health and safety policies

Risk assessment and hazard identification

The Contractor and the Subcontractors performing construction work shall, before the commencement of any construction work and during construction work, perform risk assessments which have to be done by a competent person appointed in writing.

The risk assessments shall form part of the health and safety plan to be applied on the site and shall include at least:

1. The identification of the risks and hazards to which persons may be exposed;
2. The analysis and evaluation of the risks and hazards identified;
3. A documented plan of safe work procedure to mitigate, reduce or control the risks and hazards that have been identified;
4. A monitoring plan;
5. A review plan.

These risk assessments will identify the hazards, risks and mitigation measures to reduce the risks. The method statements will describe how these tasks will be performed to implement the necessary mitigation measures.

The risk assessor has to identify the hazards with risk to personal injury and/or property damage that must be the catalyst for providing controls and preventive measures. Once a hazard has been identified, the competent person shall provide the measures to eliminate or minimize the hazard.

Hazards shall be eliminated when possible and can be minimized through awareness training, engineering controls, the use of personal protective equipment, and/or monitoring devices. Competent persons (Supervisors) must use the Risk assessment record to review the hazards identified daily before the work on site begins and the mitigation plans developed to control these hazards.

Competent persons shall monitor existing controls and preventive measures to insure accuracy and usage. The competent person shall continue to compare the actual work to the assessment allowing for changes in the assessment when changes occur. Workers shall be familiar with the Risk assessment, use the existing controls and preventive measures while performing the tasks, and provide input to their Supervisors to ensure that Risk assessment procedure reflects all hazards identified.

A set of measures are to be taken by EETC against contractors in the event of:

- Severe/fatal accidents involving the personnel of contractors؛
- Serious and very serious health and safety violations highlighted by inspections and controls conducted on site؛
- Safety performance review rating below settled thresholds within vendor rating system or similar testing systems where applicable.

Moreover, EETC has a “stop work” policy where each employee regardless of their position, seniority or role, has the right and duty to intervene and stop any activities which they believes is putting health and safety seriously at risk.

7.2.2 Human Resources Policy

Under EETC HR policy, employees will be provided with information regarding their rights under national labor and employment law, including their rights related to wages and benefits. This policy will be clear and understandable to employees. Accordingly, an HR policy is to cover the following topics:

- Entitlement to and payment of wages; permissible wage deductions;
- Overtime payments; hours of work and any legal maximums;
- Entitlement to leave for holidays, vacation, illness, injury, maternity and other reasons;
- Entitlement to benefits;
- The employees' right to form and join workers' organizations of their choice without any interference or employment consequences and to bargain collectively with the employer;
- Disciplinary and termination procedures and rights;
- Conditions of work;
- Occupational safety, hygiene and emergency preparedness;
- Promotion requirements and procedures;
- Vocational training opportunities;
- Child labor and equal opportunity.
- Retrenchment plans

With respect to contracted workers, EETC will ensure that the third parties who engage these workers abide by the project's environmental and health and safety management requirements through a contractor management plan. This is to be included in the contractor's scope of work (contract). This is to include ensuring proper housing and accommodation conditions for workers during construction and/or operation, as relevant[1]. In this context, EETC will establish policies and procedures for managing and monitoring third party performance.

In order to implement the commitments made in this document, EETC will set up appropriate due diligence processes to guarantee their implementation and monitoring through action plans.

7.3 Management Plans

Within its commitment to ensure environmental protection and maintain efficient environmental performance as well as social integrity, the project will develop various environmental and social management plans addressing the different environmental and social aspects as mentioned in section 2.4. The different environmental dimensions will be incorporated throughout the operation of the project. In this regard, the environmental plans to be developed will address:

- Hazardous substances management
- Hazardous Waste (HW) Management
- Solid Waste Management
- Preventative and Corrective Maintenance
- Housekeeping
- Dangerous/venomous animals' management
- Fire Fighting Plan
- Emergency management plan
- Occupational health and safety documentation

[1] Workers' accommodation: processes and standards - A guidance note by IFC and the EBRD, 2009

- Transportation and vehicle movement
- Training and Awareness
- Community Safety
- Community Development
- Project Decommissioning Plans

The following services are anticipated to be subcontracted to suitable qualified local companies:

- Security
- Construction works
- Waste management
- Vehicles rental
- Transformer maintenance

The following sections provide details of the different environmental management plans.

7.3.1 Hazardous substances management

Contractor shall ensure that storage facility for fuels, oils, explosives and chemicals on-site:

- Complies with the requirements of relevant authorities
- Is roofed

All the Material Safety Data Sheets must be available in the storage area and accessible in the working area.

7.3.2 Hazardous Waste (HW) Management

HW includes mainly used machinery oils. Used oils will be collected and temporarily stored till transferred off site. According to the national used oil management system, used oils are collected by Petrotrade or the supplier. The used oils will then be sent for recycling by a specialized oil recycling company.

7.3.3 Solid Waste Management

A procedure will be developed for handling, storing, transporting and disposing wastes generated as a result of typical construction activities, future maintenance activities or domestic wastes in accordance to the local Act and to the requirements below:

- The first objective of the procedure is to minimize negative effects of the generation and management of waste on human health and the environment, so shall aim at reducing the use of resources and favoring the practical application of the waste hierarchy: prevention, preparing for re-use, recycling, other recovery (e.g. energy recovery) and disposal.
- Preference of bio-based content materials, recyclable or reusable components and recycled-content materials and in general use of resources at their highest potential throughout the lifecycle.
- Identification of designated place(s) to store different types of waste such as not recycled and hazardous waste materials.
- Waste shall be segregated at source and removed by a licensed Waste Removal Contractor.

- Designated areas, waste skips and/or bins must be clearly marked to ensure visibility to the users. Skips must be identifiable and must allow for segregation of recyclable materials.
- Skips must have systems to prevent windblown litter and water accumulation such as lids or tarpaulin covers.
- Hazardous waste must be placed within a roofed facility with pollution collection measures. Where hazardous waste is stored, warning signs such as danger signs must be erected. All hazardous waste skips must be placed on concrete surfaces, or any other impermeable surface/materials, so as to avoid any kind of soil contamination. Areas around the storage areas must be maintained so that they are in a clean, neat and tidy condition at all times.
- Basin must be put under any storage of material with the potentiality of soil contamination
- A system of monitoring and reporting waste shall be implemented on site.
- All employees are required to report all the pollutants releases, including oil spills, chemical spills, etc. as soon as possible to their supervisor.

7.3.4 Preventative and Corrective Maintenance

The main objective of the transmission line or substation maintenance is to maximize equipment availability at an operating condition.

Planned maintenance

Maintenance will be carried out in accordance with:

- Equipment manufacturers' suggested requirements.
- Scheduled inspections according to good maintenance practices.
- Maintenance programs and procedures developed.

Preventive Maintenance

The preventive maintenance guidelines are based on:

- A general maintenance plan according to which all maintenance activities are scheduled.
- Regular visual inspections will be conducted on the overhead transmission line as well as the substation components and security system to detect existing and potential defects.

Corrective Maintenance Plan and Response Times

Preventive maintenance reduces the frequency of breakdowns but cannot avoid them. Unplanned maintenance involves corrective maintenance and emergency repairs resulting from equipment problems, required as a result of equipment breakdowns or deficiencies. Once a problem occurs, the project maintenance staff is enough trained to carry out the repairs in a quick response time in order to return to the normal operation levels. Corrective maintenance may involve the participation of specialized maintenance contractors.

7.3.5 Housekeeping

Regarding housekeeping of the substation, periodic inspection will be carried out to ensure proper housekeeping. Good housekeeping practices will be followed such as:

- Optimizing the use of water for cleaning purposes.

- Performing noise measurement in the related places within the project area.

7.3.6 Dangerous/venomous animals' management

The contractor and subcontractors shall consider the risk of animals, such as snakes, reptiles, spiders and wild animals in their emergency plan and implement all the reasonable measures to avoid it.

7.3.7 Fire Fighting Plan

Fire hazards may arise from electric equipment, wires and cables. A well designed Electrical Safety Program will protect employees as well as the project. Basic components of the safety program will include:

- Perform an electrical hazard assessment.
- Inform and train employees of the potential hazards and the application of Lockout/tag-out devices and warning labels
- Test and verify that employees are "qualified" to work- on specific equipment.
- Selection and provision of proper personal protective equipment for employees.
- Provide fire alarms in the substation.
- Installment of fixed and semi-fixed dry chemical fire extinguishing equipment in the substation.

7.3.8 Emergency management plan

The emergency plan must be prepared by the Main Contractor The emergency plan shall be ready before the start of the construction activity, submitted to EETC for approval.

Emergency preparedness helps to minimize the human suffering and economic losses that can result from emergencies. The methodology to develop the emergency plan should be:

1. Identification of the hazards
   - Preliminary assessment
2. Identification and implementation of the emergency measures
   - Prevention measures
   - Emergency equipment
3. Information and training
   - Information and instruction
   - Training
4. Administration of the Plan

The emergency plan must include and evaluate the following minimum contents. The emergency plan must assure the assistance and the rescue of personnel in every situation, including also injured in confined space, in gallery, in remote area.

1. General information
2. General features and layout
3. Vulnerable area
4. Emergency management

5. Local public emergency facilities
6. Emergency team
7. Information and training
8. Emergency drills
9. Emergency equipment
10. Emergency response procedure

7.3.9 Occupational health and safety documentation

Contractors and subcontractors shall provide all the documentation required by the local Act, update it whenever the activities change and keep a copy on site, available to an inspector or EETC inspection. Documents include:

- Health and safety file
- Health and safety plan
- Risk assessment
- Environmental operational plan

7.3.10 Transportation and vehicle movement

Workplace transport is any activity involving vehicles used in a workplace. Activities and operations from which risks arise are mainly

- Getting to and from the site.
- Getting in and out of the site.
- Moving around the site.

Thus, to manage workplace transport effectively, there are three key areas to assess risks and addressed in the EHS plan: site safety (design and activity), vehicle safety and driver safety.

7.3.11 Training and Awareness

The Contractor and the subcontractors shall assure that all the workers are trained, and that they have valid competent certificate of training, especially for working at height training. The Contractor shall develop a system of trainings, to be implemented also by the subcontractors, which will ensure the engagement on the project of skilled employees capable of performing all work in a manner to prevent incidents.

HSE Orientation

A Site Health, Safety and Environment Orientation is required prior to a worker's first work assignment, necessary to authorize access on site. Some specifics that should be addressed during the HSE Orientation shall include:

- The site emergency procedures
- Restrictions (i.e.: smoking ban)
- Housekeeping
- Site Specific Rules/Behaviors
- PPE to use on site
- Reporting procedures
- Waste Handling and disposal

The site HSE orientation shall advise of the requirements and expectations set forth in this document and the contractor HSE program. Re-training will be required when workers demonstrate non-compliance, prove non-understanding or prove to be incompetent in their adherence of the HS plan.

Other required training

All workers shall be trained for the work assigned, skilled as required by Local Act. Depending on employee's exposure to certain hazards other required trainings may include:

- Respiratory Protection
- Fall Protection
- Personal Protective Equipment
- Permit Required Confined Space Entry
- Excavation Safety
- Mechanical Lifting (including rigging, slings, etc.)
- Manual Lifting
- Arc Flash / Electrical Safety
- Blasting Operations
- Certifications in the operations of Cranes and Forklifts
- Work at heights and rescue training
- Management of Chemicals and Hazardous substances
- First aids
- Fire fighting
- Use of Chainsaw

7.3.12 Community Safety

In the course of ensuring that operation assets and personnel are secured and safeguarded in a legitimate manner, EETC will assess the risks and impacts upon workers, local society and communities in and surrounding the project area of influence .

The Contractor will ensure safe access and security of the site, and ensure the safety of all Employees and visitors to the site .

For security measures, EETC will contract a company to provide security services. The security company will provide security guards on site, exchanging shifts. The guards will be mainly located at the premises of the site.

Security personnel will have not been implicated in past abuses, appropriate conduct toward workers and community and to act within the applicable law. Furthermore, the grievance mechanism will allow the potentially affected community to express concerns about the security arrangements and acts of security personnel.

7.3.13 Information Disclosure and Stakeholder Engagement

To ensure the correct level of engagement is being achieved by each stakeholder, the wider "wind farm" project will develop a Communication Plan and strategies to communicate project related information to key stakeholders in a proactive and timely manner. Stakeholders engagement usually involves the following:

- the disclosure of information,
- consultation with affected communities, and
- the establishment of a grievance mechanism.

The receipt of community contacts through a well-functioning system addresses one part of the communication to be maintained with the community.

Grievance mechanism

In addition, the project would develop a Grievance Mechanism that allows the workers/stakeholders to address its comments, worries and complaints that should be accessible. An example of a basic structure for such system is shown in the figure below.

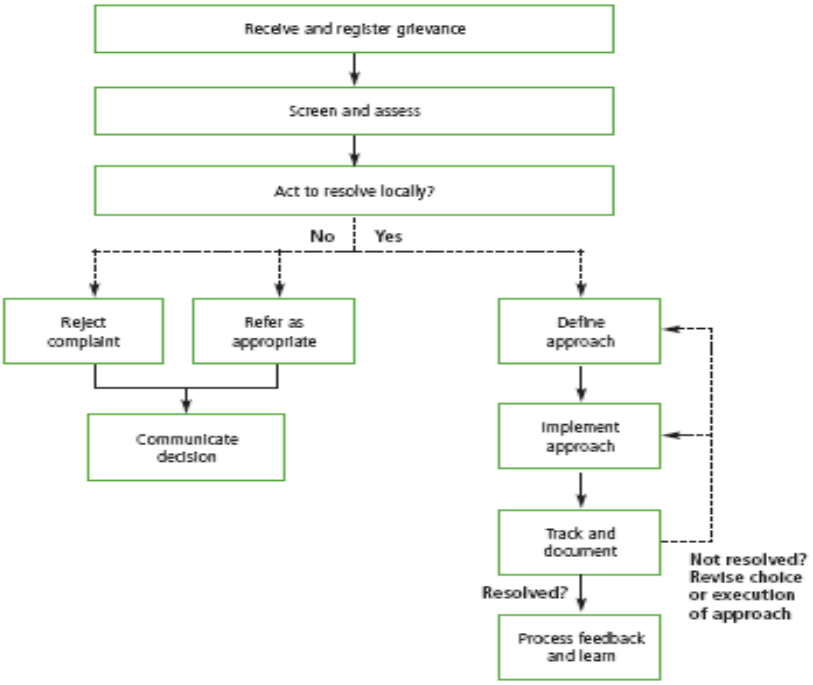

Figure (7-1): Example of Grievance Mechanism Structure

(Source: A Guide to Designing and Implementing Grievance Mechanisms for Development Projects, The Office of the Compliance Advisor/Ombudsman for the International Finance Corporation (IFC), 2008)

All employees shall be informed of this mechanism at the time of recruitment or before start of any work on site .The grievance mechanism shall also include an anonymous communication channel such as a "suggestion box". The mechanism involves the site management and will address issues and concerns promptly. All issues raised will be addressed using a transparent process that provides timely feedback where applicable, without retribution.

The procedure for the grievance mechanism for both workers and local community is described below.

- A concern is raised, either anonymous or with known name and source. All issues raised are tracked in the projects "Issue Log", and a responsible person for the issue is identified. Project Manager is ultimately responsible for all issues, but a concern/issue may be delegated to Site Manager, HSSE Manager or QA Manager as required (these might be the same person)

- Any concern indicating danger for human life, significant environmental damage or corruption will demand an immediate shut down until the concern has been investigated.
- Identified concerns are investigated. All concerns will be evaluated and corresponding actions to be agreed within 72 hours
- For all community related issues the agreed action is added to any planned agenda for information meetings or report. For all workers related issues the agreed action is communicated through the suppliers foreman to all relevant personnel at first convenience
- Once agreed actions are completed the issue is closed and final notification is given.

Any concern related to possible corruption, significant security or safety breaches or other potential major concerns gives anyone on site the right and duty to stop work and report to Site Manager.

All concerns and corresponding actions are included in reporting to management as defined in the project charter and relevant reporting templates.

7.3.14 Project Decommissioning Plans

Decommissioning is defined as the close down of operations, the removal of process equipment, buildings and structures and carryout site cleanup and remediation if required. The expected lifetime of the project ranges between 20 - 25 years that will be renewable as long as the proper predictive maintenance measures are taken and all the necessary revamps and upgrades are done. Following are the main issues addressed by the facility's decommissioning plan:

- Development of the decommissioning plan according to international and best practices guidelines.
- Removal procedures for all above ground structures
- Disassembling of components

7.4 Monitoring Plan (Construction and Operation)

Once the identification and the assessment of risks have been made, according to the results obtained, a number of measures are defined in order to minimize or remove them. Taking as a reference that information, a control for each of risks identified and evaluated are conducted.

Technical instructions will be established in order to control and measure the following activities:

- Medical assessment
- Personnel protective equipment control
- Health and safety technician/Qualified personnel
- Security inspections

7.4.1 Workplace Monitoring

HSE Audit

A system will be implemented to ensure the constant monitoring of the HSE performance on site.

- Audits: Contractor's safety and environmental officers shall perform periodic site audits (minimum bi-weekly) to verify the implementation of the HS plan and EOP. Jointly they shall perform a documentation review.
- EETC HSE team will perform periodic audits on the site and on documentation. Contractors are required to ensure the promptly resolution of any evidences found
- Inspections: Contractor and subcontractors shall ensure that visual inspections of tools and vehicles are performed daily, or prior to the start of each shift.
- Monthly documented (auditable) inspections of tools, equipment and vehicles shall be performed.
- The contractor and subcontractors shall perform daily visual inspections as required by the project of the workplace to identify potential hazards and work process verification.
- HSE Meetings: Contractor shall hold weekly HSE meetings, in the presence of EETC and subcontractors representatives, in order to manage ongoing activities, and to avoid any interference.
- HSE Meeting shall be held whenever a new contractor starts to work.

Workplace Noise

During Construction

During construction, the project will ensure that the noise level from all operating equipment would not exceed the allowable limit set by Law 4/ 1994 for 8 hours duration shift (90 dB). In case the noise levels exceeded this limit, the exposure periods will be carried out according to those indicated in Annex (7) of Law 4/1994. Moreover, ear plugs will be provided for the workers at the locations generating increased noise levels. Noise level measurement will be carried out quarterly.

During Operation

Sources of noise include the corona effect of the overhead transmission lines and substation transformers and switchgears. The measured noise levels will be compared to the levels set in Annex (7) of Law 4/1994. In case the noise exceeds the maximum limit of 90 dB, exposure periods will be proceeded as stipulated in Law 4/1994. **Error! Reference source not found.** presents the noise monitoring frequencies and the estimated monitoring cost. Regular checks will be carried out twice a year for areas of direct exposure to equipment. Moreover, proper PPEs will be provided for the workers at the given locations.

Health monitoring

The contractors must ensure that all their employees have a valid medical certificate of fitness specific to the construction work to be performed and issued by an occupational health practitioner.

Personal protective equipment

All visitors and employees on the construction site shall wear appropriate personal protective equipment (PPE). Contractor and subcontractors shall ensure that their employees wear PPE as required by the specific task being performed, the potential hazards that person will be exposed to and the specifics of the job. All employees (included supervisors) shall wear a shirt with long sleeves and long pants at all times. Tank tops, sleeveless shirts, and short pants or cutoffs are not permitted. Loose or floppy clothing is prohibited around rotating or moving equipment. Rings, neck chains or loose jewelry shall be removed.

Provision of PPE´s for visitors must be kept on site. PPE´s must be in good condition.

Below a list of minimum PPE to be adjusted implemented including:

- Head Protection
- Eye Protection
- Foot Protection
- Hand Protection
- Hearing Protection

Health and safety technician, qualified personnel

A project HSE team will be assigned. who will permanently stay on site for monitoring and auditing the execution of the contractors' Health and Safety.

7.4.2 Monitoring Air Quality

During Construction

Workplace air monitoring of equipment exhaust will be performed quarterly. Emissions are generated from exhaust from construction equipment and motor vehicles and particulates during site works. Monitoring results will be compared with the allowable limits of Law 4/1994 provided in Chapter (2) of this study.

The following parameters shall be measured:

- Carbon monoxide, CO
- Sulfur dioxide, SO_2
- Nitrogen oxides, NO_x
- PM_{10}

7.4.3 Solid and Hazardous Wastes

Non-hazardous solid wastes will be recorded in the Environmental register of the plant. On the other hand according to Law 4/1994, a register will be prepared for hazardous wastes. Information of the HW register should include types and quantities of hazardous wastes, storage means and disposal.

Table 7-2: ESMP Summary

Aspect	Issues of concern	Actions	Party Implementing the Action	Indicator of completion	Estimated Cost	Required completion Date
Construction Phase						
Air Quality	Dust emissions	- Water spraying using low water consuming suppression equipment - Implementing a speed limit for construction vehicles	Construction contractor	– Monitoring plan – Air quality measurements	To be determined at lab contracting	Throughout the construction phase period
	Working conditions of machinery	- Ensure good working conditions through frequent inspection of all construction equipment	Construction contractor	Maintenance logs	Cost of maintenance	
Noise Level	Working conditions of machinery	- Ensure good working conditions through machinery maintenance	Construction contractor	Noise measurements and Maintenance logs	To be determined at lab contracting and cost of maintenance	Throughout the construction phase period
	Provision of PPEs	- Providing necessary PPEs for workers	Construction contractor			
Soil	Housekeeping practices Waste/wastewater management	- Develop and implement site management plan and a solid waste management plan - Secondary containment for all wastes/material storage containers that could contaminate soil if released. - Availability of spill response plan, training and response equipment	Construction contractor Developers (include provisions in the construction contracts. Developers to ensure contractors compliance)	– Solid/hazardous waste and wastewater management contract – Contractor follow up documents	– Part of construction activities management – Cost of transportation and disposal	Throughout the construction phase period
Occupational Health and Safety	Site Staff and Workplace Safety	- Implementing HSE procedures according to company, national requirements and IFC	Contractor	HSE provisions in the construction contracts	Construction cost	Before construction activities

Aspect	Issues of concern	Actions	Party Implementing the Action	Indicator of completion	Estimated Cost	Required completion Date
Construction Phase						
		standards				
Emergency Response	Site Staff and Workplace Safety	- Implement procedures for emergency control	Developer	Emergency response plan		Before project commissioning
Biological Environment	• Avoid sensitive wadis during tower location selection and while offroad driving • waste management • Minimize vegetation clearance • Avoid working at night and early morning • Avoid work activities during sensitive periods of the year (such as breeding seasons)	- Develop and implement site management plan and a solid waste management plan	Construction contractor and developer Waste management contractor	– Monitoring plan – Solid waste management contract	– Part of construction activities – Cost of transportation and disposal	Throughout the construction phase period
Cultural heritage	Chance find	- Halt activities and immediately notify the concerned authorities	Construction contractor	Procedures for chance find		Throughout the construction phase period

Aspect	Issues of concern	Actions	Party Implementing the Action	Indicator of completion	Estimated Cost	Required completion Date
Operation Phase						
Water Resources consumption	Water consumption for of cleaning process	- Workers training - Use of efficient cleaning equipment	Developer	Workers training on utilization of cleaning equipment plans and selection of cleaning equipment	Operation cost	Throughout the project lifetime
Labour rights and welfare	Working conditions	Develop Human Resources policy	Developer	Contracts (with workers)	Operation cost	Throughout the project lifetime
Training and Awareness	Competence of the project personnel	Training for the personnel according to the particular responsibility	Developer	Training plans		Throughout the project lifetime
Occupational Health and Safety	Site Staff and Workplace Safety	- Developing HSE procedures according to national requirements and IFC standards	Developer	Development of HSE policies	Operation cost	Before project commissioning
Biological Environment	• off-road and wadi driving • waste management • Avifauna disturbance	- Develop and implement site management plan and a solid waste management plan - Installing visibility enhancement objects such as marker balls, bird deterrents, or diverters on the transmission lines - Carrying out carcass observations and mortality surveys, as part of the comprehensive monitoring	Developer Waste management contractor	– Monitoring plan – Solid waste management contract	Operation cost	Throughout the project lifetime
Emergency Preparedness and Response	Operation risk management	- adopt a probabilistic risk assessment framework	Developers	Emergency response plan	Operation cost	